

Impacts of Innovation Policy on a Firm's Cash Holdings: Evidence from a Natural Experiment

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Abstract

This study investigates the policy impact of China's demonstration bases for mass entrepreneurship and innovation (DBEI) on a firm's cash holdings, a critical concern for firms navigating economic transformation. To mitigate potential selection bias, our analysis employs a PSM-DID (propensity score matching difference-in-differences) strategy, using data on Chinese A-share listed companies for the period 2010–2023. The findings reveal that the policy significantly lowers corporate cash holdings by easing financing constraints, spurring innovation investment, and accelerating digital transformation. This effect is more pronounced for non-state-owned enterprises, firms in eastern China, and those in non-manufacturing sectors. We recommend that policymakers adopt differentiated measures to encourage firms to leverage policy tools for reallocating cash toward innovation, thus enhancing capital efficiency and fostering long-term growth.

Keywords

the demonstration bases for mass entrepreneurship and innovation, cash holdings, policy effect

1. Introduction

Amid growing uncertainties in economic globalization and the domestic shift toward high-quality development, liquidity management for enterprises has become a crucial aspect that influences their risk resistance, long-term development, and investment in innovation [1,2]. For Chinese enterprises in a critical period of transformation, the level of cash holdings is not only related to the stability of daily operations, but also directly affects their ability to seize policy benefits for research and development and market expansion [3,4,5]. Thus, examining how macro policies guide corporate cash-holding behavior holds significant practical relevance.

To tackle the lack of momentum in corporate transformation [6], China has introduced the policy of “mass entrepreneurship and innovation”, and in 2016, the State Council announced the first batch of 28 demonstration bases for mass entrepreneurship and innovation (DBEI). From 2017 to 2018, guidelines were issued to further clarify the role and strategic direction of the demonstration bases, promoting the deeper implementation and upgrading of the national innovation and entrepreneurship initiative. As of 2023, a “region-university-enterprise” tripartite framework has taken shape. In contrast to early innovation incubation policies focused on

“resource aggregation”, the current DBEI is centered on three core objectives: stabilizing employment, strengthening momentum, and promoting reform. Through a mix of tax incentives, financial subsidies, and expanded financing channels, the base delivers integrated support to its firms, spanning entrepreneurial incubation, financing, and talent training [7,8]. High-growth technology industries have now taken root within the bases, contributing substantially to economic growth and employment.

Against this backdrop, we adopt a difference-in-differences (DID) approach combined with Propensity Score Matching (PSM) to examine the impact of the DBEI on corporate cash holdings, along with its underlying mechanisms. This article attempts to answer the following key questions: (1) Has the policy of DBEI significantly reduced the cash holding level of enterprises? (2) Does the policy effect vary across regions, industries, or firm ownership types? (3) If policies do indeed affect cash holdings, what is the core transmission mechanism?

This study makes three key contributions. First, at the theoretical level, while existing literature on innovation policy focuses on framework design and policy tools, or on macro-level outcomes. However, there is still a lack of understanding of how China's entrepreneurship and innovation policies affect enterprises [9,10,11,12,13,14], our research can fill the gap in the relationship between entrepreneurship and entrepreneurship policies and corporate cash holdings, combining the macro effects of innovation policies with the micro responses of corporate financial behavior to enrich the theoretical framework of the micro transmission mechanism of innovation policies. Second, the literature on corporate cash holdings remains largely anchored in classical financial theories. It primarily examines the theoretical frameworks, influencing factors, and core motivational logic behind cash-holding behavior [15,16,17,18,19,20,21]. Our research takes DBEI as a unique scenario, departing from traditional theories that focus on spontaneous market factors. At the same time, our study develops a coherent transmission chain from policy to corporate behavior, and demonstrates how macro policies reshape cash-holding motivations—thereby formally establishing the concept of “policy-driven motivation” in the literature. Third, existing research may focus more on the policy effects in developed countries such as the United States and other markets [22,23,24,25,26], as an emerging market country, the impact of innovation policies on corporate cash holdings and other financial behaviors in China has positive reference significance for other developing and developed countries.

Practically, this study offers a basis for policymakers to design differentiated measures and provides guidance for firms to adjust their cash management strategies. This supports a virtuous cycle wherein policy benefits enable cash optimization, ultimately fostering innovation-led growth. The inherent logic is that the DBEI reduces the financing constraints and operational risks of enterprises by providing financial support and risk protection, while incentivizing enterprises to invest resources in innovation activities. This environment reduces the necessity for companies to hold large amounts of precautionary cash, which may lead to a decrease in cash holding levels.

This article studies how the construction of DBEI affects the cash holdings of enterprises. For enterprises, the management of cash holdings is crucial and closely related to their financial risks, investment strategies, and other factors [27]. As an important measure to stimulate economic development and promote innovation, the entrepreneurship and innovation policy has a profound impact on the cash holding behavior of enterprises.

Prior studies indicate that the construction of DBEI has reduced the financing costs of enterprises, eased their financing constraints, and this effect is more prominent in non-state-owned enterprises, high financing constraint enterprises, and the eastern region. Backed by strong government support, enterprises within the bases are more likely to attract financial institutions, thus broadening their financing channels and alleviating funding difficulties. This, in turn, reduces their reliance on internal cash reserves, leading to a decrease in cash holdings. This study examines innovation and entrepreneurship policy to develop a dual-path transmission framework encompassing both resource supply and investment demand. In doing so, it extends the scope of policy-mechanism research and builds on the work of Liu et al. by moving beyond a single-mechanism analysis of cash holdings [28]. At the same time, this study responds to and supplements the research on the relationship between policy attributes and cash holdings in the article [26]. By focusing on a “stable” type of innovation and entrepreneurship policy, it elucidates the transformation logic between policy-driven cash optimization and innovation in emerging markets, thereby refining the comparative analysis of policy attributes across different market scenarios. In addition, we have found that the innovation resources and policy guidance provided by the innovation and entrepreneurship base provide enterprises with more investment opportunities.

The DBEI aims to foster enterprise innovation by providing ample resources and platforms, stimulating firms' innovative vitality and encouraging greater investment in innovative ventures. With policy support, companies are more willing to invest cash in research and technological innovation, thereby reducing their cash holdings. The research results also indicate that the construction of demonstration bases enhances the synergistic effect among enterprises. Rational division of labor and collaboration among enterprises enable lower costs and enhanced fund utilization. The reduction in costs results in a decrease in the amount of cash that companies need to meet the same market demand conditions.

2. Literature Review

2.1 Innovation Policy

Although the role of innovation policies in fostering economic growth and industrial upgrading is widely recognized, their micro-level or firm-level impacts remain relatively under-explored. Previous studies have primarily centered on policy framework design, notably the embedded national model, which advocates for governmental coordination of multiple stakeholders through a four-dimensional framework to address innovation system failures [9]. This perspective has found empirical support in Sweden, where traditional linear policies are observed to be shifting toward a more comprehensive ecosystem approach, offering a potential model for other countries to develop holistic innovation policies [10].

In the face of transformative challenges like sustainable development, existing policy frameworks require further expansion and refinement. Research indicates that traditional innovation system theory struggles to address the demands of sustainable transformation. This gap necessitates integrating insights from socio-technical transitions and emphasizing the synergistic effects of policy mixes [11]. Scholars further stress that while traditional innovation theories provide value for sustainability policy, they must be complemented by multi-level governance mechanisms to balance system stability with breakthrough innovation [29].

Existing studies tend to emphasize macro-level outcomes, with limited attention to micro-level behaviors. For example, warning that the broad generalization of the concept of “innovation” may lead to a decrease in the targeting and effectiveness of policies [12]. However, there are few studies analyzing how China's entrepreneurship and innovation policies affect corporate liquidity management. Despite the development of analytical frameworks for public sector innovation, these studies seldom examine micro-level corporate financial decisions, particularly cash management behavior [13]. Therefore, it is necessary for future research to further explore the impact mechanism of innovation policies on micro financial behavior of enterprises, especially the specific impact on enterprise liquidity management under the background of DBEI.

2.2 Cash Holdings

Corporate cash holdings have long been a central topic in finance. Studies indicate that firms tend to hold more cash when facing greater cash flow uncertainty [30]. Scholars have further pointed out that the motivation for corporate cash holdings has increased due to risk hedging in the context of globalization (Bates et al. 2018). However, excessive cash holdings can grant managers undue discretion, which can result in inefficient capital allocation and reduced financial flexibility [31].

