

Study on the Impact of VAT Credit Refund Policy on Corporate Digital Transformation

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Abstract: With digital technologies reshaping global economic structures, the micro-level transformation of enterprises has become key to fostering sustainable growth and ensuring long-term economic vitality. This study investigates the effects of the 2018 VAT credit refund policy on corporate digital transformation, using a sample of Chinese listed companies from 2010 to 2023, and applying a difference-in-differences (DID) model. The results show that the policy significantly promotes digital transformation, a conclusion that remains robust after a series of stability tests. Mechanism analysis reveals that the policy primarily drives digital transformation through three pathways: alleviating corporate financing constraints, stimulating R&D innovation, and reducing institutional transaction costs. Further analysis indicates that the policy effect is more pronounced in high-tech industries, enterprises in central and eastern China, and firms in the mature and decline stages of their lifecycle. The findings extend research on digital transformation and offer policy implications for optimizing VAT refund systems.

Keywords: VAT credit refund; digital transformation; difference-in-differences; text analysis.

1. Introduction

As the digital economy becomes a central driver of global growth, corporate digital transformation has become essential in fostering new productive forces and promoting high-quality economic development. For enterprises, digital transformation transcends mere technological upgrades; it represents a strategic transformation and governance restructuring underpinned by digital technologies [1], capable of significantly enhancing operational efficiency and value creation [2]. At the macro level, it can promote industrial chain upgrading and regional economic synergy [3]. However, many enterprises still face multiple constraints, grappling with issues of "hesitation to transform, reluctance to transform, and lack of know-how to transform."

Previous literature identifies two main drivers of corporate digital transformation: internal governance factors, such as executives' digital awareness, organizational learning, and dynamic capabilities, which are crucial for facilitating transformation [4-5]; Second, external environmental factors, such as government digital procurement [6] and computing infrastructure development [7], can facilitate corporate transformation by providing resources, signals, and conveniences.

Tax incentives have garnered significant attention as an effective policy tool, though the research findings are mixed. Some studies suggest that tax incentives can drive transformation by enhancing innovation capabilities and improving financing conditions [8]; others suggest that information asymmetry and opportunistic behavior may trigger strategic responses from enterprises, making it difficult to incentivize substantive transformation [9]. As a core component of China's tax system, the value-added tax (VAT) has undergone continuous reforms in recent years. Among these, the VAT credit refund policy effectively alleviates corporate liquidity pressures, reduces financial risks, and eases investment burdens [10-11].

However, research on the relationship between VAT credit refunds and corporate digital transformation remains limited, awaiting empirical validation and theoretical elaboration. This paper makes the following main contributions: first, using the representative tax incentive of VAT credit refunds as an entry point to expand research on the drivers of corporate digital transformation; second, building upon existing research, it constructs a more objective and comprehensive measurement index for corporate digital transformation levels by combining text analysis with entropy weighting; third, based on identifying influencing mechanisms, it conducts heterogeneity analysis according to corporate characteristics, providing micro-level evidence for precise policy implementation.

2. Theoretical Mechanism and Research Hypotheses

As the digital economy emerges as a key competitive frontier globally, advancing deep-level digital transformation has become a strategic priority for China to achieve industrial upgrading and establish new development advantages. However, digital transformation is characterized by its long-term nature, high investment demands, and significant uncertainty, presenting substantial challenges to corporate resources and strategic resolve [12-13]. Recently, China has further deepened its VAT reform. The VAT credit refund policy provides enterprises with immediate, interest-free, and debt-free cash flow by refunding input tax credits generated from the purchase of fixed assets, intangible assets, and other expenditures [10]. This directly improves corporate cash flow, enabling enterprises to allocate more resources to digitalization in a timely manner.

Research indicates that VAT credit refunds effectively reduce corporate leverage ratios and interest burdens, alleviating financing constraints [14]. This policy signals to external stakeholders that enterprises are receiving policy support, thereby reducing debt financing costs and enhancing

their capacity for interest-bearing debt financing. The combined effects of increased internal financing and expanded funding channels systematically alleviate corporate financing constraints, providing critical financial support for digital transformation [15]. When enterprises gain liquidity through policy measures, their internal funds become more abundant, enabling better technological investments in cutting-edge fields like artificial intelligence and big data, thereby fostering more digital innovation outcomes.

