

Corporate investment efficiency in response to national innovation: the moderating role of state ownership

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Abstract

Purpose – This study examines the impact of the national innovation system (NIS) on corporate investment efficiency in Vietnam, an emerging socialist country where innovation is central to the national development plan.

Design/methodology/approach – The study employs a sample of Vietnamese listed firms on the Ho Chi Minh Stock Exchange and Hanoi Stock Exchange from 2012 to 2022. The research models are estimated by fixed-effect estimators, while two-stage least-squares with instrumental variables and entropy balancing methods are used to address the endogeneity issues in the research design.

Findings – We find that firms' investment efficiency increases with the advancement of the NIS, and this impact is attributed to the input measures of national innovation. This finding is robust to different model specifications and endogeneity tests. Additional analysis shows that the private sector improves investment efficiency to a greater extent than state-owned firms.

Research limitations/implications – The findings from this research imply a successful approach to corporate development executed by the government and encourage the continuation of the current plan with strategic modifications to further promote Vietnamese firms' corporate investment efficiency and nurture the growth of the private sector, the engine of the Vietnam economy.

Originality/value – This is the first study to examine the impact of the NIS on corporate investment efficiency, particularly in Vietnam. Secondly, this study delves into a unique structure of the Vietnamese economy through the state ownership lens and points out the heterogeneous impact of NIS on investment efficiency between firms in the private and public sectors.

Keywords Investment efficiency, National innovation system, State ownership, Vietnam

Paper type Research paper

JEL Classification — O31, G31, G32

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The authors deeply appreciate the constructive comments from Professor Le Quoc Hoi and Professor Nguyen Vu Hung – the Editors, Professor Tran Manh Dung – the Associate Editor, and three anonymous referees. Any remaining errors are the authors' own.

Funding: This study is conducted as part of the research project funded by Vietnam's Ministry of Education and Training entitled “Tác động của đổi mới sáng tạo quốc gia tới hoạt động đầu tư của doanh nghiệp” – Project code: B2024-KSA-03.

Data availability statement: The data that support the findings of this study are available from the FiinPro-X database and other stated open sources, but restrictions apply to the availability of FiinPro-X data, which were used under license for the current study and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of FiinPro-X.



1. Introduction

With the boom of technological advancement in recent decades, innovation is increasingly regarded as a key for firms to survive global competition and enhance competitive advantage (Cefis and Marsili, 2006; Hoang and Tran, 2022). In response to the contemporary fast-paced globalization, firms are increasingly utilizing innovation platforms to enhance their innovation capability for customer satisfaction (Zahra and Nambisan, 2011), subsequently contributing to firms' successes and the establishment of temporary monopolies in the product market (Smolny, 2003). Nationwide, innovation emerges as a pivotal factor in determining a country's development and economic growth, making it as necessary for developing nations as it is for the wealthier parts of the world (Fagerberg *et al.*, 2010). While science, technology and innovation serve as catalysts for firms to innovate, it is essential for governments to implement an appropriate legal framework to support these efforts (Truong, 2019). Recognizing the economic benefits of innovation, many countries have placed the mission of cultivating an innovative environment at the focal point of their national development plans. The concept of national innovation systems (NISs) serves as a framework for analyzing economic development and growth, focusing on how innovation and learning processes can be stimulated to contribute effectively to economic growth (Lundvall, 2007). The World Intellectual Property Organization (WIPO) has offered a measure of national-level innovation index in its Global Innovation Index reports, constituting multiple criteria of institutions, human capital and research, infrastructure, market sophistication, business sophistication, investment, knowledge and technology outputs and creative outputs. The division of NIS into more granular components assists policymakers in assessing the strengths and weaknesses of the current NIS and addressing them via appropriate policies to foster innovation at both the firm and national levels.

Government initiatives to foster innovation at the firm level have been shown to significantly influence firms' operational and strategic efficiency (Naqshbandi, 2016). One crucial dimension of this efficiency is corporate investment efficiency, which refers to a firm's ability to effectively allocate capital in response to available investment opportunities (Biddle *et al.*, 2009). Inefficient investment decisions can drain resources that might otherwise be used for productive activities or lead firms to forgo lucrative growth opportunities [1]. Thus, effectively seizing investment opportunities is vital for firms' growth trajectories, enabling them to scale their operations and secure long-term survival and development. The importance of enhancing investment efficiency is particularly pronounced in today's highly competitive global environment (Delios *et al.*, 2021). Firms operating in emerging markets face increasing challenges due to globalization, intensifying exposure to dominant international industry leaders. In such contexts, improving investment efficiency becomes not only a strategic necessity for maintaining competitiveness but also a key driver of resilience and sustainable growth (Liu *et al.*, 2021).