Macroeconomic and policy shifts shape corporate cash-holding decisions directly through their impact on financing constraints, operational uncertainties, and compliance costs. Most studies indicate that economic policy uncertainty (EPU) generally prompts companies to increase cash reserves to cope with potential financing difficulties [32,26]. For example, when U.S. economic policy uncertainty rises, firms—especially those facing financial constraints—significantly increase their cash holdings [26]. Similarly, Taiwanese firms raise their cash ratios in response to external uncertainty, with export-oriented enterprises showing greater sensitivity [32]. Other policies, however, can reduce cash demand. For example, strict environmental regulations deplete liquidity by raising operational costs [33]; cross-border regulatory cooperation curbs hoarding by intensifying enforcement threats [34]; and enhanced judicial independence, such as through China's circuit courts, weakens precautionary motives by lowering financing costs and litigation risk [35]. In addition, the impact of monetary policy is heterogeneous: short-term interest rate shocks increase cash, while forward guidance and quantitative easing reduce cash, reflecting the moderating effect of policy signals on firm expectations [36]. Notably, the interaction of political uncertainty with a corrupt environment amplifies

firms' precautionary cash motives [37], while climate policy uncertainty also elevates corporate cash reserves [38]. These findings highlight that macro policies not only shape corporate cash strategies through traditional financing channels, but also through uncertain expectations and institutional quality.

The corporate governance structure and internal decision-making mechanism are the key to explaining the cross-sectional differences in cash holdings. Research has found that board characteristics significantly affect cash policy: novice independent directors (RIDs) encourage companies to increase their cash holdings by strengthening supervision [39], while politically affiliated external directors (PCODs) reduce cash value by weakening precautionary motives [40]. Managerial behavioral biases such as overconfidence can drive up cash levels, but product market competition can serve as an external governance mechanism to suppress this effect [41]. Human capital quality influences cash holdings through two opposing channels: on one hand, it may increase precautionary reserves due to risks associated with skilled labor; on the other, it can reduce inefficient holdings by mitigating agency costs [42]. Culture and informal institutions are equally important. Clan culture reduces cash demand through risk sharing and reputation constraints, especially in areas with weak systems [43]. In addition, share repurchases reduce cash holdings by reducing free cash flow and optimizing agency costs, but the effect is significant only when used for equity incentives [44]. Supply chain information overflow also plays a role. The low-quality information disclosure of customer enterprises will exacerbate suppliers' concerns about risks, triggering them to increase their cash holdings [45]. These pieces of evidence emphasize that the quality of internal governance and the psychology of decision-makers jointly determine the efficiency and value of cash holdings.

Sudden changes in the external environment and specific industry transformations reshape cash holding motivations by altering corporate risk exposure and financing channels. Environmental risks such as biodiversity risks are independent of climate risks, prompting companies to increase their cash holdings for precautionary reasons [46]. Major epidemics deplete corporate cash by contracting trade credit and operating cash flow—a decline that is more pronounced in countries with stronger institutions, challenging the traditional “cash hoarding” paradigm [47]. In contrast, structural industrial shifts, such as the rise of data-driven industries (DEDI), significantly lower cash holdings by improving firms' debt capacity and trade credit access [48]. In specific industries such as aviation, there are systematic differences in cash holding strategies under different business models, reflecting the constraining effect of industry characteristics on liquidity management [49]. ESG factors also affect cash policies through multiple channels: high ESG scores reduce cash holdings by increasing stock liquidity [50], while ESG reputation risk exacerbates investors' value discounting of high cash companies [51]. In addition, the tax planning behavior of multinational corporations, such as transfer pricing agreements, will significantly affect their global cash allocation strategies [52]. In specific financial institutions such as pension funds, cash holdings are mainly driven by operational and investment needs, and there is a significant phenomenon of “excess cash” [53]. These findings indicate that the effect of external shocks depends critically on two factors: the shock's nature and firm resilience. Risk events typically amplify the precautionary motive for cash, whereas technological or institutional advances diminish this demand by improving financing conditions.

The precautionary savings theory originates from Keynes' liquidity preference theory, emphasizing that firms are more willing to hold cash to cope with future uncertainty [54]. Zeldes proposed a dynamic precautionary savings model, demonstrating that income uncertainty significantly increases savings [55]. The model demonstrates that consumers' sensitivity to temporary income changes is related to their wealth level. The pecking order theory, grounded in information asymmetry and transaction costs, prescribes a financing hierarchy: firms prefer internal funds first, then debt, and equity only as a last resort to avoid adverse signaling and high external costs. These theories provide different explanatory frameworks for corporate cash holding behavior.

Firms hold cash primarily due to precautionary and agency motives. While the precautionary motive drives savings for future uncertainties, the agency motive reflects managerial discretion over surplus cash, often leading to suboptimal capital allocation. The precautionary motivation in trade-off theory suggests that companies tend to hold more cash to cope with future uncertainties and financing constraints. As Hao et al. pointed out in their article, the uncertainty of monetary policy can lead to a corresponding increase in financing costs for enterprises, thereby increasing the risk of refinancing. Enterprises need to hold more cash to cope with liquidity [15]. Empirical research indicates that cash holdings of U.S. firms are positively associated with R&D spending and growth opportunities but negatively linked to dividend payouts and firm size [56]. In

addition, studies have shown that holding precautionary cash is mainly to compensate for potential operating losses and to finance investments. Therefore, when companies face cash risks, they often increase their cash holdings [16].

Agency cost theory centers on the problems stemming from conflicts of interest and information asymmetry between owners and managers. Jensen pointed out that managers tend to hold excessive cash to enhance control [57], which may lead to agency problems. The free cash flow hypothesis further elaborates that management strengthens control by retaining cash, rather than creating value through dividends or investments. All of this reveals the complex motivations behind cash holdings by businesses. Thus, the policy support within innovation and entrepreneurship demonstration bases, aimed at improving corporate governance and mitigating agency issues, is likely to influence firms' cash-holding behavior.

The policy changes in the institutional environment will also affect cash holdings. Direct fiscal tools, such as tax incentives and subsidies, reduce firms' reliance on external financing [17]. Furthermore, engagement in sustainable innovation minimizes excess cash, thereby improving financial efficiency—a finding that suggests firms pursuing green innovation hold lower cash reserves [18]. This implies that companies actively participating in innovation policies may maintain lower cash levels. From a theoretical perspective, the free cash flow framework posits that while overly lenient policies could exacerbate agency issues, well-designed policies can curb cash holdings by limiting managerial discretion [19,20,21].

2.3 Research on the Impact of Innovation Policies on Cash Holding

A nascent but growing stream of literature has started to examine the impact of innovation policies on cash holdings. Findings suggest that such policies can intensify corporate tax avoidance and foster incremental innovation, yet they appear to have no significant effect on breakthrough innovation [58,59]. There are still key gaps in the internal mechanism of how innovation policies affect corporate cash holdings.

The transmission mechanisms through which innovation policies affect cash holdings remain relatively unclear. Research suggests that, in a digital economy, holding some excess cash can enhance firm performance and R&D intensity. Yet, it remains unclear whether innovation policies effectively encourage firms to redeploy cash reserves into R&D investment [60]. Meanwhile, although some studies have linked innovation investment to the improvement of cash holdings, these studies generally overlook the role of policy driven innovation incentives in this process [61]. Additionally, it is worth noting that there is a relative lack of identification and research on mediating variables. While some studies have suggested that sustainable innovation can reduce excess cash [62], it remains unclear whether key channels like financing constraints, innovation investment, and digital transformation mediate this effect—precisely the pathways through which innovation policies are theorized to operate. This deficiency limits a deeper understanding of the mechanism of policy action.

Furthermore, prior work has paid scant attention to DBEI, highlighting a clear gap in the literature. Current research mostly focuses on the impact of market competition or economic policy uncertainty, without fully considering the unique attributes of the DBEI, which integrates multiple features of financing support, risk sharing, and digital empowerment. On the one hand, market competition is believed to both increase corporate cash holdings by promoting innovation and reduce cash demand due to efficiency improvements [63]. On the other hand, economic policy uncertainty has been proven to drive up corporate cash holdings, particularly in companies with severe financing constraints [64]. However, the “stability” of the entrepreneurship and innovation policy has not yet been tested.