Furthermore, the tax refunds under this policy are not earmarked for specific purposes, enabling enterprises to allocate funds autonomously toward R&D projects with long-term strategic value, effectively incentivizing innovation investment [16]. When ample cash flow acts as a 'safety cushion,' it increases enterprises' tolerance for R&D failures, fostering a greater willingness to pursue high-risk, high-return breakthrough innovations. This, in turn, helps enterprises develop core technologies under their own control. This risk mitigation effect is a crucial psychological factor enabling enterprises to sustain R&D investments [17]. Furthermore, companies gain greater capacity to recruit digital specialists and increase training investments for existing technical personnel, facilitating their transition into research-oriented, multi-skilled talent [18]. This enhances capabilities in technology absorption, application, and secondary innovation, laying a solid technical foundation for implementing digital transformation [19].

Research indicates that prior to the implementation of the VAT credit refund policy, enterprises were unable to promptly recover accumulated input tax credits. This not only tied up working capital and resulted in losses from the time value of money but also compelled enterprises to seek external financing to sustain operations, incurring additional financial costs. By promptly refunding these credits, the policy eliminates this non-market capital occupation, reducing financial costs and managerial burdens [11]. Prolonged capital occupation and financing pressures consume managerial focus and financial resources, dampening firms' willingness and ability to invest in digitalization [20]. This reallocates resources from "non-productive" to "productive efforts" [21], enabling enterprises to channel more resources and stable cash flows into digital transformation. In summary, this paper proposes the following hypothesis:

H1: The VAT credit refund facilitates corporate digital transformation.

H2: The VAT credit refund drives digital transformation by alleviating corporate financing constraints, incentivizing R&D innovation, and reducing institutional transaction costs.

3. Research Design

3.1. Model Setting

Using the 2018 VAT refund policy as a quasi-natural experiment, this study constructs a Difference-in-Differences (DID) model to estimate its net effect:

$$dig_{it} = \alpha_0 + \alpha_1 did_{it} + \sum \beta Control_{it} + \mu_i + \lambda_t + \epsilon_{it} \quad (1)$$

Here, i and t represent firm and year, respectively. The dependent variable dig_{it} measures the degree of a firm's digital transformation. The policy dummy variable did_{it} serves as the core explanatory variable, with its coefficient α_1 reflecting the difference in digital transformation between the treatment and control groups after the VAT credit refund policy implementation. $Control_{it}$ constitutes a set of control

variables. μ_i and λ_t denote firm and year fixed effects, respectively, while ϵ_{it} is the random disturbance term.

3.2. Index Selection and Variable Explanation

3.2.1. Dependent Variable

Corporate Digital Transformation (dig_{it}). Following existing studies [12], this study employs a combined text mining and entropy weighting approach for measurement. First, Python was used to scrape full-text annual reports of A-share listed companies, constructing a keyword dictionary across four dimensions: artificial intelligence, blockchain, cloud computing, and big data. The TF-IDF algorithm was applied to weight keyword frequencies, reflecting both their occurrence within individual annual reports and their scarcity across the entire sample. Finally, entropy weighting was used to objectively determine weights and calculate composite proportion indicators, which were then transformed using natural logarithms.

3.2.2. Independent Variable

VAT Credit Refund Policy (did_{it}). In 2018, the Ministry of Finance and State Taxation Administration issued Circular No. 70 [2018], implementing refunds for industries like advanced manufacturing and modern services, shifting from deferred to current-period refunds. The variable is coded 1 for covered industries from 2018 onward, and 0 otherwise.

3.2.3. Control Variables

Control variables are selected at firm and city levels. Firm-level variables include: Size, Debt-to-Asset Ratio (Lev), Return on Assets (Roa), Fixed Asset Ratio (fixed), Tobin's Q Ratio (tobinq), Shareholding Concentration (Top10), and Independent Director Ratio (indirect). City-level variables include: Fiscal Investment Intensity (inv) and Financial Development Level (fin).

3.3. Sample Selection and Data Sources

This study draws on a sample of A-share listed companies in China from 2010 to 2023. Financial data are from the CSMAR, while digital transformation indicators are manually constructed from annual reports, and city-level data are from the China Urban Statistical Yearbook. To ensure rigorous empirical analysis, the original sample underwent the following adjustments: Financial-related industries were excluded, Samples subject to special treatment or missing key variables during the sample period were removed, all continuous variables underwent two-tailed trimming at the 1% level, yielding 36,116 valid observations. Descriptive statistics show that the mean value of dig is 0.615 with a standard deviation of 0.811, indicating substantial variation across firms.

