Can Tax Incentives Promote Corporate Digital Transformation? Evidence from China's Accelerated Depreciation of Fixed Assets Policy

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The motivational effects of tax incentives in promoting corporate digital transformation have attracted significant attention. Drawing on data from A-share listed companies between 2012 and 2022, this study employs a staggered difference-in-differences model based on the accelerated depreciation policy for fixed assets to examine the impact of tax incentives on corporate digital transformation. The findings indicate that the accelerated depreciation policy significantly enhances digital transformation in enterprises and exhibits robustness across various tests. The policy facilitates corporate digital transformation by improving corporate vitality, increasing innovation investment, and enhancing profitability. Moreover, its effects are more pronounced for enterprises in growth and decline phases, highly competitive industries, and firms facing significant financing constraints. These findings provide valuable insights for the government's fiscal and tax reforms aimed at empowering corporate digital transformation.

Keywords: fiscal and tax reforms, digital transformation, accelerated depreciation policy, innovation

1. Introduction

Since the reform and opening-up, China's economy has achieved remarkable growth. However, over time, the positive effects of the traditional growth model have gradually weakened, while its negative impacts have become increasingly prominent. This necessitates an accelerated transformation of the economic growth mode to adapt to the new normal. Developing the digital economy, promoting digital transformation, and overcoming the bottleneck of diminishing marginal returns can provide new

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momentum for high-quality economic development. According to data from the China National Intellectual Property Administration, by 2022, the number of invention patents granted in China's core digital economy industries had reached 335,000, demonstrating significant achievements in this field. Despite the substantial quantity, there remains room for improvement in the quality of digital technology innovation. For instance, in the field of integrated circuits, the average citation frequency of China's patents is only 0.8, lower than the global average (0.99) and significantly lower than that of Japan (1.56) and South Korea (1.22), both of which are also Asian countries (Choung and Koo, 2023). Against this backdrop, the *14th Five-Year Plan* designates the vigorous development of the digital economy as a core objective, aiming for the digital industry's output value reaching more than 10% of China's total GDP by 2035. The State Council, in the *14th Five-Year Plan for Digital Economy Development*, emphasizes the need to accelerate enterprises' digital transformation. Therefore, how to incentivize enterprises to undergo digital transformation has become a key issue in promoting high-quality economic development, enhancing firm-level competitiveness, and achieving innovation-driven growth.

It is important to recognize that Chinese enterprises still face numerous obstacles in their digital transformation. First, restructuring organizational structures, cultural concepts, and business processes requires significant financial, human, and material resources. Second, the returns on digital transformation take a long time to materialize and are subject to uncertainty. Finally, it demands a high level of innovation capability. Constrained by these bottlenecks, enterprises encounter the dilemma of being unwilling, unable, or hesitant to undergo digital transformation. According to Accenture's 2022 China Enterprise Digital Transformation Index Report, only 53% of surveyed enterprises indicated that they would continue to increase investment in digitalization, and merely 2% expressed intentions to reshape their functions and business models. The key to overcoming the challenges of enterprise digital transformation lies in addressing these bottlenecks, which requires not only the efforts of enterprises themselves but also external incentives, particularly government policies. The primary government policies supporting enterprise innovation and development include fiscal subsidies and tax incentives. Compared to fiscal subsidies, tax incentives serve as an ex-ante stimulus and have broader societal coverage (Lin and Liu, 2022). Among tax incentives, the accelerated depreciation policy for fixed assets plays a pivotal role.

How to promote enterprise digital transformation has become a focal topic in academic research. Existing literature has conducted in-depth discussions on the influencing factors of enterprise digital transformation from both internal and external environments. Regarding the internal environment, Zhang and Zhang (2024) point out that board networks alleviate the challenges of enterprises being unable, unskilled, or unwilling to undergo digital transformation through resource effects, learning effects, and governance effects, thereby enhancing the level of digital transformation. Li (2024) suggests that an increase in strategic differentiation complicates the corporate financing environment and intensifies agency conflicts, thereby inhibiting digital transformation. Besides board networks and strategic differentiation, an efficient organizational structure and corporate culture also have a profound impact on promoting digital transformation (Singh, 2019). Moreover, executives' learning ability, decision-making capability, and perceptual ability are critical driving forces for enterprise digital transformation (Lu *et al.*, 2021). In terms of the external environment, Zhang and Jing (2024) argue that, while correcting market failures, digital economy regulation not only optimizes the digital transformation environment by maintaining competitive order, enhancing data information sharing, and encouraging innovative outputs, but also improves enterprises' digital business conditions by reducing operational costs and increasing operating profits, thereby incentivizing digital transformation. Hinings *et al*. (2018) identify three novel institutional arrangements crucial for digital transformation: digital organizational forms, digital institutional infrastructures, and digital institutional building blocks. Some scholars also focus on the relationship between tax incentives and enterprise digital transformation, suggesting that tax incentives promote digital transformation by enhancing investment and innovation levels, alleviating financing constraints, and providing financial support for human resource development and resource expansion. Xu *et al.* (2025) argue that tax administration digitalization suppresses enterprise digital transformation by increasing corporate tax burdens and reducing business risks.