2.4 Existing Gaps and Adjustment Directions

The existing research provides an important theoretical basis for this article, but there are still significant research gaps. First, existing studies predominantly operate at the macro level, largely neglecting the micro-level transmission mechanisms linking the DBEI to corporate cash holdings. In particular, the key question of whether the policy promotes the transformation of corporate cash from “defensive reserves” to “innovative investments” has not been clearly answered. In addition, there is a significant lack of research on the heterogeneity of policy effects. Existing studies mainly focus on developed countries or mature enterprises, with limited attention paid to the differentiated responses of small and medium-sized enterprises, enterprises in different regions and industries in the Chinese context, and mainly rely on static analysis, ignoring the dynamic evolution characteristics of policy effects. The deficiency of insufficient mechanism inspection is

also obvious. Although existing literature mentions that policies may affect corporate financing or innovation [64], the mediating role of these factors in the relationship between policies and cash holdings has not been explicitly validated. As a key institutional vehicle for national innovation-driven development, the DBEI is posited to reshape the conventional logic of corporate cash holdings by alleviating financing constraints and incentivizing innovation investment. On the one hand, measures like government-guided funds and reduced financing thresholds enhance firms' access to external capital, diminishing their need for precautionary cash buffers. On the other hand, risk-sharing mechanisms and innovation incentives encourage the reallocation of cash toward R&D and technological upgrading. As an important institutional arrangement for promoting innovation-driven development by the country, the policy of DBEI may reshape the traditional logic of corporate cash holdings by alleviating financing constraints and incentivizing innovation investment. The policy not only enhances firms' access to external funds, thereby reducing precautionary cash needs, but also employs risk-sharing and innovation incentives to encourage the reinvestment of cash into R&D and technological transformation. However, key issues such as whether this logic holds, whether there is heterogeneity in policy effects, and how its core role path is still to be verified. The answers to these questions will not only enrich the theoretical research on the micro effects of innovative policies, but also provide scientific basis for policy optimization and corporate cash management.

3. Theoretical Analysis and Research Hypotheses

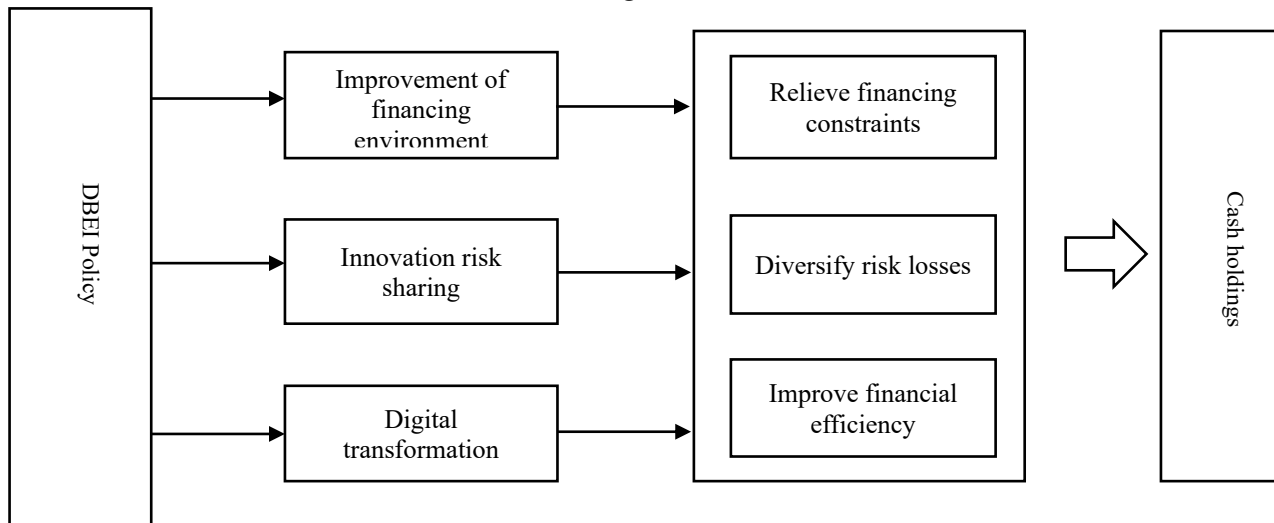
3.1 Theoretical Analysis

Based on the existing theoretical and research gaps, this article proposes a “three channel” theoretical framework for the impact of DBEI on corporate cash holdings. The DBEI has reshaped the cash management strategy of enterprises through its significant improvement effect on the financing environment. Specifically, the innovation and entrepreneurship base has improved the financing environment through institutional innovation and resource integration. The government has lowered the financing threshold for enterprises within the base by establishing a combination of guidance funds, preferential loans, and other policies [65,66]. The credit guarantee system reduces the lending risks of financial institutions and improves the accessibility of external funds for enterprises [67], and links with multi-level capital markets to provide alternative financing channels for small and medium-sized enterprises [68]. These measures alleviate financing constraints and directly weaken the precautionary motivation for cash holdings.

In terms of creating investment opportunities and effects, the DBEI creates high-quality investments for enterprises through multiple institutional designs. The core path includes: industrial ecological synergy, that is, the integration of the DBEI through the industrial chain of “leading enterprise driven + small and medium-sized enterprise supporting”, promoting enterprises to access high value-added links such as technology research and development [69,70]; market access and cost advantages, the innovation and entrepreneurship base has lowered the investment threshold for enterprises through a simple negative list for market access and optimized administrative approval processes. At the same time, the tax exemptions provided by policies have further reduced the marginal cost of investment projects, adding possibilities for investment opportunities that are not feasible [71,72]; regional resource aggregation has enabled the base to spatially gather talents, capital, and technology, providing essential support for enterprise investment [73].

The DBEI also promotes innovation investment of enterprises through the sharing effect of innovation risks [74]. This effect mainly disperses innovation risks through two mechanisms. One is that the risk compensation fund covers part of the losses of failed R&D projects, reducing the downside risk of innovation [75]. Another type is the “government industry university research” collaborative platform that shares technological risks and improves innovation success rates [76]. After reducing risks, companies are more willing to shift their cash from idle reserves to research and development investment. Although policies have already played a positive role, further optimization is still needed to fully utilize market tools, address more complex risks and challenges, and ultimately achieve the effect of risk diversification driving innovation incentives.

Figure 1



3.2 Research Hypothesis

3.2.1 Main Effect Hypothesis

The establishment of DBEI can significantly reduce the cash holdings of enterprises in the region through systematic policy intervention. The theoretical support for this main effect comes from the profound impact of institutional environment optimization on cash holding behavior. The improvement of policy-driven institutional environment can effectively reduce the cash reserves of enterprises. Empirical research on China's shareholding reform indicates that institutional optimization significantly reduces the precautionary cash needs of enterprises [77]. Empirical research in the Vietnamese market has also found that policy induced investment opportunities significantly reduce corporate cash holdings [78]. The demonstration base for entrepreneurship and innovation provides enterprises with more stable policy expectations and a more favorable development environment by establishing a sound innovation ecosystem. The optimization of this institutional environment not only directly reduces the external uncertainty faced by enterprises, but more importantly, through the joint action of the three major transmission channels, encourages enterprises to actively adjust their cash holding strategies.

Therefore, the main effect hypothesis of this article is proposed:

H1: The construction of DBEI can significantly reduce the cash holdings level of enterprises in the region.

3.2.2 Intermediary Effect Hypothesis

At the intermediary effect level, the entrepreneurship and innovation policy affects corporate cash holding decisions through three interrelated channels. First, the easing of financing constraints has weakened the precautionary cash holding motivation of enterprises. The entrepreneurship and innovation policy has significantly improved the financing accessibility of non-state-owned enterprises and small and medium-sized enterprises through financial innovation tools such as credit guarantees and risk compensation. The research shows that the stronger the financing constraints are, the higher the precautionary cash demand is [61]. When the mass entrepreneurship and innovation policy effectively alleviates financing constraints, enterprises do not need to hoard a lot of cash to cope with liquidity shocks, and the level of cash holdings decreases accordingly (H2a).

Secondly, the creation of investment opportunities promotes the reallocation of cash to physical projects. The DBEI has created rich and high-quality investment opportunities for enterprises in the region by promoting collaborative innovation between leading enterprises and small and medium-sized enterprises, gathering high-end talents and capital elements, and other specific measures. Research has confirmed that the allocation efficiency of excess cash is higher when there are sufficient investment opportunities, and companies will actively reduce their cash reserves to invest in high-yield projects [60]. The industrial innovation alliance and

shared technology platform established by the demonstration base have greatly improved the investment efficiency of enterprises, promoting the rapid conversion of idle cash into productive investment (H2b).

Finally, innovation incentives have driven the reallocation of cash towards research and development activities. The DBEI has significantly increased the innovation investment intensity of enterprises through incentive measures such as R&D subsidies, tax incentives, and talent introduction. Empirical research shows that the proportion of R&D personnel of enterprises in the mass entrepreneurship and innovation bases has increased by 4.1% compared with non-base enterprises [79]. Further research in the digital economy industry confirms a negative correlation between innovation investment and cash holdings [60]. Policy incentives encourage companies to allocate more cash to innovative activities such as R&D equipment procurement, technical personnel compensation, and technology introduction, thereby reducing idle capital holdings (H2c).

