

Digital Tax Administration and Corporate Debt Default Risk: Evidence from China's Golden Tax Project III

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Abstract: Using China's Golden Tax Project III as a quasi-natural experiment, this study empirically examines the impact of digital tax administration on corporate debt default risk and its mechanism based on data from Chinese A-share listed companies from 2009 to 2022. The results show that digital tax administration can reduce the risk of corporate debt default. Further, digital tax administration exerts governance effects by reducing agency costs and enhancing the information environment, thereby reducing the risk of corporate debt default. Additionally, the negative effect of digital tax administration on corporate debt default risk can be more significant in firms with a higher level of regional rule of law, poorer quality of internal control, and a higher degree of cash flow volatility. The findings of the current study provide a scientific reference for the enhancement of national governance systems in the digital era.

Keywords: Golden Tax Project III, Digital tax administration, Corporate debt default risk, Staggered difference-in-difference.

1. Introduction

The "11 Chaoyang Bond" incident, which occurred in 2014, represented the first time the Chinese bond market defaulted on a bond. Subsequently, the probability of defaults in the Chinese bond market increased dramatically, and by 2022, the amounts of defaults on Chinese bonds reached 36.325 billion yuan. The bond market is an important part of the capital market, and the risks caused by bond defaults are often contagious and likely to cause systemic risk. Hence, the healthy development of the bond market is necessary for maintaining financial security (Charpe and Flaschel, 2013). Therefore, focusing on corporate bond default risk is of great significance for maintaining a high-quality development of enterprises and the economy. As the main source of fiscal revenue in China, paying attention to tax collection and management problems can ensure the stability of fiscal revenue. In the context of the digital economy, the rapid development of big data, cloud computing, and 5G technology has made "data" an important element in the new industrial revolution. Therefore, this study focuses on the impact of digital tax administration on corporate debt default risk.

Digital technology has laid the foundation for the use of electronic fiscal equipment. Specifically, a combination of tax collection and big data technology can improve the level of tax collection in a country (Sury, 2019). Many scholars have studied the economic consequences of digitalized tax collection from various perspectives. First, digital tax administration can have a "tax effect," and the application of big data technology can reduce tax evasion and significantly increase tax revenue (Ali et al., 2015; Eissa et al., 2014; Matthieu et al., 2022). Moreover, the application of digital invoice encryption technology increases the difficulty of forging invoices, reduces the number of inputs that enterprises can deduce, and significantly increases a country's fiscal revenue (Fan et al., 2018). Second, digital tax collection can have a "deterrent effect," as the use of big data technology can increase the probability of detection of corporate tax evasion, standardize the behavior of taxpayers, improve corporate tax compliance, and ensure tax compliance (Antón

et al., 2021). Third, digital tax administration can have a "governance effect," whereby the government shares profits of a company through taxation and hence becomes a minority shareholder (Dyck and Zingales, 2004). Therefore, tax collection is characterized by coercion and represents essentially a transfer of property rights and wealth from private individuals to the state. In this context, the application of big data technologies may strengthen tax enforcement (Antón et al., 2021); the stricter the enforcement by tax authorities, the less likely the controlling shareholders will utilize transfer pricing and other methods to seek gains at the expense of minority shareholders (Dyck and Zingales, 2004). Some studies have also verified the corporate governance effect of tax enforcement by examining the reduction in two types of agency costs by tax enforcement (Xu et al., 2011). An increase in institutional investors' shareholding can effectively reduce the probability of default, suggesting that external governance plays an important role in reducing the risk of default (Chiang et al., 2015; Switzer et al., 2018; Antón et al., 2021). Hence, this study focuses on the governance effect of digital tax administration and investigates its effect on corporate debt default risk.

Compared with previous studies, the marginal contribution of this study is reflected in the following three aspects: First, it provides a new perspective for research related to corporate debt default risk. Most current studies have mainly examined the impact of corporate governance on corporate debt default risk from the perspectives of the proportion of shares held by major shareholders, board size, the proportion of independent directors, and proportion of shares held by institutional investors (Chao, 2022; Chiang et al., 2015; Jensen, 1993; Switzer et al., 2018). Although discussions have been conducted from the perspectives of internal control and external regulation, there is room for expansion. This study innovatively considers the impact of digital tax governance on corporate debt default risk. Second, it enriches the related research on tax governance. Previous studies have focused on the impact of tax governance on information disclosure, surplus manipulation, and corporate social responsibility (Gavious et al., 2022; Konda et al., 2022; Hanlon, 2014; Leviner, 2008; Li and Jia, 2019; Wang et al.,

2023; Xiao and Shao, 2020). Meanwhile, this study provides new evidence from a debt risk perspective by examining the impact of tax administration as an external governance mechanism on corporate debt default risk. Finally, it provides scientific references for digital national governance systems. In line with the findings of Gupta et al. (2017) that digital technology enhances the efficiency of the public sector, this study provides empirical evidence to support the government's efforts to promote the construction of "Digital China" by examining the policy effects of digital tax administration.