In summary, while previous studies have extensively examined the factors influencing enterprise digital transformation, providing valuable theoretical insights for this research, there remain three notable gaps. First, there is limited research on the dynamic effects of tax incentives on enterprise digital transformation. Second, few studies have examined the mechanisms by which tax incentives influence digital transformation based on the transmission chain of "policy incentives–behavioral adjustment–capacity building–transformation deepening," particularly from the perspectives of enhancing enterprise vitality, stimulating innovation input, and fostering endogenous profitability. Third, there is a lack of studies investigating the heterogeneity in the impact of tax incentives on enterprise digital transformation concerning factors such as firm lifecycle, industry competition, and financing constraints. In light of these gaps, this study aims to explore whether and how tax incentives promote enterprise digital transformation, thereby providing policy implications for deepening fiscal and tax reforms and advancing enterprise digital transformation.

The marginal contribution of this paper is mainly in three aspects. First, taking the accelerated depreciation policy for fixed assets as an entry point, this study analyzes the dynamic effects of tax incentives on enterprise digital transformation. Second, this paper clarifies the influence mechanism of tax incentives affecting enterprises' digital transformation. This paper explores multiple channels such as the promotion effect of enterprise vitality, the driving effect of enterprise innovation investment and the endogenous effect of enterprise profit. Thirdly, from the perspectives of life cycle, industry competition and financing constraints, this paper examines the impact of firm heterogeneity on tax preference and digital transformation.

2. Institutional Background and Theoretical Analysis

2.1. Institutional Background

Since 2012, China's economy has transitioned from high-speed to moderate-to-high-speed growth, exacerbating issues such as insufficient investment capacity, declining corporate profitability, high external financing costs, and increased difficulty in transformation (Liu and Zhao, 2020). To support rapid enterprise development, the accelerated depreciation policy for fixed assets was introduced. On October 20, 2014, the Ministry of Finance and the State Administration of Taxation jointly issued the "Notice on Improving the Corporate Income Tax Policy for Accelerated Depreciation of Fixed Assets," which allowed enterprises in six major industries, including biopharmaceutical manufacturing, specialized equipment manufacturing, railway, ship, aerospace and other transportation equipment manufacturing, computer, communications and other electronic equipment manufacturing, instrument and meter manufacturing, and information transmission, software and information technology services, to shorten the depreciation period or adopt accelerated depreciation for fixed assets purchased after January 1, 2014. For assets valued under 1 million yuan, it permitted a one-time deduction, and for those exceeding 1 million yuan, accelerated depreciation was allowed. Compared with the straight-line depreciation method, shortening the depreciation period or using accelerated depreciation effectively addresses issues like insufficient investment capacity and high external financing costs, thereby accelerating the renewal and iteration of fixed assets and enhancing transformation levels. In 2015 and 2019, the accelerated depreciation policy was further expanded to key industries in light industry, textiles, machinery, and automotive, as well as to all manufacturing sectors.

The accelerated depreciation policy for fixed assets provides an ideal quasi-natural experiment for analyzing the causal relationship between tax incentives and corporate digital transformation. First, the policy uses tax deductions as a tool to defer the tax burden at the initial stage of investment, reducing the cost of investing in digital assets, improving cash surplus conditions, and enhancing innovation capabilities, thereby resolving the challenges of digital transformation. Second, as an exogenous event not influenced by corporate will, it effectively avoids endogeneity issues. Third, the policy was implemented in three phases, each targeting different industries and time periods, fulfilling the conditions necessary for applying a staggered difference-in-differences model.

2.2. Theoretical Analysis

In the dynamic process driven by the accelerated depreciation policy for fixed assets, the enhancement of vitality, growth in revenue, and increase in innovation input are not only the "direct outcomes" of behavioral changes triggered by tax incentives, but also serve as "driving forces" that propel the deepening of enterprise digital transformation. This forms a transmission chain of "policy incentives–behavioral adjustment–capacity building–transformation deepening." Based on this transmission chain, this study conducts a theoretical analysis of the relationship between the accelerated depreciation policy and enterprise digital transformation from three dimensions—enterprise vitality, innovation input, and profitability—and accordingly proposes research hypotheses, as follows:

The accelerated depreciation policy for fixed assets enhances corporate vitality, thereby facilitating digital transformation. The accelerated depreciation policy for fixed assets increases the deductible amount of corporate income tax in the early stages of investment, thereby encouraging enterprises to undertake technology upgrading and equipment renewal. This policy incentivizes firms to expedite their transformation and upgrading processes, ultimately enhancing corporate vitality (House and Shapiro, 2008; Shen *et al.*, 2016; Zhang *et al.*, 2021). At present, digital transformation in Chinese enterprises is in its initial phase, primarily involving infrastructure restructuring. This process encompasses both software aspects (e.g., restructuring organizational frameworks, cultural paradigms, and business processes) and hardware aspects (e.g., updating and iterating digital fixed assets). Infrastructure remodeling, as a critical indicator of corporate vitality, demands substantial financial, human, and material resources, requiring long cycles and incurring high costs. When resources are constrained, enterprises tend to adhere to traditional operational models for stability, which suppresses corporate vitality and delaying or impeding digital transformation. In this context, the accelerated depreciation policy reduces corporate tax burdens, lowers operating costs, improves cash flow, and supports enterprises in infrastructure remodeling related to digital transformation. By reshaping organizational structures, cultural paradigms, and business processes and accelerating the renewal of digital fixed assets, the policy stimulates corporate vitality and promotes digital transformation.