4. Empirical Analysis

4.1. Baseline Regression Results

Table 1 presents the baseline regression results. Fixed effects are controlled for, and firm-level and city-level control variables are incorporated sequentially in all models. The coefficient of did remains significantly positive at the 1% level across all specifications, confirming that the VAT credit refund policy significantly promotes corporate digital transformation. This preliminarily validates Hypothesis 1.

Table 1. Benchmark Regression Results

Variable	(1)	(2)	(3)
did	0.169*** (0.017)	0.134*** (0.017)	0.134*** (0.017)
size		0.178*** (0.012)	0.177*** (0.012)
lev		-0.113*** (0.042)	-0.114** (0.042)
ROA		-0.312*** (0.062)	-0.306*** (0.062)
fixed		-0.220*** (0.050)	-0.217*** (0.050)
tobinq		0.019*** (0.004)	0.019*** (0.004)
top10		-0.373*** (0.056)	-0.369*** (0.056)
indirect		-0.278*** (0.087)	-0.282*** (0.087)
inv			-0.004* (0.002)
fin			0.030*** (0.009)
Constant	0.557*** (0.006)	-3.022*** (0.270)	-3.110*** (0.270)
Firm and Year Fixed Effects	YES	YES	YES
Sample	36,138	36,138	36,138

Standard errors in parentheses. ***p < 0.01; **p < 0.05; *p < 0.10. As shown in the table below

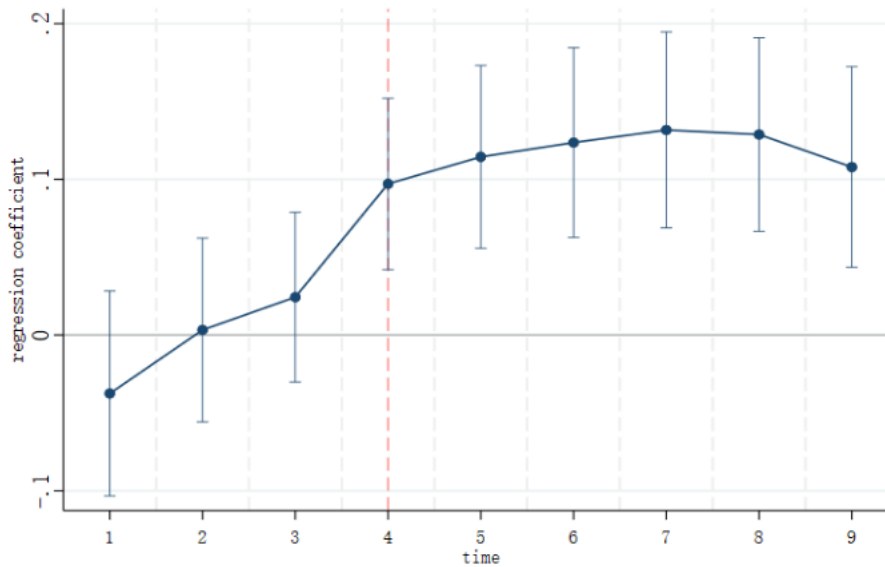


Figure 1. Parallel Trends Test

4.3. Placebo Test

To rule out unobservable confounding factors, we randomly selected a placebo treatment group of the same size as the actual treatment group and conducted 500 placebo regressions. The estimated coefficients from the placebo

4.2. Parallel Trends Test

To validate the DID model, we test the parallel trend assumption using 2017 as the baseline year. As shown in Figure 1, the pre-policy coefficients fluctuate around zero and are statistically insignificant, confirming that the treatment and control groups exhibit parallel trends. After the policy implementation, the coefficients become significantly positive at the 1% level, showing that the VAT credit refund policy significantly accelerated digital transformation with a sustained effect.

shocks are centered around zero and approximately follow a normal distribution, with most p-values exceeding 0.1, as shown in Figure 2. The true estimate of 0.134 is an outlier in the simulated distribution, effectively ruling out the possibility that omitted variables or random factors contributed to the findings.