The remainder of this paper is organized as follows: Section 2 provides a background on China's Golden Tax Project III presents theoretical analysis, and formulates the research hypotheses. Section 3 describes the research design, modeling, and data. Section 4 presents the empirical results. Finally, Section 5 summarizes the conclusions and provides recommendations.

2. Institutional Background and Theoretical Analysis

2.1. Institutional Background

The digital economy is becoming a key force in reorganizing global factor resources, reshaping the structure of the global economy and changing the patterns of global competition. Hence, coping with the challenges of the digital economy has become an important issue in the context of global tax governance, which is defined by the "rule by data." The Golden Tax Project represents a typical and successful

application of China's digital tax administration transformation. The Golden Tax Project (Li et al., 2020) has undergone four phases. The first phase of the Golden Tax Project began in 1994, mainly for the management of value-added tax (VAT) invoices. However, owing to the limited technology at that time, manual collation with an extremely high error rate, it stopped running in 1996. In 1998, the State Administration of Taxation summarized and optimized the problems of the first phase of the Golden Tax Project and launched the second phase. However, the second phase of the Golden Tax Project still faced problems of a low digitalization level and covering a single type of tax. Unlike the previous two phases, the third phase of the Golden Tax Project has established "one platform, two levels of processing, three covers, and four systems" to unify the levy and management information system of state and local taxes and realize the coverage of all tax types, monitoring of all samples, sharing of information between platforms, and more detailed management of tax sources. Hence, this study focuses on China's Golden Tax Project III.

The third phase of the Golden Tax Project was first piloted in 2013 in Chongqing, Shanxi, and Shandong (except Qingdao). In 2014, it was implemented in Guangdong (except Shenzhen), Henan, and Inner Mongolia, followed by other 14 regions, including Jilin, in 2015. By 2016, it was implemented in 31 provinces. Table 1 shows the timeline of the implementation of Golden Tax Project III in each province of China. The pilot implementation and rollout of the Golden Tax Project III across the country provides a favorable quasi-natural experimental scenario that can be used for the study of digitization of tax administration.

Table 1. Golden Tax Project III implementation timeline

Effective time	Pilot areas
2013	Chongqing, Shandong (except Qingdao), and Shanxi
2014	Guangdong (except Shenzhen), Henan, and Inner Mongolia
2015	Hebei, Ningxia, Guizhou, Yunnan, Guangxi, Hunan, Qinghai, Hainan, Tibet, Gansu, Anhui, Sichuan, and Jilin
2016	Liaoning, Jiangxi, Fujian, Beijing, Tianjin, Shaanxi, Hubei, Shanghai, Jiangsu, Zhejiang, Qingdao, Shenzhen, and Heilongjiang

2.2. Theoretical Analysis and Research Hypothesis

2.2.1. Governance mechanism

Digital tax administration reduces agency costs, which consequently alleviates the risk of debt default. Specifically, it can strengthen external supervision, which is conducive to alleviating the agency problem between shareholders and management, thus reducing the risk of corporate debt default. The agency problem stems from the separation of corporate ownership and control, as the conflicts of interest between shareholders and managers is a long-standing problem of corporate governance (Jensen and Meckling, 1976). Managers are the main decision makers in a firm and hence hold an information superiority position. In the process of running the firm, managers are more inclined to maximize their own interests than creating value for the firm through engaging in behaviors such as overinvestment, on-the-job spending, short-sighted investment, and other behaviors that are detrimental to the firm's value, which increases the firm's operational risk and the risk of defaulting on the firm's debt (Haynes et al., 2015). The government becomes a stakeholder of businesses in the context of tax collection and management because it is compelled to share in the profits. Tax authorities

have the authority and capacity to oversee the financial data, and they ideally expect that business report profit is accurate. In order to lower the enterprise's operational risk and debt default risk, digital tax administration can strengthen external regulation, have a deterrent effect, compel managers to manage the business more effectively, severely impede the managers' self-interested behavior, and optimize the governance mechanism of the company.