3.2.3 Heterogeneity Hypothesis

In terms of the nature of property rights, the negative effect of entrepreneurship and innovation policies on cash holdings is more significant in non-state-owned enterprises. This is mainly due to two mechanisms: on the one hand, state-owned enterprises enjoy implicit government guarantees and more policy support, and their demand for financing support provided by the innovation and entrepreneurship policies is relatively weak; however, non-state-owned enterprises face credit discrimination for a long time, and the easing of financing constraints brought by the policy has a stronger marginal effect on them (H3a). On the other hand, non-state-owned enterprises have higher flexibility in business decision-making and can quickly allocate cash to investment opportunities created by policies. Driven by their goal of maximizing profits, non-state-owned enterprises are more responsive to investment opportunities and innovation subsidies provided by the innovation and entrepreneurship policy, thereby significantly reducing their cash holdings.

In terms of regional distribution, the impact of entrepreneurship and innovation policies on cash holdings reveals significant regional differences, with the effect being more prominent in the eastern region. This is mainly attributed to the higher degree of marketization and more perfect institutional environment in the eastern region. The developed financial market and comprehensive legal protection system enable enterprises in the eastern region to quickly obtain financial support and efficiently allocate cash to investment projects (H3b). In contrast, the central and western regions face institutional barriers such as “poor factor flow” [80], and there is a time delay in policy transmission, which reduces the immediacy of policy effectiveness. This regional heterogeneity reflects the key role of marketization in policy transmission.

In the dimension of industry characteristics, the negative effect of entrepreneurship and innovation policies on cash holdings of high-tech enterprises is more obvious. This is mainly because the marginal returns on innovation investment in the high-tech industry are significantly higher than those in traditional industries [60], and the innovation incentive measures of the innovation and entrepreneurship policy are highly in line with the development needs of the high-tech industry. According to the theoretical explanation of the “transformational innovation framework”, technology industry enterprises are more likely to obtain systematic transformation opportunities through policy support [14], which in turn motivates them to reallocate cash reserves to research and development activities. This industry heterogeneity reflects the important influence of the matching degree of policies and industrial characteristics on the policy effect.

4. Models, Variables, and Data

4.1 Model Specification

Based on the “quasi natural experiment” attribute of the policies of the DBEI, this paper uses the propensity score matching double difference method (PSM-DID) to identify the causal effect of policies on corporate cash holdings. At the same time, through the mediating effect model, it tests the transmission path of financing constraints mitigation, investment opportunity creation, and innovation input increase, and analyzes the heterogeneity of policy effect through interactive regression. All models control for individual, industry, and year fixed effects to mitigate omitted variable bias, and the definition of core variables remains consistent with the previous text (Table 1). We estimate the following difference-in-differences (DID) model:

$$\text{Cash}_{i,t} = \alpha_0 + \alpha_1(\text{Batch}_i \times \text{Time}_t) + \sum_{k=2}^n \alpha_k \text{Control}_{i,t} + \mu_i + \gamma_j + \lambda_t + \varepsilon_{i,t} \quad (1)$$

Among them, $Cash_{i,t}$ refers to the level of cash holdings of enterprise i in year t , measured in the narrow sense of cash holdings (Nch) or the broad sense of cash holdings (Gch). $Control_{i,t}$ represents a series of control variables at the enterprise level, including Lev , $Lasset$, $Lreve$, etc., and μ_i , γ_j , λ_t represent the fixed effects of enterprises, industries, and years respectively.

To reveal the underlying mechanism of policy impact on cash holdings, we further adopt a mediation effect model based on Baron and Kenny's (1986) method and combined with structural equation modeling. In addition, we also expanded the benchmark model to verify the heterogeneity of Policy effect in different dimensions.

$$Cash_{i,t} = \beta_0 + \beta_1 (Batch_i \times Time_t) + \beta_2 Mediator_{i,t} + \sum \beta_k Controls_{i,t} + \mu_i + \gamma_j + \lambda_t + \varepsilon_{i,t} \quad (2)$$

$$Mediator_{i,t} = \gamma_0 + \gamma_1 (Batch_i \times Time_t) + \sum \gamma_k Controls_{i,t} + \mu_i + \gamma_j + \lambda_t + v_{i,t} \quad (3)$$

4.2 Variable Definition

The cash holding level of an enterprise is the core content of financial decision-making and an important part of enterprise liquidity management, which comprehensively reflects the agency problem, precautionary motive and future investment opportunities of enterprises. We use two methods for measurement: one is narrow cash holdings (Nch), which refers to the ratio of monetary funds to total assets; the other is broad cash holdings (Gch), which uses the ratio of the sum of monetary funds and transactional financial assets to total assets. The higher this ratio, the more abundant the cash and cash-like assets held by the enterprise.

Batch: Refers to the virtual variable of the treatment group determined after the tendency score matching (PSM). A value of 1 is assigned if the firm is located within a DBEI; otherwise, it is 0. Time: Set the starting point for policy implementation in the base batch. Time=1 in the year after policy implementation, otherwise it is 0. Batch*Time: generated by multiplying the treatment group virtual variable (Batch) and the time virtual variable (Time), which can reflect the effect of policy implementation.

To control other factors that may affect the level of enterprises' cash holdings, this paper introduces the following variables into the regression model: enterprise size (Lasset), leverage ratio (Lev), profitability (Roe), cash flow status (Cf), asset operating efficiency (Ato), property quality (Soe), and financing constraints (Sa). In addition, the model also controls for industry fixed effects and annual fixed effects to eliminate interference from industry characteristics and macro time trends that do not change over time.

Table 1: Variable definition table

Variable types	Variable name	Variable symbol	Variable definition
Explained variables	Cash holdings	Nch	Monetary funds/total assets
	Broad cash holdings	Gch	(Monetary funds + Trading financial assets)/Total assets
Core explanatory variable	Policy impact of DBEI	Batch*Time	As a dummy variable, the treatment group enterprise takes 1 in the year after the policy is implemented; otherwise, it takes 0 (DID item) Generated by Batch*Time
	Is it a treatment group	Batch	Virtual variable: enterprises within the scope of the DBEI after PSM matching take 1, and enterprises in the matched control group take 0
	Policy implementation time	Time	Virtual variable, taking 1 as the year after the implementation of the batch policy to which the enterprise belongs and 0 as the year before implementation
Control variables	Leverage ratio	Lev	Year-end total liabilities/Year-end total assets
	Company size	Lasset	Natural logarithm of year-end total assets
	Revenue scale	Lreve	Natural logarithm of operating income
	Return on equity	Roe	Net profit/Net assets
	Return on total assets	Roa	Net profit/Total assets
	Cash flow ratio	Cf	Net cash flows from operating activities/Total assets
	Total asset turnover ratio	Ato	Revenue/Total Assets

Variable types	Variable name	Variable symbol	Variable definition
	Is it profitable	Net	Virtual variable, net profit ≥ 0 is taken as 1, and the rest is taken as 0
	Nature of property rights	Soe	Virtual variables, 1 for state-owned enterprises and 0 for non-state-owned enterprises
	Financing constraints	Sa	SA index
	Innovation sharing	Rand	Number of R&D personnel/total number of employees
	Digital transformation	Score	Digital Transformation Index (Liu et al. 2025)

4.3 Data sources and Descriptive Statistics

Data sources: CSMAR and RESSET. The data period is from 2010 to 2023, excluding ST, delisted, and missing data samples, resulting in 4982 listed companies and a total of 42870 samples. Among them, there are 1321 listed companies related to the mass entrepreneurship and innovation bases. Identification method of listed companies in the mass entrepreneurship and innovation bases: (1) The regional mass entrepreneurship and innovation bases adopts the method of matching the registration place of listed companies, that is, listed companies registered in the regional mass entrepreneurship and innovation bases are included in the relevant listed companies in the mass entrepreneurship and innovation bases; (2) The mass entrepreneurship and innovation bases of colleges and universities and the mass entrepreneurship and innovation bases of enterprises are identified mainly by matching the first shareholder of listed companies, supplemented by manual network search, that is, the listed companies actually controlled by colleges and universities and enterprises are included in the mass entrepreneurship and innovation bases. To eliminate the influence of extreme values, the variables were truncated to the 1st percentile, resulting in a total of 42870 firms. The descriptive statistics of the main variables are shown in Table 2. The mean value of the narrow cash holdings level Nch of enterprises is 0.19, and the standard deviation is 0.14, indicating that the sample enterprises hold 19% of the total assets in monetary capital on average, and the difference between enterprises is small, which is basically consistent with previous studies. The average value of Gch in the treatment group (0.22) was higher than that in the control group (0.19), indicating that the policy may increase the level of cash holdings. The average asset liability ratio is 0.42, which is in line with the average debt level of Chinese listed companies. The average digital score is 0.16, and the standard deviation is 0.15, indicating that the sample enterprises' digital transformation is at a medium level, and the difference in digital degree among enterprises is significant. The distribution of other variables is reasonable and consistent with the conclusions of existing literature, which verifies the reliability of the data.