The accelerated depreciation policy improves corporate profitability, thereby promoting digital transformation. The pecking order theory suggests that, given the existence of transaction costs, firms typically prioritize internal surplus financing as the optimal funding choice (Myers and Majluf, 1984). Consequently, corporate managers, constrained by financing considerations, tend to focus more on short-term profitability. Unlike managers, owners are more concerned with long-term profitability. The returns from digital transformation are uncertain and take a long time to materialize, which can negatively impact short-term profitability. Under such circumstances, managerial decision-making regarding digital transformation is often subject to moral hazard and adverse selection problems, as the potential short-term profit reduction may disincentivize digital initiatives. These issues lead managers to favor stability by adhering to traditional business models, thereby neglecting digital transformation. The accelerated depreciation policy, through tax deductions and deferred tax burdens on initial investments, indirectly increases cash inflows from core operations, enhances investment returns, and maintains stable profitability. Under the positive profit effects of the accelerated depreciation policy, digital transformation projects are more likely to gain managerial approval and encouraging active engagement in infrastructure upgrading. This mitigates managerial short-sightedness, reduces arbitrage-driven behavior, alleviates agency problems, and fosters digital transformation.

The accelerated depreciation policy increases innovation investment, thereby facilitating digital transformation. Digital transformation involves the application of advanced information technologies, such as big data, 5G, and artificial intelligence, to improve resource allocation efficiency, representing a form of disruptive innovation that integrates digital technology throughout business production and operation process. Existing research emphasizes that innovation serves as a cornerstone of digital transformation, and high-level innovation capabilities requires substantial investment(Wang *et al.,* 2023). Insufficient innovation investment undermines the foundation for digital transformation, particularly in traditional enterprises with limited digital technology bases, which urgently need to boost innovation investment to adopt digital technologies. Thus, innovation investment is critical for digital transformation. The accelerated depreciation policy enhances corporate profitability by deferring tax burdens on initial investments, preventing cash flow inadequacies from crowding out innovation investment, and bolstering innovation capabilities. By expanding the scale of innovation investment, the policy positively influences digital transformation. Furthermore, as a government tax incentive supporting enterprise innovation, the policy provides a signaling effect that alleviates information asymmetry in innovation activities, attracts external capital, overcomes funding constraints, and offers financial support for digital transformation.

Based on the above analysis, this study proposes the following research hypotheses:

H1: The accelerated depreciation policy promotes corporate digital transformation.

H2a: The accelerated depreciation policy promotes corporate digital transformation by enhancing corporate vitality.

H2b: The accelerated depreciation policy promotes corporate digital transformation by improving corporate profitability.

H2c: The accelerated depreciation policy promotes corporate digital transformation by increasing corporate innovation investment.

3. Research Design

3.1. Model Setup

Since 2014, China has implemented three phases of pilot projects for the accelerated depreciation policy for fixed assets. The first phase was launched in 2014, involving six major industries. The second phase began in 2015, expanding to include four additional industry-specific sectors. The third phase commenced in 2019, extending the policy to all manufacturing enterprises. The introduction of the accelerated depreciation policy as an exogenous event provides an ideal quasi-natural experiment for identifying the impact of tax incentives on corporate digital transformation. Given that the pilot projects were approved at different times, this study adopts a staggered difference-in-differences (*DID*) model to evaluate the policy's effects, as formulated in Equation (1):

$$Digital_{jit} = \varphi_0 + \varphi_1 DID_{jit} + \sum \beta X_{jit} + \sum \gamma Year_t + \sum \lambda Firm_i + \varepsilon_{ijt} \tag{1}$$

In the model, j denotes the industry, i denotes the firm, and t denotes the year. The dependent variable, *Digital* indicates the level of corporate digital transformation. The core explanatory variable, *DID* represents the policy shock of the accelerated depreciation policy for fixed assets. X represents a set of control variables, *Year* accounts for year fixed effects, *Firm* accounts for firm fixed effects, and ϵ represents the random error term. Definitions of the dependent variable, core explanatory variable, and control variables are provided in the variable definition section.

3.2. Variable Definitions

3.2.1. Explained Variable

Corporate Digital Transformation Level (*Digital*). Following the approach of Wu *et al.* (2021), this study utilizes Python web scraping capabilities and text analysis methods to identify and measure the level of corporate digital transformation. The specific approach is as follows: First, annual reports of companies listed on the Shanghai, Shenzhen, and Beijing stock exchanges are collected and downloaded via web scraping, and the content of these reports is extracted to serve as a database for subsequent keyword searches. Second, after a comprehensive review of existing literature on digitalization, important policy documents, and research reports, keywords related to corporate digital transformation are determined, as shown in Figure 1 in the Appendix on the Journal's website. Third, from the constructed search database, keywords expressed with negation—such as 'no', 'not', 'none', 'never', 'without', 'lacks', 'neither', 'has not', 'utterly lacks', 'need not', 'unrelated'—are excluded, and the frequency of keywords without negation is counted across five major categories:

cloud computing, blockchain technology, big data, artificial intelligence, and digital technology applications. Fourth, the sum of the frequencies of keywords across these five categories is totaled and logarithmically transformed (log(frequency + 1)) to serve as the measure of the level of corporate digital transformation.