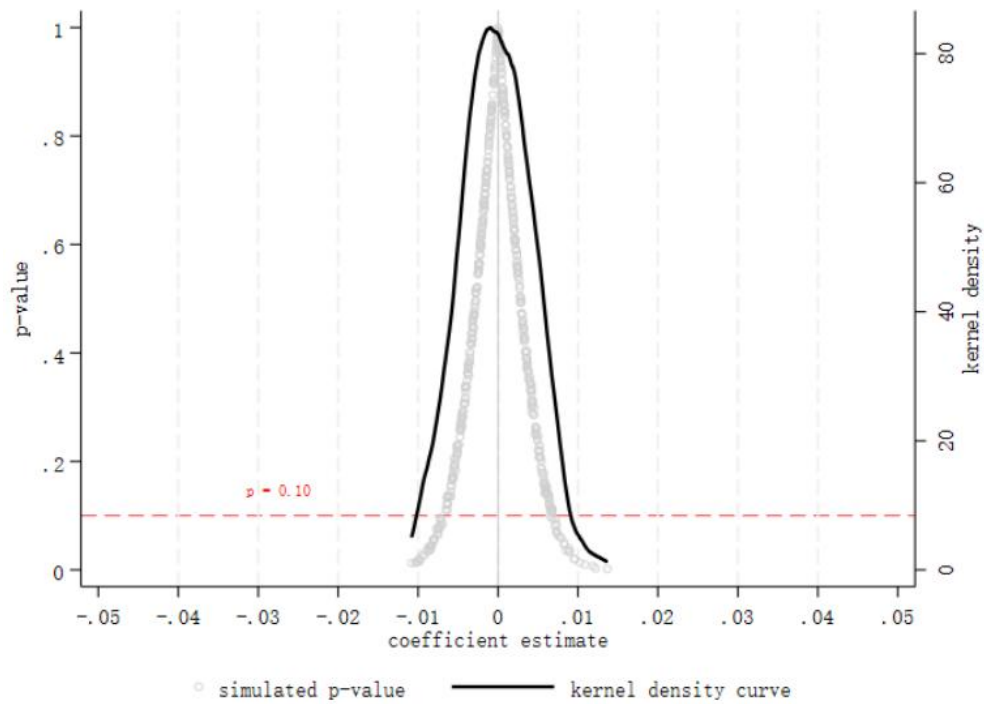


Figure 2. Placebo Test

4.4. PSM-DID Test

To address potential sample selection bias due to the VAT refund policy's industry targeting, we employ the PSM-DID method. Using the control variables from the baseline model as covariates for kernel matching, the kernel density

distribution of the matched samples in Figure 3 exhibits a high degree of overlap, satisfying the common support assumption. Column (1) of Table 2 shows that the DID coefficient for the matched sample remains significantly positive at the 1% level. This confirms that the baseline conclusion remains valid after correcting for potential sample selection bias.