Table 2: Descriptive statistics

Variable	N	Mean	SD	p50	Min	Max
Nch	42870	0.19	0.14	0.15	0.02	0.69
Gch	42870	0.22	0.16	0.17	0.02	0.74
Lev	42870	0.42	0.21	0.41	0.05	0.94
Lasset	42870	22.18	1.3	21.98	19.82	26.26
Lreve	42870	21.48	1.46	21.32	18.44	25.69
Net	42870	0.88	0.33	1	0	1
Roe	42870	0.05	0.15	0.07	-0.83	0.39
Cf	42870	0.05	0.07	0.05	-0.17	0.24
Ato	42870	0.6	0.41	0.51	0.07	2.49
Rand	42870	0.11	0.14	0.09	0	0.96
Score	42870	0.16	0.15	0.19	0	0.76
Sa	42870	-3.84	0.29	-3.84	-5.83	-0.48

5. Regression Analysis

5.1 Benchmark Regression

Table 3 presents the baseline regression results estimating the impact of the innovation policy on corporate cash holdings for the period 2010–2023. Among them, columns (1) to (3) are the estimation results of cash holdings (Nch) in the narrow sense as the explained variable, column (1) is the estimation results without adding the control variable, column (2) is the result of taking the year as the fixed effect, and column (3) is the

estimation results after adding the control variable. Before adding control variables, the coefficient of the core cross term Batch*Time was -0.046. After adding control variables, the coefficient of Batch*Time increased by 0.034, both of which were significantly negative at the 1% level. Columns (4) to (6) report the results using broad cash holdings (Gch) as the dependent variable, column (4) is the estimation result without adding the control variable, column (5) is the result of taking the year as the fixed effect, and column (6) is the estimation result after adding the control variable. The coefficients of Batch*Time before and after adding control variables were -0.029 and -0.014, respectively, and were significant at the 1% level. Overall, the implementation of the innovation policy leads to a significant reduction in both narrow (Nch) and broad (Gch) cash holdings, indicating that firms tend to reduce cash reserves, which is consistent with the assumption. In addition, the coefficients of leverage ratio (Lev) and income scale (Lreve) are both negative, indicating that high debt enterprises face debt pressure and need to prioritize debt repayment, while high revenue enterprises tend to use funds for investment and expansion, which will reduce their cash holdings.

Table 3: Basic regression analysis

variable	Dep.= Nch			Dep.= Gch		
	(1)	(2)	(3)	(4)	(5)	(6)
Batch*Time	-0.046***	-0.013***	-0.012***	-0.029***	-0.015***	-0.014***
	(-20.85)	(-5.54)	(-5.43)	(-12.71)	(-6.23)	(-6.14)
Lev			-0.245***			-0.274***
			(-53.05)			(-57.82)
Lasset			0.011***			0.018***
			(4.15)			(6.58)
Lreve			-0.016***			-0.023***
			(-6.61)			(-9.21)
Net			0.013***			0.013***
			(6.54)			(6.35)
Roe			0.012**			0.017***
			(2.56)			(3.58)
Cf			0.227***			0.225***
			(27.00)			(25.96)
Ato			-0.008*			-0.00600
			(-1.87)			(-1.35)
Cons	0.200***	0.195***	0.385***	0.222***	0.220***	0.418***
	(337.88)	(328.98)	(15.10)	(362.94)	(357.92)	(15.96)
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	No	Yes	Yes
N	42870	42870	42870	42870	42870	42870
Adj. R ²	0.479	0.515	0.572	0.562	0.590	0.644
F	434.9	30.69	632.5	161.7	38.80	727.4

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2 Robustness Test

5.2.1 PSM-DID

To mitigate potential selection bias and ensure the robustness of our difference-in-differences (DID) estimates, we employ Propensity Score Matching (PSM) to construct a comparable control group. Three models were used to estimate the effects of the treatment: (1) the effect of including firms and industries, (2) the fixed effect of increasing years, and (3) the effect of adding additional control variables. Select industry (measured by industry code SIC), enterprise size (measured by Lasset), profitability (measured by Roe), and revenue scale (measured by Lreve, etc.) as covariates. A one-to-one nearest neighbor matching method was adopted for the sample from 2010 to 2023, forming 22000 observations to match similar control samples for enterprises affected by the innovation and entrepreneurship policy. During the verification process, to validate the reliability of the matching results, a balance assumption was made for the score matching of each year. Before matching, the standard error of the treatment group and the control group in the enterprise size, profitability and other covariates was large, and the difference was obvious. After matching, the standard errors of both the treatment group and the control group decreased significantly, and the standard errors of each

variable were effectively controlled, indicating that propensity score matching effectively reduced the difference between the treatment group and the control group.

Regression results indicate that in the model with narrow cash holdings (Nch) and broad cash holdings as dependent variables, the coefficients of Batch*Time are -0.046 and -0.029 respectively, and the significance remains stable after all fixed effects and control variables are included ($p < 0.01$). The robustness tests indicate that the establishment of entrepreneurship and innovation policy significantly reduces the level of cash holdings of enterprises. After controlling the differences in observable characteristics, the negative effect of policies on corporate cash holdings still exists, which verifies that the benchmark conclusion is not affected by sample selection bias, indicating that our basic results are robust to different model configurations. Specifically, the processing effect remains significant on both innovation indicators, which enhances the credibility of the results.

Table 4: Robustness tests

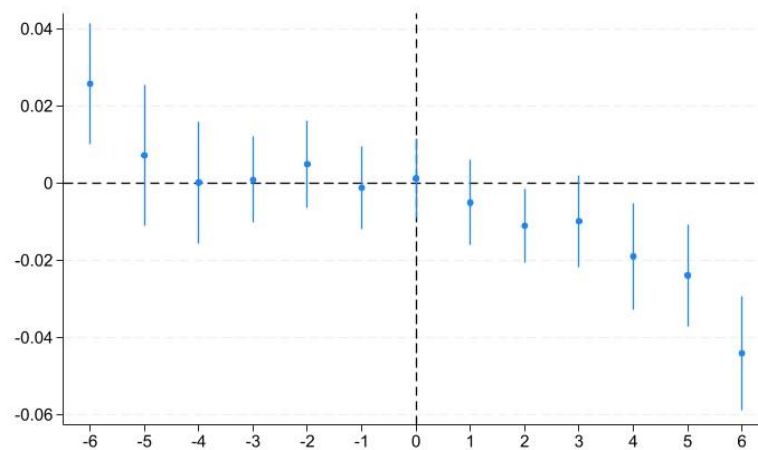
variable	Dep.= Nch			Dep.= Gch		
	(1)	(2)	(3)	(4)	(5)	(6)
Batch*Time	-0.046***	-0.010***	-0.009***	-0.029***	-0.012***	-0.010***
	(-20.36)	(-3.57)	(-3.28)	(-12.38)	(-4.11)	(-3.82)
Lev			-0.246***			-0.278***
			(-36.12)			(-39.75)
Lasset			0.016***			0.024***
			(4.09)			(6.02)
Lreve			-0.022***			-0.029***
			(-6.04)			(-7.99)
Net			0.015***			0.014***
			(4.95)			(4.72)
Roe			0.012*			0.015**
			(1.72)			(2.21)
Cf			0.235***			0.231***
			(18.82)			(18.00)
Ato			-0.00400			0.00100
			(-0.64)			(0.09)
Cons	0.214***	0.203***	0.399***	0.232***	0.227***	0.422***
	(222.84)	(192.06)	(10.89)	(234.42)	(207.65)	(11.20)
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	No	Yes	Yes
N	22000	22000	22000	22000	22000	22000
Adj. R ²	0.484	0.521	0.576	0.556	0.587	0.640
F	414.7	12.71	302.4	153.3	16.91	349.6

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2.2 Parallel Trend Test

To exclude alternative explanations for causal relationships caused by pre-existing trends, the experimental and control groups need to satisfy the assumption of parallel trends. Therefore, the article constructed a double difference model, and we tested the parallel trend hypothesis by examining the dynamic effects of different periods before and after policy implementation. Figure 2 plots the estimation coefficients of each pre-processing period, showing that before the implementation of the policy, the regression coefficients are not significant, that is, there is no significant difference between the cash holding levels of the treatment group and the experimental group, and the confidence interval covers 0 point, which shows that the parallel trend hypothesis in this paper is valid. After the implementation of the policy, the regression coefficient was significantly negative and showed a downward trend, indicating that the parallel trend test was passed, further reflecting the authenticity of the policy effect. This indicates that with the continuous promotion of the DBEI, it has shown a strong dynamic effect on reducing the level of cash holdings.