3.2.2. Core Explanatory Variable

In terms of policy implementation, the industries targeted by the three phases of the accelerated depreciation policy pilot projects were identified based on the *National Economic Industry Classification (GB/T4754-2011)*, while the industries of listed companies were classified according to the *Industry Classification Guidelines for Listed Companies (Revised 2012)*. Although the Industry Classification Guidelines for Listed *Companies (Revised 2012)* was revised based on the *National Economic Industry Classification (GB/T4754-2011)*, it omits the medium and small industry categories of the latter, instead focusing on broader main industry categories and major groups.

In the first phase of the accelerated depreciation policy pilot, biopharmaceutical manufacturing is classified as a small industry category under the *National Economic Industry Classification (GB/T4754-2011),* but it has no corresponding classification in the *Industry Classification Guidelines for Listed Companies (Revised 2012)*. Similarly, in the second phase, industries such as plastic products and daily-use chemical products manufacturing are small categories that also do not correspond to classifications in the *Industry Classification Guidelines for Listed Companies (Revised 2012)*.

To avoid inconsistencies between the industry classifications of the accelerated depreciation policy and those of listed companies affecting policy evaluation, this study excludes the broader industry categories to which these small categories belong. Specifically, biopharmaceutical manufacturing falls under the pharmaceutical manufacturing industry, while plastic products and daily-use chemical products manufacturing fall under the chemical raw materials and chemicals manufacturing industry and the rubber and plastic products industry, all of which are excluded from the analysis.

For companies classified in the first phase of the accelerated depreciation policy pilot, the variable *DID* is assigned a value of 1 from 2014 (inclusive) onwards and 0 for other years. For companies in the second phase of targeted industries, *DID* is assigned a value of 1 from 2015 (inclusive) onwards and 0 for other years. For companies in the third phase of targeted industries, *DID* is assigned a value of 1 from 2019 (inclusive) onwards and 0 for other years.

3.2.3. Control Variables

Following existing literature, this study selects the following control variables: Enterprise Size (*Size*), measured by the logarithm of assets; Return on Equity (*Roe*), calculated as (2 × net profit) / (shareholders' equity at the beginning of the year + shareholders' equity at the end of the year); Leverage Ratio (*Lev*), defined as total liabilities divided by total assets; Growth Rate of Operating Income (*Growth*), calculated as (current year operating income - previous year operating income) / previous year operating income; Capital Intensity (*Capr*), measured by net fixed assets divided by total assets; CEO Duality (*Mega*), assigned a value of 1 if the chairman and the general manager are the same person, otherwise 0; Firm Age (*Age*), measured by the logarithm of the number of years from the firm's establishment to the observation year plus one; Management Ownership (*Share*), measured by the ratio of shares held by directors, supervisors, and senior executives to shareholding ratio; Ownership Type (*State*), with state-owned enterprises assigned a value of 1 and private enterprises a value of 0.

3.3. Data Selection and Sources

This study uses data from A-share listed companies in China from 2012 to 2022 as the research sample. The research sample was refined as follows: The following observations are exclucled: companies with negative net assets; companies designated as ST, *ST, under delisting procedures, or suspended from trading; companies in the financial and real estate sectors[1]; companies listed after 2014; and companies with missing data for key variables were excluded. Only companies with continuous data for at least five years were retained. Additionally, a tail-trimming process was applied to the top and bottom 1% of the main variables to mitigate the impact of outliers. The data used in this study was sourced from the CSMAR (China Stock Market & Accounting Research) database. Table 1 summarizes the descriptive statistics of the main variables.

Table 1. Descriptive Statistics of Main Variables

Variable	Sample Size	Mean	Standard Deviation	Minimum	Median	Maximum
Digital	19460	1.520	1.415	0.000	1.386	5.075
DID	19460	0.464	0.499	0.000	0.000	1.000
Roe	19460	0.047	0.148	–0.749	0.061	0.382
Mega	19460	0.253	0.434	0.000	0.000	1.000
Share	19460	10.264	17.071	0.000	0.168	65.213
Growth	19460	0.159	0.462	–0.585	0.084	3.022

[1] The exclusion of the financial and real estate industries is primarily based on three considerations. (1) Avoiding research bias: Financial and real estate firms exhibit distinct characteristics in R&D investment compared to other industries, which could introduce distortions in the research findings. (2) Enhancing data stability: The financial and real estate sectors are highly influenced by macroeconomic conditions and policy changes, leading to significant data fluctuations that may reduce overall data stability. (3) Improving data comparability: Differences in statistical standards and accounting practices between the financial and real estate industries and other sectors may undermine data comparability.

Variable	Sample Size	Mean	Standard Deviation	Minimum	Median	Maximum
Lev	19460	0.444	0.202	0.055	0.440	0.902
Capr	19460	0.214	0.162	0.003	0.177	0.698
Size	19460	22.381	1.321	19.738	22.233	26.157
Age	19460	2.943	0.331	1.099	2.996	4.025

4. Empirical Results and Analysis

4.1. Benchmark Regression

Table 2 presents the baseline regression results on the impact of the accelerated depreciation policy for fixed assets on corporate digital transformation. Column (1) shows the results of the univariate high-dimensional fixed effects regression, while columns (2) through (4) successively incorporate control variables, time fixed effects, and firm fixed effects.