2.2.2. Information mechanism

Digital tax administration plays the role of a third-party information intermediary through the information-sharing and information evaluation mechanisms, which is conducive to mitigating the information asymmetry between the supply and demand sides of capital and breaking down information barriers. Information asymmetry between the supply and demand sides of funds is one of the reasons why enterprises find it difficult to raise funds. The demand side of funds needs to spend time and money to prove to banks or investors that the company has good development prospects and is worth investing in, whereas the supply side of funds needs to hire professionals to carry out background investigations on the company to consider whether it is worth investing in. At this time, both parties must incur extra costs to reduce information

mismatch because of the existence of information asymmetry. The intervention of digitalized tax collection as a third-party information intermediary can mitigate information asymmetry, alleviate financing constraints, and reduce the risk of corporate debt default (Zhang et al., 2023).

The national system integration has been achieved and isolated data has been processed to create useful information in the Golden Tax project III. Additionally, It can also leverage big data technologies to monitor company data in real time, assess the logic of different costs, and cross-check the information that companies reveal. When a corporation engages in financial fraud, all of these characteristics greatly raise the chances that it will be discovered. The problem of information dislocation between investors and enterprises will be lessened with increased enterprise information transparency. Furthermore, the signal that information transmission sends to investors will affect their willingness to support the resources of the businesses, which in turn will affect the likelihood that the businesses would default on their obligations. Based on the above analysis, the following hypothesis is proposed:

Hypothesis 1

Digital tax administration can reduce corporate debt default risk.

3. Research Design

3.1. Model Assumptions and Variable Definitions

To verify the research hypotheses, this study uses Golden Tax Project III, a quasi-natural experimental scenario, to examine the impact of digital tax administration on corporate debt default risk. The model is constructed as follows:

$$Default_{i,t} = \beta_0 + \beta_1 GTP + \gamma Controls_{i,t} + Year_t + Ind_i + \varepsilon_{i,t} \quad (1)$$

Where *Default* is the risk of corporate debt default and *GTP* is a dummy variable for digitalized tax collection, a policy variable for Golden Tax Project III. *Controls* comprises a set of control variables.

(1) Explained variable

In our study, the explanatory variable is corporate debt default risk (default), which is calculated based on the option pricing theory by referring to Merton (1974) and denoted by *E*. The Merton distance-to-default (DD) model is simplified and calculated according to Bharath and Shumway (2008) as follows:

First, the value of the firm's equity is calculated, and the market value of the firm's debt is estimated as the book value of the liabilities. A firm's book value *V* is calculated as follows:

$$V = E + D \quad (2)$$

Where *E* is the period-end closing price $\times$ number of tradable stocks + net assets per share $\times$ number of non-tradable stocks. *D* = current liability + 0.5 $\times$ non-current liability.

Second, the volatility of each firm's debt is approximated as follows:

$$\sigma_D = 0.05 + 0.25\sigma_E \quad (3)$$

Among them, 0.05 represents the term structure volatility, where 25% equity volatility makes volatility associated with default risk.

Third, σ_E is estimated using the historical volatility method as follows:

$$\sigma_E = \sigma_n * \sqrt{n} \quad (4)$$

$$\begin{aligned} \sigma_n &= \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (u_i - \bar{u})^2} = \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (u_i - \frac{1}{n} \sum_{i=1}^n u_i)^2} \\ &= \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (\ln(\frac{S_i}{S_{i-1}}) - \frac{1}{n} \sum_{i=1}^n \ln(\frac{S_i}{S_{i-1}}))^2} \end{aligned} \quad (5)$$

Among them, *n* represents the actual trading days, *S_i* is the closing price of the stock on the first trading day, and *S_{i-1}* is the closing price of the stock on the first trading day.

Fourth, the volatility of the value of a firm's assets is approximated using a weighted approach.

$$\sigma_V = \frac{E}{V} \sigma_E + \frac{D}{V} \sigma_D = \frac{E}{E+D} \sigma_E + \frac{D}{E+D} (0.05 + 0.25\sigma_E) \quad (6)$$

Finally, based on Merton's model, the default distance is calculated by substituting the default distance DD as follows:

$$DD = \frac{\ln(\frac{V}{D}) + (\mu - \frac{1}{2}\sigma_V^2)T}{\sigma_V \sqrt{T}} \quad (7)$$

The larger the *DD*, the stronger the enterprise's ability to repay its debt and the smaller the enterprise's debt default risk. Based on the findings of current research statistics, the true likelihood of debt default does not fit the typical positive distribution that is assumed. Consequently, the debt default risk of the company is represented in this article by taking the opposite value of the default distance.

(2) Explanatory variable

The explanatory variable is *GTP*, which is mainly used to represent the dummy variable of digital tax administration. Its value is determined by the time of Golden Tax Project III implementation in each region. Specifically, when a region implemented Golden Tax Project III in year *t*, *GTP* = 1; otherwise, *GTP* = 0. Referring to Li (2020), if a region implemented the policy in the first half of the year, it is regarded as year *t*; whereas if the region implemented the policy in the second half of the year, it is regarded as year (*t*+1).