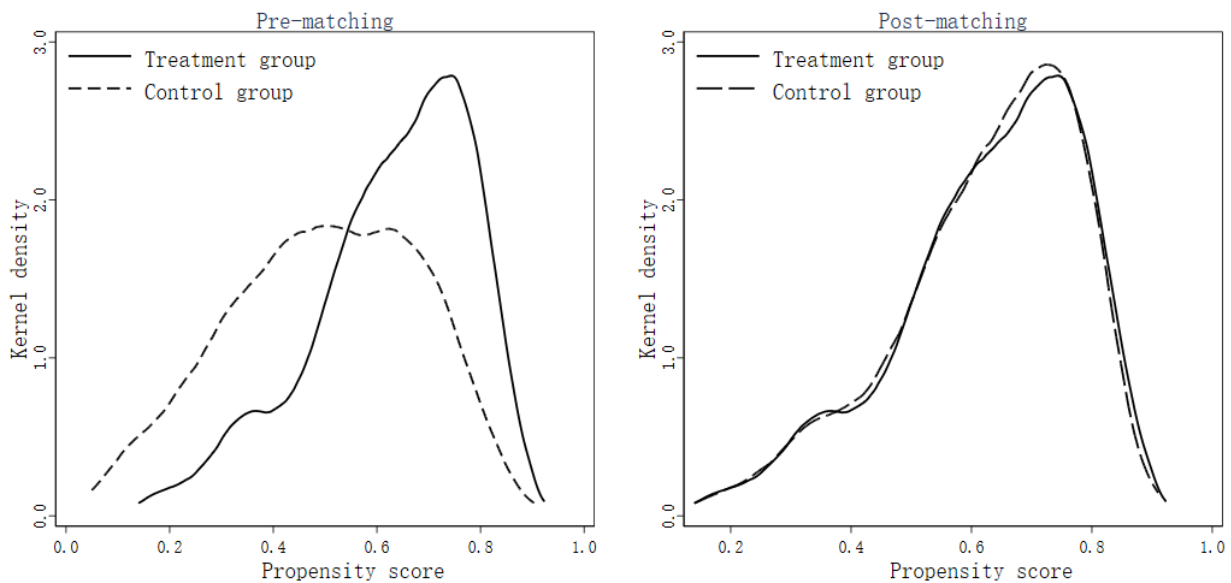


Figure 3. Propensity Score Matching Results

4.5. Additional Robustness Tests

To ensure the robustness of the results, additional robustness tests were conducted using high-dimensional fixed effects, excluding concurrent policies, adjusting the sample

period, accounting for lagged effects and endogeneity, eliminating the general tax reduction effect, and changing the dependent variable. As shown in Table 3, the coefficients remain significantly positive across all robustness checks, confirming the robustness of the main conclusion.

Table 2. Robustness Tests

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	PSM-DID	High-Dimensional Fixed Effects	Exclusion of R&D tax credit	Exclude 2022-2023	One Lagged Period	Accounting for General Tax Cuts	Replace the dependent variable
did	0.1132*** (0.0210)	0.1313*** (0.0168)	0.1428*** (0.0175)	0.1335*** (0.0167)		0.1324*** (0.0166)	0.0042*** (0.0005)
RD_did			-0.0281 (0.0249)				
L_did					0.1801*** (0.0130)		
tax						-0.1120*** (0.0283)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects for firms	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	-	Yes	Yes	Yes	Yes	Yes
Province×Year FE	No	Yes	No	No	No	No	No
Sample size	28,554	36,116	36,116	28,002	30,690	36116	36116
Adjusted R ²	0.7690	0.8122	0.8109	0.7962	0.8239	0.8111	0.8151

5. Further Research

5.1. Mechanism Analysis

Building upon the theoretical analysis, the VAT credit refund policy promotes digital transformation by easing financing constraints, incentivizing R&D innovation, and reducing transaction costs. Drawing on prior literature [22], the regression model is specified as follows:

$$M_{it} = \alpha_0 + \alpha_1 did_{it} + \beta Control_{it} + \mu_i + \lambda_t + \epsilon_{it} \quad (2)$$

Where M_{it} represents the instrumental variable, and other variables are defined as in Equation (2). Financing constraints are measured using the thesa index, where higher values indicate greater constraints. Technological innovation is assessed by the natural logarithm of the number of invention patent applications filed by the firm in the current year plus one. Institutional transaction costs are measured as the ratio of sales, general, and administrative expenses to total assets.

In Column (1) of Table 4, the coefficient of did on financing constraints (sa) is -0.0344, significant at the 1% level. This result suggests that the policy alleviates financing constraints by converting accumulated credit into immediate cash, thus lowering the financial threshold for digital transformation. This provides firms with essential financial support for strategic transformation initiatives.

Table 3. Mechanism Test

Variable	(1)	(2)	(3)
	sa	patent	tc
did	-0.0344*** (0.0037)	0.0800** (0.0356)	-0.0087*** (0.0017)
constant	-4.0846*** (0.0922)	-9.4849*** (0.5797)	0.4424*** (0.0293)
Controls	Yes	Yes	Yes
Firm and Year Fixed Effects	Yes	Yes	Yes
Sample	36,116	36,116	36,116
Adj R ²	0.9546	0.7701	0.8222

Column (2) shows a significantly positive coefficient, indicating that cash dividends from VAT refunds stimulate corporate innovation. These funds directly bolster R&D

budgets, supporting enterprises in developing more efficient production methods. Simultaneously, enhanced R&D vitality strengthens enterprises' capacity to absorb and integrate emerging technologies, which provides technological support for advancing digital transformation in depth.

Column (3) indicate that transaction costs are significantly negative at the 1% level, demonstrating that the VAT credit refund policy effectively reduces enterprises' transaction costs. By improving cash flow and simplifying tax procedures, this policy lowers the information search and coordination costs for digital upgrades. With the reduction in institutional transaction costs, the relative benefits of digital transformation become more apparent, enhancing enterprises' willingness and feasibility to advance their transformation efforts. The results support Hypothesis 2.