The results reveal that the estimated coefficient for the core explanatory variable (*DID*) is positive and significant at the 1% level. This indicates that the accelerated depreciation policy has a significant positive effect on promoting corporate digital transformation, providing strong empirical support for research hypothesis H1.

From an economic perspective, using column (4) as an example, with the estimated *DID* coefficient at 0.128 and the mean level of digital transformation among sampled firms at 1.520, the implementation of the accelerated depreciation policy corresponds to an 8.421% increase in the level of digital transformation for the benefited firms. This finding demonstrates that the policy's incentive effect on digital transformation is both statistically significant and economically meaningful.

Table 2. Regression Results

	(1)	(2)	(3)	(4)
	Digital	*Digital*	*Digital*	*Digital*
DID	0.921***	0.698***	0.486***	0.128***
	(47.17)	(35.70)	(22.45)	(6.55)
Control Variables	No	Yes	Yes	Yes
Constant	1.093***	–3.353***	–1.054***	–4.331***
	(93.06)	(–18.42)	(–5.11)	(–9.73)
Sample size	19460	19460	19460	19460
Adjusted R^2	0.105	0.221	0.241	0.770
Time Fixed Effects	NO	NO	YES	YES
Firm Fixed Effects	NO	NO	NO	YES

Note: Values in arentheses are t-values calculated using robust standard errors clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The table below follows the same notation.

4.2. Robustness Check

To ensure the validity of the staggered difference-in-differences model approach in policy evaluation, it is crucial to satisfy the parallel trends assumption. This assumption posits that, prior to the implementation of the accelerated depreciation policy for fixed assets, the digital transformation levels of the treated and control group firms must not differ, exhibiting parallel trends. If this condition is not met, the estimates from the *DID* model could be biased. To verify this assumption, the paper utilizes two methods.First Method: Drawing a trend graph of the mean changes in the digital transformation levels of firms. This graph observes whether, before the policy shock, the treated and control groups maintained the same growth trends in digital transformation levels, as shown in Figure 1(a).Second Method: Employing an event study approach to examine whether the digital transformation levels of treated and control group firms meet the parallel trends assumption. The econometric model for this analysis is specified as follows:

$$Digital_{jit} = \varphi_0 + \varphi_1 \sum_{n=-3}^{8} Relative_{jit} + \sum \beta X_{jit} + \sum \gamma Year_t + \sum \lambda Firm_i + \varepsilon_{ijt} \tag{2}$$

In the model, *Relative* represents a dummy variable for the relative period in which the enterprise is affected by the accelerated depreciation policy for fixed assets. For instance, *Relative*=-3 indicates the third year before the impact of the policy, and *Relative*=3 indicates the third year after the policy impact.The sample period of this study spans from 2012 to 2022, while the pilot implementation of the accelerated depreciation policy for fixed assets began as early as 2014 and as late as 2019, thus *Relative*∈[-7,8]. This study designates the year prior to the enterprise being affected by the accelerated depreciation policy *(Relative=-1)* as the baseline year and conducts a high-dimensional fixed effects estimation for Model (2). The regression results are presented in Figure 1(b).

Figure 1(a) shows that before the implementation of the accelerated depreciation policy for fixed assets, the digital transformation levels of both the treated and control groups maintained similar growth trends. After the policy was implemented, however, there was a notable divergence in the growth trends of digital transformation levels between the treated and control groups.Figure 1(b) demonstrates that for *Relative≤0*, the estimated regression coefficients are small and statistically insignificant, indicating that before the introduction of the accelerated depreciation policy, there were no significant differences in the trends of digital transformation levels between the treated and control groups, thus satisfying the pre-treatment parallel trends assumption. However, for *Relative>0,* both the values and significance levels of the regression coefficients increase, suggesting that after the policy's introduction, the treated group's digital transformation levels changed more markedly compared to the control group. Furthermore, it is observed that as time progresses, the regression coefficients consistently show an upward trend, indicating that the promoting effect of the accelerated depreciation policy on digital transformation has some sustainability. In summary, both the analysis of changes in mean levels of digital transformation and the results of the event study method pass the parallel trends test, providing robust support for the effectiveness of the policy in promoting digital transformation. We also make placebo test and some other robustness test, the results are shown in the Appendix online.