(3) Control variables

Regarding the control variables, we refer to the practice in the related literature to control for the variables that may affect corporate debt default risk, mainly: asset size, book-to-market ratio, Tobin's *Q* value, corporate growth, whether it is loss-making, the proportion of independent directors, CEO duality, equity checks and balances, whether it is audited by one of the Big Four firms, the return on assets, and the level of economic development. Table 2 presents the definitions of variables.

Table 2. Variable definitions

Category	Variable	Definition
Explained variable	Default	Calculated based on the Merton DD model
Explanatory variable	GTP	If the enterprise implements Golden Tax Project III in the current year, GTP = 1; otherwise, GTP = 0
Control variables	Size	Natural logarithm of the enterprise's total asset size
	BM	The proportionality between the book value and the market value of a company's stock
	TobinQ	Market value of the business divided by the replacement cost of the business's capital
	Growth	Growth rate of business revenue
	Loss	If the enterprise loses money in the current year, Loss=1; otherwise, Loss=0
	Indep	Number of independent directors as a percentage of the total number of board members
	Dual	If the chairperson of the board and the general manager are the same person, Dual=1; otherwise, Dual=0
	Balance	Ratio of shareholding of the second-to tenth-largest shareholders to the shareholding of the first-largest shareholder
	Big4	Whether the company's auditor's firm is one of Big Four, accounting firms (i.e., PricewaterhouseCoopers, Deloitte, KPMG, and Ernst & Young)
	ROA	Return on assets
	lngdp	The natural logarithm of GDP of the province in which the firm is located

3.2. Sample Selection and Data Source

This study selected A-shares companies listed on the Shanghai and Shenzhen stock exchanges from 2009 to 2022 as samples. First, we preprocessed the data, excluding delisted companies, companies in the financial industry, and companies with serious missing main variables, and compensated for a small number of missing values by linear interpolation. Finally, 961 companies with a total of 13,454 observations were obtained. In addition, to eliminate the influence of outliers, this study applied 1% shrinkage to the continuous variables. Table 3 presents the descriptive statistics of the variables. The minimum value of corporate debt default risk was -25.97, the maximum value was -3.59, the mean value was -10.91, and the standard deviation was 4.47, indicating a large inter-individual variation in the debt default risk of Chinese enterprises. The mean value of digital tax administration upgrading was 0.505, indicating that 50.5% of the samples were affected by the Golden Tax Project III pilot policy during the sample period.

The data for each province were obtained from the National Statistical Yearbook, the time of implementing the Golden Tax Project III pilot policy in each province was manually organized by the author, and the other data were obtained from the China Stock Market & Accounting Research Database (CSMAR) Database.

Table 3. Descriptive statistics

VARIABLES	N	mean	sd	min	max
Default	13,454	-10.912	4.470	-25.973	-3.592
GTP	13,454	0.505	0.500	0.000	1.000
Size	13,454	22.730	1.394	20.175	26.780
Loss	13,454	0.079	0.270	0.000	1.000
Indep	13,454	37.250	5.460	30.770	57.140
Dual	13,454	0.176	0.380	0.000	1.000
Balance	13,454	0.782	0.715	0.036	3.535
Big4	13,454	0.095	0.294	0.000	1.000
ROA	13,454	0.044	0.052	-0.120	0.217
BM	13,454	0.667	0.263	0.138	1.227
TobinQ	13,454	1.876	1.133	0.815	7.229
Growth	13,454	0.141	0.319	-0.498	1.790
lngdp	13,454	10.386	0.768	6.100	11.768

4. Empirical Results and Discussions

4.1. Benchmark Regression

Table 4. Benchmark regression.

	(1)	(2)	(3)
VARIABLES	Default	Default	Default
GTP	-0.448***	-0.442***	-0.382***
	(0.123)	(0.123)	(0.119)
Size			0.392***
			(0.146)
BM			-6.710***
			(0.348)
TobinQ			-0.573***
			(0.066)
Growth			0.408***
			(0.100)
Loss			0.177
			(0.138)
Indep			0.005
			(0.009)
Dual			-0.111
			(0.127)
Balance			-0.120
			(0.092)
Big4			0.125
			(0.432)
ROA			1.567
			(1.117)
lngdp			-0.225
			(0.411)
Constant	-9.532***	-7.243***	-8.624*
	(0.117)	(0.777)	(5.063)
Firm	YES	YES	YES
Year	YES	YES	YES
Industry	NO	YES	YES
Province	NO	YES	YES
Adj_R2	0.471	0.472	0.499
N	13,454	13,454	13,454

Notes: Robust standard errors clustered at the firm level are shown in parentheses. ***: $p < 0.01$, **: $p < 0.05$, and *: $p < 0.1$. Table 4 reports the regression results for the effect of digital

tax administration on corporate debt default risk. Column (1) considers year and individual fixed effects. Column (2) considers year, individual, industry and province fixed effects. The results in Columns (1) and (2) indicate that the coefficient on corporate debt default risk is significantly negative at the 1% level. This implies that the debt default risk of the pilot firms showed a significant reduction after the inclusion of the Golden Tax Project pilot. After adding control variables in Column (3), the coefficient of corporate debt default risk is still negative and significant at 1% level. The above results show that the implementation of Golden Tax Project III can inhibit the risk of enterprise debt default, which supports Hypothesis 1.