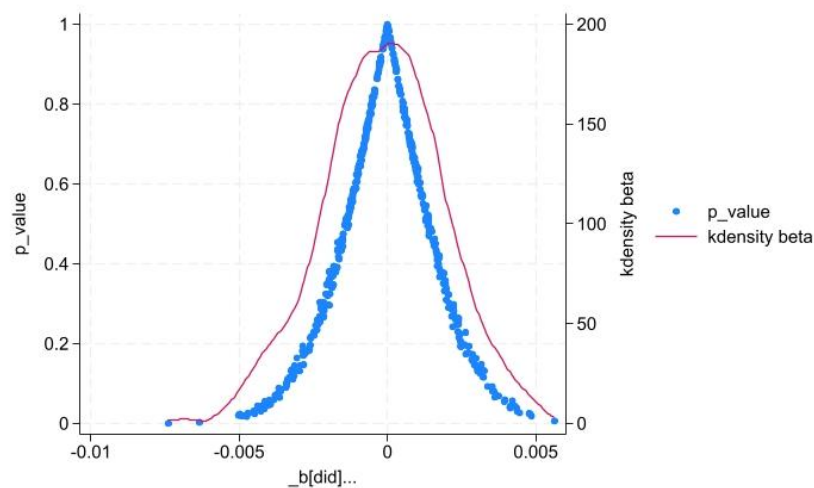
Figure 2: Parallel trends test



5.2.3 Placebo Test

To further verify whether there are endogeneity issues caused by false correlations or unobserved time-varying factors in this study, we conducted a placebo test by randomly replacing the core explanatory variables. Randomly shuffle the values of policy shock variables, simulate the scenario of policy random occurrence, repeat this process 500 times, and obtain the estimated coefficient density distribution as shown in Figure 3. The results suggest that these coefficients are distributed near zero and conform to the normal distribution. They are significantly different from the estimated coefficients of policy effect in the benchmark regression and conform to the expectations of the placebo test. The coefficient is significantly different from the estimated coefficient of policy effect in the benchmark regression, which indicates that the impact of entrepreneurship and innovation policies on cash holdings in the benchmark regression is not accidental, and it is less likely to be interfered by other policies or random factors, which further verifies the statistical robustness of the negative effect of policies on the level of enterprises' cash holdings.

Figure 3: Placebo test



5.3 Heterogeneity Analysis

To examine whether the policy effect varies across different types of firms, we conduct heterogeneity analyzes along three dimensions: ownership type, geographic region, and industry. The results reveal significant differential effects.

5.3.1 Different Types of Enterprises

To explore whether the policy effect will be different due to the different nature of enterprise ownership, we divide the research sample into two groups: state-owned enterprises and non-state-owned enterprises. The results show that for non-state-owned enterprises (non-SOEs), the coefficient of Batch*Time is -0.004 and statistically insignificant in the baseline model. After including control variables, however, it increases to -0.010 and becomes significant at the 1% level, indicating a modest but robust negative policy effect. This likely reflects their higher sensitivity to both financing constraints and policy stimuli. In contrast, state-owned enterprises (SOEs) exhibit larger absolute coefficient values and stronger statistical significance once controls are added. The possible reasons for this result are that, compared with state-owned firms, non-state-owned firms face tighter financing constraints, have stronger demand for holding cash to cope with potential external risks, and the effect of policies to reduce cash holdings is weakened. However, state-owned companies have more relaxed financing constraints, stronger policy enforcement, and the decline of cash holdings is more obvious under the mass entrepreneurship and innovation policy. To explore whether the policy effect will be different due to the different nature of enterprise ownership, we divide the research sample into two groups: state-owned enterprises and non-state-owned enterprises. The results suggest that the coefficient of Batch*Time in this group of data of non-state-owned firms is -0.004 in the benchmark model, which is not significant, while the coefficient becomes -0.010 after the control variable is added, which is significant at the level of 1%, indicating that there is a weak but statistically significant negative effect of the policy, which is mainly due to the difference between financing constraints and policy responsiveness. State-owned firms have larger absolute values and higher significance after adding control variables. The possible reasons for this result are that, compared with state-owned enterprises, non-state-owned enterprises face tighter financing constraints, have stronger demand for holding cash to cope with potential external risks, and the effect of policies to reduce cash holdings is weakened. However, state-owned firms have more relaxed financing constraints, stronger policy enforcement, and the decline of cash holdings is more obvious under the mass entrepreneurship and innovation policy. This finding aligns with resource-based theory, highlighting how state-owned enterprises leverage institutional support to enhance risk resilience.

Table 5: Different types of enterprises

Dep.= Nch	SOEs			Non-SOEs		
	(1)	(2)	(3)	(4)	(5)	(6)
Batch*Time	-0.004 (-1.59)	-0.008*** (-2.77)	-0.010*** (-3.60)	-0.076*** (-23.04)	-0.021*** (-6.49)	-0.017*** (-5.35)
Lev			-0.163*** (-23.42)			-0.254*** (-41.95)
Lasset			0.00300 (0.73)			0.016*** (4.47)
Lreve			-0.00400 (-1.31)			-0.019*** (-5.39)
Net			0.007** (2.49)			0.012*** (4.63)
Roe			0.022*** (3.46)			0.00200 (0.28)
Cf			0.218*** (18.78)			0.260*** (23.67)
Ato			-0.012** (-2.44)			-0.00600 (-1.09)
Cons	0.171*** (226.77)	0.171*** (219.42)	0.281*** (7.46)	0.217*** (262.54)	0.209*** (265.24)	0.315*** (9.15)
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	No	Yes	Yes
N	15000	15000	15000	28000	28000	28000
Adj. R ²	0.596	0.600	0.635	0.441	0.528	0.580
F	2.536	7.697	159.8	531.0	42.14	385.6

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.3.2 Different Regions

Considering that there are significant differences in institutional and economic development levels among regions in China, this difference may lead to heterogeneity in the impact of corporate cash holdings policy shocks. Therefore, we divide the sample according to the four regions of the east, middle, west and northeast to test the heterogeneity between different regions.

Among them, columns (1) to (2) correspond to the eastern region. Before adding control variables and year fixed effects, the Batch*Time coefficient was -0.058, significantly negative. After adding, the coefficient remained significantly negative at the 1% level, but the absolute value decreased. The data reveals that the policy plays the most significant role in reducing the level of cash holdings of enterprises in the eastern region. The possible reasons for this result are that the eastern region has a high degree of marketization and a perfect financial system. The developed financial market has improved the availability of external financing for firms. The mechanism for the policy to reduce cash holdings by alleviating financing constraints is clear, and the dependence of enterprises on cash reserves has also decreased. This result is consistent with its high degree of marketization and efficient policy transmission channels.

Columns (3) to (4) correspond to the central region, which is dominated by traditional manufacturing industries, with strong heterogeneity of enterprises. When the variable is not controlled, the coefficient is -0.025, which is significant at the level of 1%, indicating that when the company characteristic variable is not included, the policy has a significant negative impact on the cash holdings level in the central region, and the intensity of the effect is close to that in the western region. After adding control variables and year fixed effect, the coefficient dropped to -0.001, which is not statistically significant at all. This indicates that the initial significant effect may be caused by the deviation of missing variables. This part of enterprises themselves is caused by enterprises with low cash holdings, rather than the role of policies, which reflects that there may be structural barriers in policy transmission in the central region.

Column (5) to (6) corresponds to the western region, with a coefficient of -0.027 before the addition of variables and year fixed effects, which is significantly negative at the 1% level. After the addition of variables, the coefficient becomes -0.012, which is significant at the 5% level. The fitting degree of the model is better than that of the central region. This is mainly due to the influence of national strategies such as the “Western Development”. The policy provides stronger support for the western region, which to some extent alleviates the financing constraints of firms. However, due to the weak economic foundation, the intensity of the effect is not as significant as in the eastern region.

Column (7) to (8) corresponds to the Northeast region, and the data indicates that regardless of whether control variables are included, the coefficients are positive, indicating a significant positive effect of policies, which is different from other regions. The main reason for this result is that companies believe that the risks of transformation are high, and the uncertainty of policy effects is strong, so they are more inclined to hold cash to cope with potential crises. On the other hand, because the liquidity released by policies is difficult to enter entities, private companies must increase their cash holdings to protect themselves. In addition, the small sample size may also be influenced by local policy pilot programs.