This study examines the impact of the NIS on Vietnamese firms' investment efficiency during the 2012–2022 period. Unlike developed economies, where NISs have been well established and corporate governance structures are largely independent of state intervention, Vietnam continues to grapple with challenges in institutional development, financial market efficiency and technological advancement (World Bank, 2022). Being a transitioning, socialist country with state-owned enterprises dominating core sectors further complicates corporate decision-making, as state-owned enterprises (SOEs) often operate under different incentives, governance constraints and policy influences compared to privately owned firms (Le *et al.*, 2021). These specific traits set Vietnam apart as a unique case and present an opportunity to analyze how firms adapt to national innovation policies under varying state ownership structures, an aspect that has been underexplored in the literature.

This study is expected to contribute in several ways. Firstly, from a theoretical perspective, this study aims to unravel the undocumented effect of national innovation support on corporate investment efficiency. Research outputs that can disentangle this impact are of utmost importance and can deliver the direct policy implications expected to strengthen the

ecosystem. Secondly, by scrutinizing the impact of NIS on Vietnamese firms conditional on their state ownership structure, this study may bring forth some helpful references directing to the private sector, which is widely recognized as the driving force of Vietnam's economic growth yet remains fragile and sensitive to economic fluctuations (Hoang, 2023). Given the government's proactive efforts to support innovation-intensive projects, comprehending the effectiveness of the current innovation policies on the private sector's investment efficiency is a must to ensure their capacity to sustain and thrive in an increasingly dynamic economic environment.

The remainder of the paper is presented as follows: Section 2 discusses the literature and develops research hypotheses. Section 3 presents the methods and data used. Section 4 reports and analyzes the statistical results. Section 5 concludes and offers several research implications and future research directions.

2. Literature review and hypothesis development

2.1 The role of innovation in fostering corporate investment and its efficiency

Innovation has gained significant attention in business research and development (R&D) in recent years (Cefis and Marsili, 2006). The concept of innovation emphasizes the creation or implementation of new products, services and technologies (Ettlie *et al.*, 1993; Kaasa and Vadi, 2008) through improving production and distribution processes in various economic and business sectors (Dedahanov *et al.*, 2017). Innovation is crucial in optimizing production and distribution processes and improving efficiency, productivity, competitiveness and cost-effectiveness within businesses (Goktan and Miles, 2011; Naqshbandi, 2016); thus, encouraging corporate innovation can foster businesses' growth and market expansion.

As innovation plays a key role in technological transformation and globalization, many studies have focused on how innovation capacity affects firms' outcomes. Huergo and Jaumandreu (2004) highlight that process innovation occasionally adds abnormal productivity growth to the above-average productivity growth of young firms, though such additional growth gradually attenuates to an insignificant level as the productivity of surviving firms tends to converge. Vo and Li (2021) employ a rigorous analytical framework comprising the Investment Intensity Index and Principal Component Analysis to reveal that information technology application plays a decisive role in driving firms' investments. Ehie and Olibe (2010) show that investing in R&D helps increase the market value of manufacturing and service sector businesses using the 18-year data of US businesses.

Despite innovation being an ever-growing topic of interest among scholars, it is noteworthy that current literature has hardly mentioned the impact of innovation systems on business activities but mainly focuses on providing empirical evidence on the relationship between firm-level innovation and other business facets. The NIS framework, developed in evolutionary economics, conceptualizes innovation as a collective outcome driven by interconnected actors within a country's institutional and economic environment (Lundvall, 2007). At its core, the NIS perspective emphasizes that a nation's ability to generate, diffuse and apply knowledge depends on both input and output factors. Inputs include policy effectiveness, human capital, infrastructure, the financial market and businesses' capabilities. Meanwhile, outputs reflect knowledge production, technology commercialization and the broader economic impact of innovation (Edquist, 2005; World Intellectual Property Organization, 2024). The interactions between these elements determine a country's overall innovation performance and its capacity to sustain economic growth in the global knowledge economy.