4.2. Robustness Tests

4.2.1. Parallel trend test

An important prerequisite assumption for the difference-in-differences (DID) method is the ability to satisfy the parallel trend assumption. Without the policy shock of Golden Tax Project III, the experimental and control groups should maintain the same trend. To test whether the DID approach employed in this study satisfied the parallel trend assumption, 15 dummy variables were constructed using the year before the implementation of Golden Tax Project III in each region as the benchmark group: Pre5, Pre4, Pre3, Pre2, Pre1, Current, Las1, Las2, Las3, Las4, Las5, Las6, Las7, Las8, and Las9, with which the Golden Tax Project variable was replaced in the regression model. Based on the parallel trend assumption, we expected the regression coefficients of Pre5, Pre4, Pre3, Pre2, and Pre1 to not differ significantly from 0. As shown in Fig. 1, the regression coefficients of Pre5, Pre4, Pre3, Pre2, and Pre1 did not differ significantly from 0. Meanwhile, the regression coefficients of Current, Las1, Las2, Las3, Las4, Las5, Las6, Las7, Las8, and Las9 were significantly less than 0, indicating that the reduction in corporate debt default risk was not caused by a trend over time, further validating the robustness of the benchmark regression results of this study.

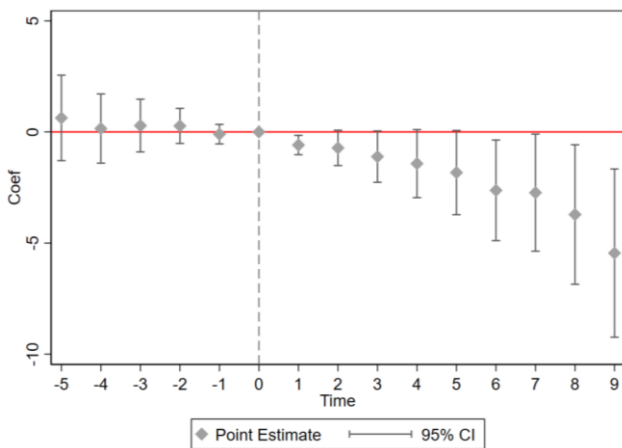


Figure 1. Parallel trend test

4.2.2. Placebo test

To exclude the possibility that the experimental results were the result of random events, the relationship between joining the Golden Tax Project III pilot and the risk of corporate debt default was further validated through a placebo test. Specific steps: For the sample of enterprises joining the pilot region of Golden Tax Project III from 2009 to 2022, a list of enterprises implementing the Golden Tax Project III was randomly generated, thus providing a false estimate; this process was then repeated 1,000 times. As shown in Fig. 2,

the results of the extraction indicated that the estimated coefficients were basically concentrated around 0 and normally distributed, the vast majority of the regressions were insignificant, and the gap between them and the true coefficient was large, as expected from a placebo test, suggesting that the regression results were relatively robust.

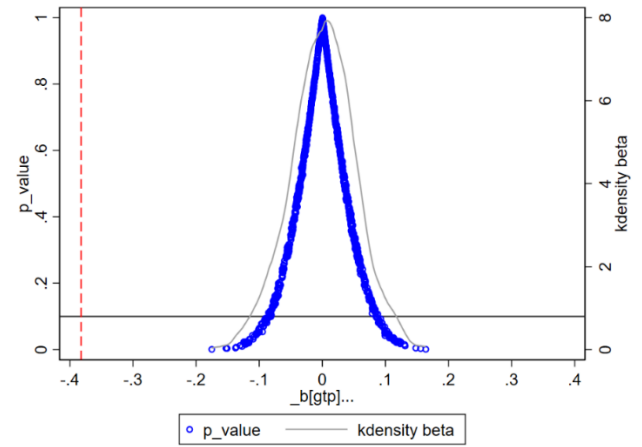


Figure 2. Placebo test

4.2.3. PSM-DID

As Golden Tax Project III is a quasi-natural experimental scenario, the selection of city pilots was not completely exogenous, and there may have been sample bias problems. To solve this problem, we adopted the propensity score matching (PSM) method to match the experimental and control groups; selected the characteristic variables such as Size, BM, TobinQ, Growth, Loss, Indep, Dual, Balance, Big4, ROA, and Lngdp; and then used logit model for 1:2 nearest-neighbor matching. The results of the regression are shown in Column (4) of Table 5. The results indicated that the estimated coefficients of digital tax administration remained significantly negative at the 1% level. In other words, the PSM-DID results were consistent with the benchmark results, further validating the stability of the results.