Table 6: Different regions

Dep.= Nch	East		Central		West		Northeast	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Batch*Time	-0.058***	-0.015***	-0.025***	-0.001	-0.027***	-0.012**	0.022**	0.034***
	(-21.34)	(-5.57)	(-4.11)	(-0.15)	(-5.04)	(-2.11)	(2.34)	(3.29)
Lev		-0.254***		-0.214***		-0.231***		-0.201***
		(-43.06)		(-18.58)		(-21.17)		(-10.16)
Lasset		0.011***		-0.00400		0.019***		0.034***
		(3.13)		(-0.60)		(2.91)		(3.02)
Lreve		-0.017***		-0.00300		-0.018***		-0.025**
		(-5.28)		(-0.47)		(-3.14)		(-2.40)
Net		0.015***		0.009*		0.011**		0.016*
		(5.86)		(1.88)		(2.38)		(1.95)
Roe		0.010*		0.0110		0.0140		-0.00700
		(1.65)		(1.06)		(1.30)		(-0.41)

Dep.= Nch	East		Central		West		Northeast	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cf		0.250***		0.162***		0.210***		0.182***
		(24.16)		(7.73)		(9.29)		(4.72)
Ato		-0.011**		-0.032***		0.0170		0.00900
		(-2.24)		(-3.25)		(1.59)		(0.52)
Cons	0.211***	0.411***	0.182***	0.437***	0.180***	0.230***	0.155***	-0.00300
	(279.31)	(12.62)	(134.71)	(6.89)	(120.76)	(3.61)	(62.51)	(-0.02)
Individual	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes	No	Yes	No	Yes
N	29000	29000	6054	6054	5590	5590	1692	1692
Adj. R ²	0.480	0.584	0.476	0.556	0.461	0.541	0.448	0.504
F	455.5	441.2	16.89	75.70	25.37	91.68	5.486	21.43

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. 5.3.3 Different industries.

Owing to heterogeneity in production technology, capital intensity, and financing demand across industries, we conduct a comparative analysis between the manufacturing and non-manufacturing sectors to investigate the cross-sector disparity in cash holdings. The first three columns reflect that enterprises with sufficient cash flow accumulate more cash from the manufacturing industry. The coefficient of the core policy variable is -0.041, which is significantly negative, indicating that the policy has reduced the level of cash holdings of manufacturing enterprises, which is in line with the external financing needs of manufacturing enterprises facing higher production cycles. After the year fixed effect is added, the coefficient drops to -0.004. This recession reflects the high heterogeneity within the manufacturing industry. Grouping variables absorb the characteristics of unobserved industry segments and dilute the overall policy. After adding the relevant control variables, the Adj. R² increased, and the leverage ratio showed a significant negative correlation, indicating that the cash holdings level of highly indebted firms was lower, and the cash flow was significantly positive, indicating that firms with sufficient cash flow accumulated more cash. The asset turnover rate is significantly negative, indicating that enterprises with low asset utilization efficiency have less cash holdings. The last three columns reflect the policy effect of non-manufacturing industries. Under the benchmark model, the coefficient is -0.052, which is greater than that of manufacturing industries, indicating that the initial impact of policy on cash holdings is more significant. After adding grouping variables, the coefficient decreased slightly but remained significantly negative, indicating a higher degree of homogeneity in non-manufacturing industries. After adding the control variables at the enterprise level, Adj. R² is higher than that of the manufacturing industry, and the model has a better fit. The symbols of control variables such as Lev and Lreve are in line with expectations, which confirms that the policy effect is not interfered by enterprise characteristics.

Table 7: Different industries

Dep.= Nch	Manufacturing			Non-Manufacturing		
	(1)	(2)	(3)	(4)	(5)	(6)
Batch*Time	-0.041***	-0.00400	-0.005*	-0.052***	-0.024***	-0.022***
	(-13.67)	(-1.40)	(-1.66)	(-15.66)	(-6.44)	(-6.18)
Lev			-0.264***			-0.228***
			(-44.97)			(-28.86)
Lasset			0.024***			-0.006*
			(6.11)			(-1.69)
Lreve			-0.024***			-0.011***
			(-6.52)			(-3.15)
Net			0.012***			0.013***
			(4.85)			(3.99)
Roe			0.010*			0.0100
			(1.69)			(1.41)
Age			0			0
			(.)			(.)
			0.233***			0.245***
			(21.27)			(18.80)

Dep.= Nch	Manufacturing			Non-Manufacturing		
	(1)	(2)	(3)	(4)	(5)	(6)
Ato			-0.020***			0.00900
			(-3.36)			(1.47)
Cons	0.198***	0.193***	0.276***	0.204***	0.198***	0.653***
	(273.66)	(270.39)	(8.13)	(199.22)	(188.38)	(15.03)
Individual	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	No	Yes	Yes
N	28000	28000	28000	14000	14000	14000
Adj. R ²	0.439	0.487	0.550	0.571	0.591	0.641
F	186.9	1.959	438.9	245.4	41.53	223.8

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4 Mechanism Analysis

5.4.1 Financing Constraints

This paper refers to Hadlock & Pierce's method and uses SA index to measure the financing constraints of enterprises [81]. The coefficient of the explained variable SA index is negative under the policy variable, which can significantly observe that the policy impact reduces the SA index, indicating that the policy has eased the level of financing constraints to a certain extent. After controlling the heterogeneity of firms, the coefficient is still negative, indicating that policies have an independent effect on easing financing constraints. It can be seen from the key data that the data of enterprise scale is positive, indicating that the larger the enterprise, the weaker the financing constraints. If the coefficient of firm age is negative, it indicates that mature firms often have a better reputation and operating records, and their financing level is also lower. A positive return on equity reflects that companies with sufficient internal cash flow have more cash reserves. The result of the coefficient of SA index tests the theory of precautionary motive, and proves that companies facing stronger financing constraints will ease external financing problems by holding more cash. After controlling the characteristics of companies, we tested whether the relationship between financing constraints and cash holdings was still valid. We found that the leverage ratio coefficient was negative, indicating that highly leveraged enterprises would reduce their cash holdings under debt constraints. A positive cash flow meant that firms with sufficient internal cash flow would have more cash holdings. In model (1) and model (3), policies ease the financing constraints of enterprises by changing the availability of external financing.

Through analysis, it is finally confirmed that financing constraints measured by SA index is an important intermediary variable in the relationship between policy and firm cash holdings, that is, the policy ultimately reduces the level of cash holdings by easing financing constraints. For enterprises with strong financing constraints, such policies can optimize their liquidity allocation and reduce inefficient cash hoarding.

Table 8: Mechanism analysis: financing constraints

	Dep.= SA	Dep.= Nch	Dep.= SA	Dep.= Nch
	(1)	(2)	(3)	(4)
Batch*Time	-0.247***		-0.010***	
	(-77.80)		(-3.95)	
Sa		0.177***		0.196***
		(51.70)		(27.35)
Lev			0.00300	-0.240***
			(0.77)	(-52.55)
Lasset			0.060***	0.009***
			(29.81)	(3.53)
Lreve			-0.029***	-0.012***
			(-14.49)	(-4.86)
Net			-0.011***	0.013***
			(-4.42)	(6.34)
Roe			0.021***	0.010**
			(3.75)	(2.26)

	Dep.= SA	Dep.= Nch	Dep.= SA	Dep.= Nch
	(1)	(2)	(3)	(4)
Age			-0.041***	0
			(-412.76)	(.)
			-0.029***	0.228***
			(-3.07)	(27.26)
Ato			0.038***	-0.013***
			(11.80)	(-3.35)
Cons	-3.800***	0.874***	-3.794***	1.082***
	(-4433.36)	(67.00)	(-323.81)	(30.14)
Individual	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes
N	43000	43000	43000	43000
Adj. R ²	0.742	0.513	0.807	0.580
F	6052	1569	18000	656.6

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4.2 Innovation Sharing

The results confirm that the policy effectively stimulates corporate R&D investment, likely by sharing innovation costs and reducing investment uncertainty, which incentivizes firms to increase R&D expenditures. The larger t-statistic and higher Adj. R² highlight the strength and reliability of the relationship between policy driven R&D investment. As the proportion of R&D personnel increases, cash holdings will decrease accordingly. After controlling for variables at the enterprise level, the coefficient remains significantly positive, and the relationship between company size and age is positively significant. This result excludes the alternative explanation of R&D investment driven by characteristics such as size and age, proving that the promotion effect of policies on R&D is independent. The analysis confirms that enterprise R&D investment is a key intermediary variable in the relationship between policy and cash holdings. Policies stimulate R&D investment through innovation costs, thereby reducing enterprises' cash holdings. For policy makers, this means that innovation-oriented policies can simultaneously achieve the dual goals of “promoting cash” and “optimizing cash allocation”, alleviating issues related to cash hoarding and innovation.