One particular question raised in this research is whether the effort to diffuse innovation spirit from the government results in more efficient investments at the firm level. This potential effect can be channeled via innovation theories. The conventional NIS framework underlines that government support is typically transmitted through policies favoring corporate innovation, promoting science and technology infrastructure, fostering human capital and

promoting interactions among economic stakeholders (Freeman, 1995). Adding to this classic viewpoint of NIS, the triple helix model, introduced by Etzkowitz and Leydesdorff (2000), extends by emphasizing the necessity of establishing close bonds among the three key actors: the government as regulator and facilitator, academia as the knowledge generator and diffuser and businesses that implement and commercialize new technological advancements. The model also highlights that each actor can assume the role of another actor when necessary, creating a strongly interconnected ecosystem. For instance, the government may act not only as a regulator but also as a direct participant in innovation activities by funding research projects or investing in technology companies. Similarly, academic institutions can assume entrepreneurial roles by commercializing their ideas rather than transferring such knowledge to businesses. This dynamic flexibility among actors fosters a deeply interconnected ecosystem, enabling the continual exchange of information flows and the cross-pollination of expertise. Such an ecosystem is critical for aligning investments with high-potential opportunities and raising the success rate of corporate investments (Perkmann *et al.*, 2013).

The knowledge spillover theory of innovation further elucidates the mechanisms through which firms benefit from the unintentional spillover of knowledge within an NIS (Audretsch *et al.*, 2021; Sun *et al.*, 2021). Firms in such environments gain access to external knowledge flows, which supplement their internal resources with enriched information and critical insights, thereby enabling them to make better-informed investment decisions. Additionally, collaboration within the ecosystem broadens firms' networks of expertise, providing opportunities to refine investment strategies based on insights from academic and industrial partners. These collaborations help firms reduce the costs of acquiring information and expert advice, allowing them to identify and pursue optimal investment opportunities in both tangible and intangible assets while curtailing the likelihood of suboptimal investment selections. Thus, the interplay of innovation diffusion, collaboration and knowledge spillovers facilitates a virtuous cycle of enhanced investment efficiency across firms.

If the aforementioned theories corroborate the significance of institutions, infrastructure, human capital and research collaborations, it should be highlighted that the costs associated with innovation are a key deterrent to firms' innovation intention (De Ridder, 2024). Therefore, a well-functioning financial market is needed to provide firms with access to external capital for innovation-intensive projects, alleviating financial constraints and expanding investment opportunities. Also, when resource concerns are lifted, it boils down to businesses to capitalize on the external support via their technological readiness, managerial competence and absorptive capacity – key internal capabilities that influence their ability to integrate innovation inputs into strategic investment decisions.

While innovation inputs at the national level serve as primary enablers for firms to initiate and optimize their investment activities, the produced innovation outputs, such as knowledge creation and technological advancements, intensify competition among industry peers, as such outputs raise the entrance bar to enter the industry while imposing pressure on current rivals to continually innovate to stay competitive in the industry (De Ridder, 2024). This pressure, in turn, drives firms to enhance investment efficiency as a means of sustaining the competitive advantage (Edquist, 2005). The cumulative impact of these innovation pillars; hence, promises to yield a positive effect on firms' investment efficiency.

Although the theoretical framework suggests a potential influence of the NIS on corporate investment efficiency, an empirical investigation into this connection remains absent in the current literature. This empirical link has only been implicitly related in several existing studies. As mission-oriented innovation policies are closely linked to investment-led growth, the interrelationship between innovation, investment and growth is vital in determining the success of strategic missions. National innovation drives and goes hand in hand with higher quality investment at the firm level and creates greater competition in the economy (Mazzucato, 2018), promoting performance, quality products and services and contributing to the development of the startup ecosystem (Lerner, 2013). Given the importance of improving

the efficiency of firms' investments to ensure long-term growth, this potential relationship is worthy of investigation.