4.2.4. Exclusion of other disturbing factors

During the sample period, other reform measures might have affected the risk of default on business debt and might have been confounded by the policy effects of digitized tax collection. Among tax policies, business tax (BT) to VAT and VAT credit refund policies are two of the most influential.

The BT to VAT is a major tax reform that was implemented by the state in 2016; after the BT is changed to VAT, the tax chain becomes complete, which can avoid double taxation and has a tax reduction effect, which may have an impact on the risk of corporate debt default. Therefore, this study removed the service industry, which is the most affected by the BT-to-VAT reform, from the sample to eliminate the effect of this policy.

VAT credit refunds can promptly refund over-levied VAT on firms, reduce the problem of crowding out firms' cash flow, enhance firms' liquidity, and potentially reduce the risk of firms' debt default. Therefore, this study constructed the VAT_CR dummy variable. If the enterprise was in the range of 18 industries issued by the State Administration of Taxation on VAT credit refunds, VAT_CR was taken as the experimental group after 2018, VAT_CR = 1; otherwise, VAT_CR = 0.

In addition, the impact of the COVID-19 pandemic, which erupted in 2019, had a far-reaching impact on firms. To remove the effect of the COVID-19 pandemic, this study

narrowed the sample to 2019 to examine the impact of a digitized tax administration on corporate debt default risk.

The regression results are shown in Columns (1)-(3) of Table 5, which report the effects of excluding the BT-to-VAT, VAT credit refunds, and the COVID-19 pandemic, respectively. The coefficients on digital tax collection were all significantly negative at the 1% level, indicating that the robustness of results.

Table 5. Exclusion of other disturbing factors.

	(1)	(2)	(3)	(4)
VARIABLES	BT to VAT	VAT credit refunds	COVID-19	PSM-DID
GTP	-0.385***	-0.383***	-0.382***	-0.358***
	(0.124)	(0.120)	(0.119)	(0.120)
VAT_CR		-0.549***		
		(0.140)		
Controls	YES	YES	YES	YES
Firm	YES	YES	YES	YES
Year	YES	YES	YES	YES
Industry	YES	YES	YES	YES
Province	YES	YES	YES	YES
N	12551	13454	13454	13251
Adj-R2	0.509	0.500	0.572	0.505

Notes: Robust standard errors clustered at the firm level are shown in parentheses. ***: $p < 0.01$, **: $p < 0.05$, and *: $p < 0.1$.

4.3. Mechanism Analysis

As previously mentioned, the digitalization of tax collection and administration can reduce the risk of corporate debt default by reducing agency costs and improving information environment. Therefore, this study tested whether the digitalization of tax collection and administration could reduce the risk of corporate debt default to a greater extent under the scenario of high agency costs and substantial information asymmetry.

(1) Governance mechanism.

With the digital tax administration, the external government is now considered a "minority shareholder" in businesses. Enterprise managers will behave less selfishly and more in the interest of the company's expansion when they are under the function of external monitoring, which will increase the enterprise's value. Therefore, the digital tax administration will play a governance effect, reduce the agency cost between shareholders and managers, and reduce the risk of corporate debt default.

This study used the management expense ratio (Mfee) to represent the agency problem between shareholders and managers (Chen and Ma, 2011; Xu et al., 2011). The management expense ratio is the ratio of management expenses to operating income. The management expense ratio reflects the cost of supervising managers and on-the-job consumption by managers during a company's operations, which to a certain extent reflects the agency cost between shareholders and managers. The larger the management expense ratio, the higher is the agency cost between shareholders and management.

The results in Columns (1) Table 6, show that the coefficient of GTP is significantly negative at the 1% level, and the coefficient of the coefficient of $Mfee \times GTP$ is significantly negative at the 1% level, indicating that the

negative impact of digital tax administration on corporate debt default risk is more significant with a larger management cost ratio. This finding suggests that agency costs exacerbate the negative relationship between digital tax administration and corporate debt default risk. Therefore, digital tax administration can reduce corporate debt default risk by reducing the first type of agency costs and resolving the agency problem between shareholders and management.

(2) Information mechanism.