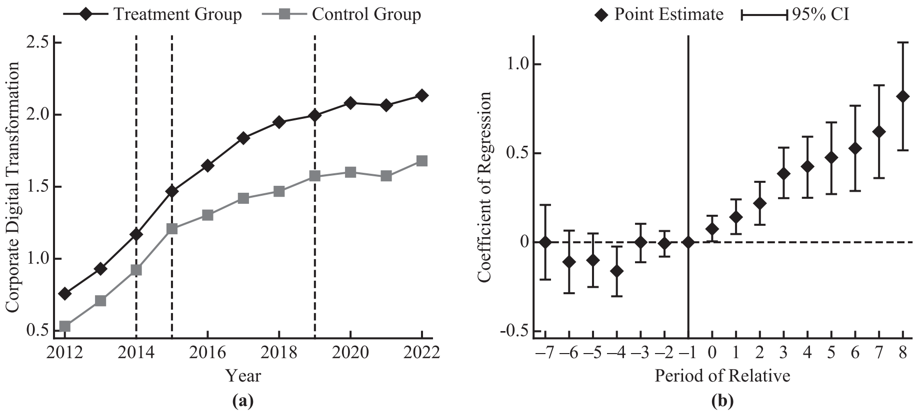

Figure 1. Parallel Trend Test Results

5. Further Analysis

5.1. Dynamic Effects Analysis

Although the previous analysis confirms the positive impact of the accelerated depreciation policy for fixed assets on enterprise digital transformation, the effectiveness of the policy across different periods remains to be further examined. Given that the pilot implementation of the accelerated depreciation policy began in 2014, this study divides the research period into three phases: the first three years after the policy pilot (2012–2016), the first six years after the policy pilot (2012–2019), and the first nine years after the policy pilot (2012–2022). Table 3 presents the analysis results of the policy effects across different periods. As shown in Table 3, the impact of the accelerated depreciation policy on enterprise digital transformation exhibits long-term effectiveness.

Table 3. Analysis Results of Policy Effects in Different Periods

	Three years after the policy pilot began	Six years after the policy pilot began	Nine years after the policy pilot began
	Digital	*Digital*	*Digital*
DID	0.151^{***}	0.153^{***}	0.128^{***}
	(6.04)	(7.02)	(6.55)

	Three years after the policy pilot began	Six years after the policy pilot began	Nine years after the policy pilot began
	Digital	*Digital*	*Digital*
Control Variables	Yes	Yes	Yes
Constant	–5.389***	–5.230***	–4.331***
	(–6.31)	(–9.37)	(–9.73)
Sample size	9061	14386	19460
Adjusted R^2	0.782	0.783	0.770
Time Fixed Effects	YES	YES	YES
Firm Fixed Effects	YES	YES	YES

5.2. Testing the Impact Mechanism

While previous sections confirmed the role of the accelerated depreciation policy in promoting corporate digital transformation, the underlying mechanisms remain unclear. Therefore, this section aims to elucidate the impact mechanisms according to research hypotheses H2a to H2c, which suggest the potential effects of the policy on enhancing corporate vitality, increasing innovation investment, and improving profitability levels. Drawing from previous research, this study uses the logarithm of trading volume (as a proxy for corporate vitality), the ratio of R&D expenditure to operating income (for innovation investment), and the logarithm of operating income (to measure profitability level) to construct a mediation model to test these pathways. Equation (3) and Equation (4) incorporate a mediating variable, *Med*, selected as either corporate vitality (*Vitality*), innovation investment (*Innovation*), or profitability level (*Revenue*), with other variables consistent with those discussed earlier. Table 4 reports the results of the tests for these impact mechanisms.

$$Med_{jit} = \varphi_0 + \varphi_1 DID_{jit} + \sum \beta X_{jit} + \sum \gamma Year_t + \sum \lambda Firm_i + \varepsilon_{ijt} \tag{3}$$

$$Digital_{jit} = \varphi_0 + \lambda_1 Med_{jit} + \varphi_1 DID_{jit} + \sum \beta X_{jit} + \sum \gamma Year_t + \sum \lambda Firm_i + \varepsilon_{ijt} \tag{4}$$

In the regression analysis, the coefficient of the core explanatory variable in Column (1) is positive and significant at the 1% level, indicating that the accelerated depreciation policy effectively enhances corporate vitality. Furthermore, the *Vitality* coefficient in Column (2) is also significantly positive at the 1% level, demonstrating that improved corporate vitality directly facilitates digital transformation activities, thus confirming Hypothesis H2a. Additionally, the results in Columns (3) and (4) show that both the *DID* and the *Revenue* coefficients are significantly positive. This suggests that the accelerated depreciation policy influences digital transformation through enhanced profitability, confirming Hypothesis H2b.Lastly, the estimation results in Columns (5) and (6) indicate that the accelerated depreciation policy not only increases innovation investment but also that such increased investment significantly enhances the capability for digital transformation, thereby validating Hypothesis H2c.These findings collectively demonstrate that the accelerated depreciation policy robustly promotes digital transformation across various dimensions, including corporate vitality, innovation investment, and profitability.

As discussed earlier in the theoretical analysis, under the initiative to "accelerate digital development and build a digital China," enterprises inherently possess a strong motivation for digital transformation. However, they face challenges such as high investment costs, slow returns on investments, and high demands for innovative capabilities, leading to hesitations in undergoing transformation due to fear, unwillingness, or inability. The accelerated depreciation policy, by utilizing tax deductions to defer the tax burden at the initial stages of investment, effectively reduce investment costs, enhance corporate vitality, and accelerate the updating and iteration of digital assets. Additionally, it alleviates the diversion of funds from R&D, providing financial resources to enhance innovation capabilities. Furthermore, by improving profitability levels, the accelerated depreciation policy also reduces internal fund occupation, further promoting digital transformation.