5.2. Heterogeneity Effects

5.2.1. Technological Endowment

Digital transformation depends on corporate technological capabilities. This study categorizes enterprises into high-tech and non-high-tech industries for grouped regression analysis, with results presented in Columns (1) and (2) of Table 5. The policy exhibits a strong effect on the high-tech industry group but not in non-high-tech ones. This is because high-tech enterprises possess more prominent R&D capabilities, deeper technological accumulation, and face fiercer market competition, generating greater transformation willingness. In contrast, non-high-tech firms lack technological foundations and transformation needs, hindering policy dividend conversion.

5.2.2. Regional Location

Due to significant regional disparities in economic development, digital infrastructure, and fiscal capacity, this study divides the sample into eastern, central, and western regions. The results are presented in columns (3), (4), and (5) of Table 6. The estimated coefficients are highly significant for enterprises in the central and eastern regions but not significant for those in the western region. This is because eastern and central regions possess stronger economic foundations and market conditions conducive to transformation, while western regions face constraints such as weak digital infrastructure, and insufficient factor supply, limiting the policy's incentive effect.

Table 4. Tests of Technological Endowment and Regional Heterogeneity

Variable	(1) High-Tech Enterprises	(2) Non-high-tech firms	(3) Eastern Region	(4) Central Region	(5) Western Region
did	0.154*** (0.032)	-0.033 (0.029)	0.151*** (0.021)	0.085*** (0.033)	0.052 (0.043)
constant	-2.920*** (0.361)	-3.428*** (0.455)	-3.400*** (0.353)	-2.598*** (0.526)	-1.631*** (0.560)
Controls	Yes	Yes	Yes	Yes	Yes
Firm and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sample	21096	14,981	25,392	6,698	4009
Adj R ²	0.858	0.744	0.839	0.795	0.817

5.2.3. Corporate Life Cycle

Grouping sample enterprises into growth-stage, mature-stage, and decline-stage categories for regression analysis yielded the results shown in Table 7. The coefficients were significantly positive for mature-stage and decline-stage enterprises but not significant for growth-stage enterprises. This stems from the fact that mature firms have ample resources to support transformation, declining firms use digitalization to overcome bottlenecks, while growth firms prioritize scale expansion under tighter resource constraints.

Table 5. Testing for Heterogeneity Across the Corporate Life Cycle

Variable	(1) Growth Stage	(2) Maturity Phase	(3) Decline Phase
did	0.048 (0.035)	0.114*** (0.021)	0.185*** (0.026)
constant	-2.179*** (0.468)	-3.520*** (0.340)	-3.789*** (0.576)
Controls	Yes	Yes	Yes
Firm and Year Fixed Effects	Yes	Yes	Yes
Sample	7953	17,686	8563
Adj R ²	0.869	0.855	0.848

6. Research Findings and Policy Implications

6.1. Research Findings

This study investigates the impact of the VAT credit refund policy on corporate digital transformation using data from Chinese listed companies between 2010 and 2023. Findings show: (1) The policy significantly promotes digital transformation, with robust results; (2) It works by easing financing constraints, boosting R&D innovation, and cutting transaction cost; (3) Effects are more pronounced among high-tech firms, central-eastern regions, and growth and decline-stage companies.

6.2. Policy Implications

First, improve the long-term mechanism for VAT credit tax rebates to stabilize policy expectations. While existing frameworks have institutionalized credit refunds, current eligibility remains largely restricted to firms with A or B credit ratings. It is recommended that restrictions be moderately relaxed to include qualified M-rated enterprises, enabling more newly established enterprises in critical phases of digital transformation to benefit from the policy dividends.

Second, strengthen policy coordination to optimize the institutional environment for digital transformation. Fiscal

and tax policies should be synergized with financial and industrial policies: leverage tax credit systems to ease financing pressures, and align with national digital strategies to channel resources toward digital sectors, fostering an innovation-supportive ecosystem.

Third, implement differentiated supporting measures based on enterprise heterogeneity to enhance policy targeting. Given that firm characteristics significantly shape VAT refund policy effects, tailored approaches are needed: for western regions, moderately lower refund thresholds and increase refund ratios; for growth-stage firms, combine tax cuts with R&D subsidies to mitigate transformation risks; Strengthen support for high-tech enterprises while assisting non-high-tech enterprises to narrow the transformation gap.

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