By building a unified external information management system, the digital tax administration realizes data sharing, which turns the data into useful information. As a result, investors could improve their comprehension of businesses, lessen the information asymmetry that exists between businesses and investors, raise their readiness to invest, and ultimately lower the risk of corporate debt default. Thus, this study examines the digital tax administration in order to enhance the company information environment from the standpoint of information transparency. This study uses the modified Jones model to quantify the degree of earnings management (DA), which is a proxy for information transparency in businesses. Generally speaking, an enterprise's information environment is worse and its degree of information asymmetry is larger the more earnings management it practices (Myers et al., 2007; Ramalingegowda et al., 2021).

The results in Column (2) of Table 6 show that the coefficient of GTP is significantly negative at the 1% level, and the coefficient of the cross-multiplier term of $DA \times GTP$ is significantly negative at the 1% level. This indicates that the degree of earnings management exacerbates the negative relationship between tax administration digitization and corporate debt default risk, suggesting that the impact of tax administration digitization on corporate debt default risk can be more pronounced in firms with a higher degree of earnings management. Therefore, digital tax administration can reduce the risk of corporate debt by improving information environment.

Table 6. Mechanism analysis.

	(1)	(2)
VARIABLES	Mfee	DA
gtp	-0.277**	-0.420***
	(0.115)	(0.115)
Mfee	5.569***	
	(1.041)	
GTP*Mfee	-8.765***	
	(0.974)	
DA		0.856***
		(0.330)
GTP*DA		-1.568***
		(0.490)
Controls	YES	YES
Constant	-13.130***	-1.299
	(4.095)	(3.910)
N	13,454	13,454
Firm	YES	YES
Year	YES	YES
Industry	YES	YES
Province	YES	YES
Adj-R2	0.575	0.601

Notes: Robust standard errors clustered at the firm level are

shown in parentheses. ***: $p < 0.01$, **: $p < 0.05$, and *: $p < 0.1$.

4.4. Heterogeneity Analysis

4.4.1. Regional rule of law environment

The implementation of digitalized tax collection and management may trigger enterprise tax risk, which, in turn, affects the risk of enterprise debt default. According to the law, if the tax violations of an enterprise are not discovered or rectified in time, it may not cause tax risks for the enterprise. Conversely, if the enterprise's tax violations are discovered, the enterprise may face punitive actions, such as paying back taxes and penalties, and may even be placed on a tax violation blacklist.

We used intermediary organizational development and law scores as indicators for the regional level of the rule of law, following Gang et al. (2021). To verify the above speculation, this study used the median regional level of the rule of law as the criterion and divided the sample into two groups: high and low levels. From Columns (1) and (2) of Table 7, for the group with a high regional level of rule of the law, the coefficient of GTP was negative and significant at 1% level. In contrast, the coefficient of GTP was not significant for the group with a low regional level of the rule of law. This finding suggests that the negative effect of digitalized tax collection on the risk of corporate debt default is more significant in regions with higher levels of rule of the law.

4.4.2. Internal control quality

Internal control is the main tool for enterprise risk management through the internal environment, risk assessment, control activities, information and communication, and internal supervision. Enterprises with a higher quality of internal controls indicate better internal governance, stronger internal monitoring mechanisms, and a lower risk of debt default. Thus, the impact of digital tax collection on corporate debt default risk may be influenced by the quality of internal controls. A substitution relationship may exist between digital tax collection as a mechanism of external governance and the effect of internal control quality on corporate governance.

We used the “Dibble - China Listed Companies Internal Control Index” as a proxy variable for internal control quality, with a higher internal control index score indicating a better internal control quality of a company. Based on the median score, the companies were divided into two groups: high and low internal control quality. As shown in Columns (3) and (4) of Table 7, the coefficient of GTP was not significant for the group with high internal control quality. In addition, for the group with low internal control quality, the coefficient of GTP was significantly negative at the 1% level. This finding suggests that digitalized tax collection has a more significant governance effect on corporate debt default risk when a firm's internal control system is weak. This also explains, to some extent, the substitution relationship between digital tax administration and internal controls.

4.4.3. Cash flow volatility

Fluctuations in an enterprise's cash flows can affect its value. On the one hand, a high degree of volatility in a firm's cash flow indicates that the firm faces a high degree of operational risk; on the other hand, it may make it difficult to predict the firm's future cash inflows and reduce the firm's internal financing ability, both of which may affect the firm's debt default risk. Referring to Keefe and Yaghoubi (2016), we used the standard deviation of a firm's cash flow from operating activities over the past three years to measure the degree of cash flow volatility.