Table 9: Mechanism analysis: innovation sharing

	Dep.= Rand	Dep.= Nch	Dep.= Rand	Dep.= Nch
	(1)	(2)	(3)	(4)
Batch*Time	0.111***		0.041***	
	(64.62)		(24.75)	
RDPerso		-0.184***		-0.150***
		(-23.96)		(-20.66)
Lev			-0.00500	-0.242***
			(-1.32)	(-52.84)
Lasset			0.017***	0.012***
			(8.26)	(4.57)
Lreve			0.00300	-0.015***
			(1.55)	(-6.20)
Net			0.003*	0.013***
			(1.75)	(6.47)
Roe			-0.016***	0.010**
			(-4.68)	(2.16)
Age			0.009***	0
			(61.78)	(.)
			-0.00500	0.225***
			(-0.72)	(26.80)
Ato			-0.00400	-0.008*
			(-1.30)	(-1.90)
Cons	0.096***	0.215***	-0.493***	0.354***
	(206.55)	(213.14)	(-27.66)	(13.92)

	Dep.= Rand	Dep.= Nch	Dep.= Rand	Dep.= Nch
	(1)	(2)	(3)	(4)
Individual	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes
N	43000	43000	43000	43000
Adj. R ²	0.683	0.522	0.752	0.576
F	4175	302.6	1770	616.2

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

5.4.3 Digital Transformation

Digital transformation has become the key link between policy intervention and enterprise liquidity management. We use Liu et al. (2025). The regression results demonstrate that the coefficient of the core policy variable Batch*Time is 0.128, and it is significant at the level of 1%, which confirms that policies can effectively promote the digital transformation of companies and are the key factor of digital transformation. Its mechanism may include improving digital infrastructure. The coefficient of Score in column (2) is -0.184, which is significant at the level of 1%, indicating that the deeper the digital transformation is, the lower the level of cash holdings of enterprises, and the control variables such as enterprise size and time are also in line with expectations. The coefficient of the core variable is still positive after the control variables at the company level are included. After further verification of the key control variables, it is confirmed that the promotion of policies on digital transformation is independent. The data finally shows that the policy has finally reduced the cash holdings level of enterprises by accelerating the digital transformation. For companies, investing in digital transformation with policy support is a feasible way to reduce idle funds and improve capital efficiency.

Table 10: Mechanism analysis: digital transformation

	Dep.= Score	Dep.= Nch	Dep.= Score	Dep.= Nch
	(1)	(2)	(3)	(4)
Batch*Time	0.128***		0.021***	
	(56.86)		(10.23)	
Score		-0.184***		-0.153***
		(-31.74)		(-27.65)
Lev			0.029***	-0.239***
			(6.55)	(-52.37)
Lasset			0.023***	0.014***
			(8.96)	(5.31)
Lreve			0.005**	-0.016***
			(2.06)	(-6.32)
Net			0.00200	0.013***
			(1.17)	(6.68)
Roe			-0.031***	0.008*
			(-7.28)	(1.69)
Age			0.014***	0
			(76.39)	(.)
			0.00700	0.226***
			(0.88)	(27.07)
Ato			-0.014***	-0.009**
			(-3.56)	(-2.21)
Cons	0.143***	0.224***	-0.707***	0.323***
	(234.71)	(206.53)	(-31.94)	(12.74)
Individual	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes
N	43000	43000	43000	43000
Adj. R ²	0.490	0.528	0.643	0.580
F	3233	519.4	2330	658.7

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6. Research Conclusion and Policy Implications

6.1 Research Conclusions

We systematically examine the impact of DBEI on corporate cash holdings and its mechanism and heterogeneity effect. The core research findings are as follows:

First, entrepreneurship and innovation policies have a significant negative impact on corporate cash holdings. After controlling the heterogeneity of enterprises, industry trends and macroeconomic shocks, the policy reduced the narrow cash holdings (Nch) and broad cash holdings (Gch) of enterprises by 1.2% and 1.4% respectively (Table 3). This result has passed the robustness verification of parallel trend test, placebo test, and alternative sample matching strategy (Table 4, Figure 1-2), indicating that the policy effectively breaks the logic of “defensive cash hoarding” of companies and promotes the reallocation of idle funds, which is consistent with the conclusion of institutional environment optimization theory and policy driven uncertainty reduction mechanism.

Second, the impact of policies on cash holdings is realized through three core intermediary channels: financing constraints are alleviated as an intermediary, and policies reduce the SA index, which measures financing constraints, by 0.247 (Table 8), weakening the precautionary cash motivation of companies. This is consistent with the research conclusion of [61] that the increased availability of external financing brought about by policies will reduce the dependence of companies on internal cash reserves. Under the stimulus of policy innovation investment, the proportion of R&D personnel (Rand) increased by 11.1% (Table 9), and higher innovation investment will “squeeze out” idle cash - consistent with the research findings of [60] in the field of digital economy, that innovation driven cash reallocation can improve capital utilization efficiency. In terms of accelerating digital transformation, policies have led to a 0.128 increase in enterprise digital scores (Table 10), while digitalization reduces cash holdings by optimizing operational efficiency (such as inventory turnover and accounts receivable management), supporting the hypothesis of “technology empowering liquidity optimization”.

Third, policy effect suggests significant heterogeneity in multiple dimensions. The negative effects of policies on non-state-owned enterprises (coefficient=-0.017, $p<0.01$) are stronger than those on state-owned enterprises (coefficient=-0.010, $p<0.01$) (Table 5). The reason is that non-state-owned firms face tighter financing constraints before the implementation of policies, and are more sensitive to policy-driven financing support. The policy effect in the eastern region is the most significant (coefficient=-0.015, $p<0.01$), the effect in the central region is not significant, and the northeast region even presents a positive effect (coefficient=0.034, $p<0.01$) (Table 6). The developed financial market and efficient policy transmission mechanism in the eastern region are the key reasons, while the risk aversion tendency of enterprises in the northeast region (such as concerns about policy uncertainty) leads to an increase in cash hoarding. The policy response of non-manufacturing enterprises (coefficient=-0.022, $p<0.01$) is stronger than that of manufacturing enterprises (coefficient=-0.005, $p<0.1$) (Table 7). Non-manufacturing industries have a higher dependence on liquidity and lower asset specificity, making them more sensitive to cash reallocation incentives.

6.2 Policy Implications

Based on research findings, the following targeted policy recommendations are proposed. Among them, differentiated policy combinations need to be designed at the government level. For non-state-owned enterprises, we should expand the scale of government guarantee funds, venture capital guidance funds and other policy tools to further alleviate the financing constraints, that is, to supplement the “risk sharing mechanism” on the basis of existing credit support and reduce its preventive cash motivation. For state-owned firms, it is necessary to strengthen performance evaluation indicators related to cash utilization efficiency to avoid policy driven idle cash. Additionally, it is necessary to achieve regional collaborative optimization. Policy efforts should prioritize optimizing the “innovation cash reallocation” ecosystem in eastern regions, prioritize improving policy transmission channels in the central and western regions, and solve the problem of factor flow friction. In the northeast region, we will carry out pilot projects such as policy stability commitments to alleviate the risk aversion tendency of enterprises and avoid the reverse effect of cash hoarding. Industry-oriented guidance can also be used to enable manufacturing companies

to incorporate cash management into innovative policy design, while non-manufacturing companies need to accelerate the construction of digital infrastructure and amplify the role of digitization in optimizing liquidity.

Firms should adjust their cash management strategies accordingly. Non-state-owned enterprises and high-tech enterprises should actively use the policy tools of mass entrepreneurship and innovation to reduce idle cash and invest more resources in R&D and digital transformation. Enterprises in developed eastern regions should prioritize the reallocation of cash to projects, while enterprises in underdeveloped regions can use policy support to reserve cash for short-term operations and plan long-term innovation investments.

7. Research Limitations and Prospects

Although this study has made certain contributions, there are still limitations that provide direction for future research.

The sample range is relatively limited. This study focuses on A-share listed companies and fails to fully cover the main beneficiaries of the innovation and entrepreneurship policy - small and medium-sized firms. These firms are systematically different from listed companies in terms of financing channels, innovation ability and risk tolerance, and the impact of policies on their cash holdings may show different characteristics. In the future, the sample can be expanded to non-listed small and medium-sized enterprises through research data or registration data to capture the impact of policies on more vulnerable market entities. The measurement method of mediator variables also needs to be improved. The digital transformation index (Score) used in this study is a composite index based on limited dimensions such as digital infrastructure, which is difficult to comprehensively reflect the digitalization degree of firms at the operational process, strategic layout and other levels. In the future, we can use more microscopic data to refine the digital measurement method, and explore its heterogeneity impact on cash holdings in operational digitalization, strategic digitalization and other dimensions.

In addition, dynamic effects and spillover effects have not been fully explored. This study focuses on the average effect of policies, without analyzing the dynamic evolution and spatial, industry spillover effects of the effects. In the future, dynamic DID models can be used to test the sustainability of policy effects, or spatial econometric models can be used to analyze geographic and industry spillovers, to more comprehensively evaluate policy effects.

Finally, the interaction effects between policies have not been included in the analysis, and this study did not consider the interaction effects between entrepreneurship and innovation policies and other policies of the same period. In the future, we can refer to the analysis of the interaction between monetary policy and cash holdings, and explore the joint impact of policy combinations such as “entrepreneurship” “innovation” and “tax incentives” on cash holdings.

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Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgment

This paper is an output of the science project.

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