Table 4. Regresion Results of Impact Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)
	Vitality	*Digital*	*Revenue*	*Digital*	*Innovation*	*Digital*
DID	0.098^{***}	0.124^{***}	0.026^{**}	0.125^{***}	0.326^{***}	0.068^{***}
	(5.71)	(6.34)	(2.46)	(6.41)	(3.38)	(3.10)
Vitality		0.028^{***}				
		(3.11)				
Innovation						0.006^{***}
						(3.06)
Revenue				0.115^{***}		
				(7.16)		
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	11.532^{***}	-4.655^{***}	0.381	-4.375^{***}	13.527^{***}	-4.914^{***}
	(28.25)	(–10.08)	(1.29)	(–9.84)	(4.67)	(–9.63)

	(1) Vitality	(2) Digital	(3) Revenue	(4) Digital	(5) Innovation	(6) Digital
Sample size	19391	19391	19460	19460	16227	16227
Adjusted R^2	0.699	0.771	0.951	0.771	0.698	0.786
Time Fixed Effects	YES	YES	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES	YES	YES

5.3. Heterogeneity Test

The preceding analysis demonstrated the impact and mechanisms of the accelerated depreciation policy on corporate digital transformation. However, given variations in corporate growth cycles, financing constraints, and industry competition, the policy's incentive effects may differ across these dimensions. This section further explores the structural differences in the policy's effects on corporate digital transformation based on corporate growth cycles, financing constraints, and industry competition.

5.3.1. Corporate Lifecycle

Growth-stage enterprises have promising development prospects and a strong willingness to transform, but they often face financing constraints. In contrast, mature enterprises typically have sufficient financial resources, yet their stable operations and managerial inertia result in weaker motivation for transformation. Declining-stage enterprises exhibit strong transformation incentives but are limited by institutional and financial barriers. Comparatively, the tax incentives provided by the accelerated depreciation policy for fixed assets can alleviate financial pressure and enhance financing capacity for both growth-stage and declining-stage enterprises, thereby exerting a more significant impact on their digital transformation.

To test this conclusion, and following the methodologies of Dickinson (2011) and Yan *et al*. (2024), this study employs the cash flow method (Table 5) to classify sample enterprises into three lifecycle stages: growth, maturity, and decline. Group regression analysis is then conducted to examine the heterogeneity of the policy's effects across these stages. The results, shown in Column (1) of Table 6, indicate that the accelerated depreciation policy has a significantly greater effect on promoting digital transformation for growth-stage and declining-stage enterprises compared to mature-stage enterprises.

Table 5. Cash Flow Characteristics of Enterprises in Different Lifecycle Stages

Cash flow	Growth-stage		Mature-stage	Declining-stage				
	Start up stage	Growth stage	Mature stage	Turbulent stage	Turbulent stage	Turbulent stage	Elimination stage	Elimination stage
Operating	Negative	Positive	Positive	Negative	Positive	Positive	Negative	Negative
Investment	Negative	Negative	Negative	Negative	Positive	Positive	Positive	Positive
Fundraising	Positive	Positive	Negative	Negative	Positive	Negative	Positive	Negative

5.3.2. Industry Competition

Existing research suggests that enterprises in industries with varying levels of competition differ significantly in their capabilities, particularly in financial strength. In industries with low competition levels, there are fewer firms, larger market shares per firm, stronger financial capacities, and fewer financing constraints. These firms can often manage digital transformation independently, resulting in a relatively smaller impact of the accelerated depreciation policy. Conversely, in industries with high competition levels, a larger number of firms share market resources, leading to weaker financial capacities and greater financing constraints. These firms are less able to address digital transformation challenges on their own, making the accelerated depreciation policy more impactful.

To test this conclusion, this study follows the approach of Teng *et al.* (2016), using the Herfindahl-Hirschman Index (*HHI*) to measure industry competition levels (Equation (5)). A higher HHI indicates lower industry competition levels. Industries with an HHI less than or equal to the mean HHI of all industries during the sample period are defined as high-competition industries, while those with a higher HHI are defined as low-competition industries.

$$HHI_{jt} = \sum_{t=1}^{T} \sum_{j=1}^{n} \left(yysr_{jit} / yysr_{jt} \right)^2 \tag{5}$$

where HHI_{jt} represents the Herfindahl-Hirschman Index of industry j in year t, $yysr_{jit}$ represents the operating revenue of enterprise i in industry j in year t, and $yysr_{jt}$ represents the total revenue of all enterprises in industry j in year t.

Column (2) of Table 6 reports the heterogeneity of the incentive effect of the accelerated depreciation policy for fixed assets on enterprise digital transformation concerning industry competition. As shown in the estimation results of column (2) in Table 6, the policy's incentive effect is stronger for enterprises operating in highly competitive industries compared to those in less competitive industries.

5.3.3. Financing Constraints

Based on the theory of financing constraints, a firm's financing capacity significantly affects its investment levels. Corporate digital transformation is a disruptive innovation that encompasses a broad scope, requiring not only digital technology research and application but also investments related to digital assets. These activities demand substantial inputs of human, financial, and material resources, resulting in high investment costs. Financing constraints often impede the smooth implementation of digital transformation, and the higher the financing constraints, the more prominent this issue becomes. The accelerated depreciation policy, by leveraging tax deduction tools and deferring the tax burden at the early stages of investment, alleviates financing constraints and thereby facilitates digital transformation. Consequently, the policy's incentive effects on digital transformation are stronger in firms with higher financing constraints than in those with lower constraints.