We divided the sample according to the median cash flow volatility into two groups: high and low cash flow volatility. Columns (5) and (6) in Table 7 show that the coefficient of GTP was significantly negative at the 1% level for the group with high cash flow volatility, whereas it was insignificant for the group with low cash flow volatility. These results suggest that the impact of digital tax collection on corporate debt default risk is more significant in companies with a high degree of cash flow volatility than those with a low degree of cash flow volatility. Therefore, digital tax administration has a positive impact on improving a company's cash flow situation, which can alleviate financial pressure on enterprises and reduce the risk of corporate debt default.

Table 7. Heterogeneity analysis.

VARIABLES	(1) law=1	(2) law=0	(3) inner=1	(4) inner=0	(5) cash=1	(6) cash=0
gtp	-0.533*** (0.180)	-0.240 (0.199)	-0.266 (0.187)	-0.485*** (0.169)	-0.374** (0.179)	-0.319 (0.195)
Controls	YES	YES	YES	YES	YES	YES
N	7,699	5,755	6,493	6,961	6,548	6,906
Firm	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
Province	YES	YES	YES	YES	YES	YES
Adj-R2	0.481	0.540	0.503	0.512	0.491	0.608

Notes: Robust standard errors clustered at the firm level are shown in parentheses. ***: $p < 0.01$, **: $p < 0.05$, and *: $p < 0.1$.

5. Conclusions and Recommendations

In the context of the digital economy, as the global digitalization of services is accelerating, the promotion of digital change is of great significance to national governance. China's Golden Tax Project III links tax collection and management to big data technology, strengthens the Chinese government's supervisory ability, and plays an important role

in corporate governance. In view of this, this study selected data on listed companies from 2009 to 2022, and took the implementation of Golden Tax Project III as a quasi-natural experiment to explore the impact of digital tax administration on corporate debt default risk. The results of the study show that (1) digital tax administration can significantly inhibit corporate debt default risk through a governance effect, which was confirmed by a series of robustness tests. (2) The mechanism tests show that digital tax administration can reduce corporate debt default risk by reducing agency costs

and improving information environment. On the one hand, digital tax administration can reduce the agency costs between management and shareholders, thus reducing corporate debt default risk. On the other hand, it can break information barriers for investors through third-party information reporting, ease financing constraints, mitigate corporate financial distress, thus also reducing corporate debt default risk. (3) Heterogeneity analysis shows that digital tax administration has different effects on corporate debt default risk for different subgroups. Specifically, the inhibitory effect of digital tax administration on corporate debt default risk is more significant in enterprises located in regions with higher levels of rule of the law, with lower, quality of internal control and higher degree of cash flow volatility.

Based on the above analysis, this study puts forward the following policy suggestions:

First, the Chinese government should continue to promote the modern tax governance model of “tax by digitalization.” This study verifies that digital tax administration has a dampening effect on corporate debt default risk. Hence, further promoting the application of big data technology in tax administration can bring the positive externalities of tax administration into play. By realizing “tax management by digitalization” and “benefiting enterprises by tax,” the government’s external supervision of enterprises can be strengthened, thus promoting the healthy and sustainable development of enterprises. Therefore, the national government should vigorously develop the digital tax system and improve the governance mode of tax collection and management.

Second, enhancing the level of the rule of law can bring into play the advantages of digital tax administration. Our findings indicate that digital tax administration has a more significant inhibitory effect on corporate debt default risk in regions with a high level of rule of law. This is because the tax avoidance behavior of enterprises will be reduced significantly in regions with a high level of rule of the law. Therefore, to magnify the positive effects of digital tax administration, the rule of the law should be continuously enhanced nationwide.

Third, companies should build internal control evaluation systems and improve their internal control governance mechanism. As an important component of corporate governance, internal controls have a positive impact on improving the quality of accounting information and preventing major risks. This study finds that the effect of digital tax administration is more significant for companies with weaker internal control governance. Thus, to reduce corporate debt default risk, enterprises should improve their internal control systems, make informed corporate investment and financing decisions, and improve their operational efficiency. Simultaneously, digital tax administration can be used as an external monitoring mechanism in coordination with the enterprise’s internal control mechanism to promote the high-quality development of the company in a two-pronged manner.

Nevertheless, this study also has certain limitations. First, the problem of corporate debt default risk, which is the focus of this study, may be only one of the dimensions of the governance effect played by digital tax collection. Hence, future research should explore the governance effect of digital tax administration from a more comprehensive perspective to reveal the role of digital tax administration in the modernization process of tax administration. Second, the

digital tax administration indicators in this study were measured by whether Golden Tax Project III was implemented in each region of China, a dummy variable. Although China’s Golden Tax Project III, used in this study as a proxy variable for digital tax collection and management, is supported by many studies (He et al., 2023; Jiang et al., 2023; Li et al., 2020), a more representative continuous variable should be explored by future research.

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