To test this conclusion, this study adopts the SA index, as proposed by Hadlock and Pierce (2010) and further explored by Wang *et al*. (2023), to measure corporate financing constraints. The larger the absolute value of the SA index, the greater the financing constraints faced by the firm. The calculation formula is given in Equation (6), with variable definitions consistent with those in the previous sections. Based on the SA index, the full sample is divided into two sub-samples: firms with high financing constraints (SA index greater than the mean) and those with low financing constraints (SA index less than or equal to the mean).

$$SA_{it} = -0.737 \times Size_{it} + 0.043 \times Size_{it}^2 - 0.040 \times Age_{it} \tag{6}$$

Table 6, Column (3) reports the heterogeneity of the policy's incentive effects on corporate digital transformation in terms of financing constraints. The estimation results in Column (3) show that compared to firms with low financing constraints, the policy's incentive effects are significantly stronger in firms with high financing constraints.

Table 6. Results of Heterogeneity Tests

	Lifecycle			Industry Competition		Financing Constraints	
	(1)			(2)		(3)	
	Growth-Stage	Mature-Stage	Declining-Stage	Low	High	Low	High
	Digital	*Digital*	*Digital*	*Digital*	*Digital*	*Digital*	*Digital*
DID	0.135***	0.080**	0.165***	0.087**	0.135***	0.097***	0.134***
	(3.88)	(2.21)	(2.99)	(2.55)	(4.97)	(3.44)	(4.47)

	Lifecycle			Industry Competition		Financing Constraints	
	(1)			(2)		(3)	
	Growth-Stage	Mature-Stage	Declining-Stage	Low	High	Low	High
	Digital	*Digital*	*Digital*	*Digital*	*Digital*	*Digital*	*Digital*
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	–4.145***	–3.505***	–5.504***	–4.352***	–4.862***	–5.926***	–3.620***
	(–5.42)	(–3.66)	(–3.70)	(–4.38)	(–5.93)	(–7.99)	(–4.43)
Sample size	8036	7230	4194	10593	8867	10570	8890
Adjusted R^2	0.784	0.764	0.790	0.828	0.774	0.760	0.801
Time Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effects	YES	YES	YES	YES	YES	YES	YES

6. Conclusion and Implications

Using the accelerated depreciation policy for fixed assets as an exogenous event, this study analyzes data from listed companies between 2012 and 2022, applying a staggered difference-in-differences model to explore the relationship between tax incentives and corporate digital transformation. The study yields the following key findings. First, the accelerated depreciation policy significantly promotes corporate digital transformation. Second, by enhancing corporate vitality, increasing innovation investment, and improving profitability, the policy fosters progress in digital transformation. Third, the effects of the policy on digital transformation exhibit significant heterogeneity. From a lifecycle perspective, the policy has a stronger impact on growth-stage and declining-stage firms compared to mature-stage firms. Regarding industry competition, the policy's effects are more pronounced in high-competition industries. In terms of financing constraints, the policy provides greater benefits to firms with high financing constraints than those with low constraints.

Based on these findings, the study offers the following policy implications:

Further refine the accelerated depreciation policy to amplify its incentives and promote corporate digital transformation. The widespread adoption of the accelerated depreciation policy for fixed assets may lead to a short-term reduction in government tax revenue, exerting fiscal pressure. This could potentially affect the government's capacity to invest in and support public services, infrastructure development, and other related expenditures. Accordingly, the next iteration of accelerated depreciation policies should ensure that tax reduction pressures remain within the fiscal capacity of local governments. Policymakers should consider moderately relaxing various conditions, expanding pilot coverage, and increasing the degree of accelerated depreciation. These adjustments will help reduce corporate burdens, enhance motivation for digital transformation, and achieve a win-win outcome for both the government and enterprises. Moreover, the unique regulatory role of tax policy should be emphasized. For fixed assets related to digital transformation, policymakers could consider allowing an additional deduction of over 50% during income tax calculations on top of the accelerated depreciation policy, providing further incentives for corporate digital transformation.

Strengthening capital market development and optimizing the business environment to maximize policy effectiveness. To strengthen the policy's effectiveness, it is essential to establish a high-level socialist market economy system. This includes improving capital market infrastructure, optimizing the business environment, broadening corporate financing channels, and encouraging the market to provide diversified financial services. These measures would unlock corporate creativity, attract innovation-oriented capital, and enhance profitability, addressing key challenges such as high investment costs, slow returns, and demanding innovation requirements in digital transformation. By advancing capital market development and improving the business environment in tandem, tax incentives under the accelerated depreciation policy can be precisely targeted, ensuring financial support for the improvement of digital organizational structures and the acquisition of digital assets.

Implementing targeted tax incentives to avoid inefficiencies and resource waste is crucial. It is necessary to improve the targeting of tax incentives. The accelerated depreciation policy for fixed assets should give priority to supporting three types of enterprises to alleviate the contradiction between a "large demand for digital transformation and weak financial strength". The three types of enterprises are enterprises in the growth and decline stages, enterprises with high level of industry competition, and enterprises with high financing constraints. Prioritizing such firms can also send a signal to social capital, encouraging its influx to further alleviate financial pressures. The deduction ratio under the accelerated depreciation policy for fixed assets can be adjusted based on industry differences, enterprise size, and asset type.The synergy between tax incentives and increased social capital will jointly promote enterprise digital transformation, ensuring sustainable progress in building a digital economy.

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