2.2 Vietnam's innovation background and hypothesis development

In Vietnam, innovation diffusion is the spearhead of the state's sustainable development plan and has been materialized in many key documents. The Vietnam Socio-economic Development Strategy for 2021–2030 synchronously presents the role of science, technology and innovation, from the strategy's theme to the development perspective. On September 27, 2019, the Vietnam Politburo issued Resolution No. 52-NQ/TW on several guidelines and policies to proactively participate in the Fourth Industrial Revolution, clearly defining the role of innovation centers and affirming that businesses are central to the innovation ecosystem. To concretize this resolution, the government issued Resolution No. 50/NQ-CP in 2020, which assigns specific tasks to ministries alongside encouraging localities and businesses to establish innovation centers. Furthermore, the government has established the National Innovation Center (NIC), which serves as a cornerstone for the national innovation plan to advance Vietnam's self-reliant and sustainable development.

Given the limited access of Vietnamese firms to advanced infrastructure and facilities, which are critical for investment viability, strengthening NIS can significantly enhance investment efficiency through several mechanisms. First, improved mechanisms for timely knowledge and technology adoption enable firms to integrate advanced technologies into their operations, thereby optimizing production processes and broadening their investment horizon (Ferrer-Serrano *et al.*, 2024). Such an operational advantage gives them an edge in identifying and pursuing profitable investment opportunities in high-tech areas. Second, heightened awareness of the strategic benefits of innovation among Vietnamese firms fosters greater R&D intensity, subsequently contributing to knowledge creation within firms and enhancing their ability to make informed and strategic investment decisions (Nguyen, 2022; Hoang, 2024).

Third, government initiatives aimed at cultivating a highly skilled and innovative workforce offer businesses a talent pool equipped with the expertise to critically evaluate investment opportunities and drive sustained innovation (Li, 2024). By being able to access this valuable source of human assets, firms can facilitate multilateral idea exchanges within their knowledgeable workforce, thus amplifying the effectiveness and impact of corporate investments. Fourth, innovation-driven firms enjoy preferential treatment (OECD, 2023). In recent years, the Vietnamese government has consistently invested in innovation infrastructure, exemplified by the establishment of the Hoa Lac Hi-Tech Park and high-tech complexes in major cities. Additionally, innovation centers operating under the NIC model as well as individuals and organizations engaged in innovation activities at NIC, enjoy numerous incentives, including tax benefits, advanced facilities and access to domestic and international funding sources. These incentives grant businesses greater flexibility in resource allocation and empower them to undertake more strategic and selective investment projects. Finally, collaboration between businesses and other economic actors enhances networking opportunities and resource sharing, creating a more interconnected and efficient ecosystem for innovation and investment (Kong *et al.*, 2022). As mentioned above, the expertise borrowed from the outside adds insights into firms' decision-making and can improve the outcome of their investments. Overall, strengthening NIS not only equips Vietnamese firms with the tools and resources to boost their investment efficiency but also accelerates Vietnam's trajectory toward sustainable and knowledge-driven economic growth.

As innovation had not been central to Vietnam's development plan until the past few years, research on investment efficiency, an important factor driving firms' success, has been virtually missing. Nevertheless, a few studies have suggested the beneficial effect of NIS on corporate efficiency. The only directly relevant study is Yan *et al.* (2022), which offers empirical evidence for the optimistic development of corporate innovation following the establishment of innovation pilot zones in China. Tran and Vu (2018) investigate innovation

among Vietnamese firms, including small, medium and large firms and find that government support plays a key role in facilitating product innovation and new technology applications, which eventually lead to greater corporate efficiency. On the other hand, some studies suggest no relationship between national innovative support and corporate efficiency, such as Doan *et al.* (2021), who show that either alone or combined, government financial or technical assistance neither improves small and medium-sized enterprise (SME) efficiency nor reduces the cost of SME's innovative activities.

Given the current context of Vietnam, which has started to place a high priority on innovation development strategy in the following years, the question is whether the NIS helps improve investment efficiency at the firm level as firms play the core role of innovation actors in Vietnam (Nham *et al.*, 2016). In the vein of our discussion, we propose our research hypotheses as follows:

H1. An upgrade in the national innovation system improves investment efficiency among Vietnamese firms.

Suppose the national support for innovation activities impacts firms' investment efficiency, does the impact of such support differ between firms based on their state dependence? Studies have shown that SOEs play a significant role in the Vietnamese economy and are more privileged to access national innovation infrastructure due to their naturally private political connection (Dang *et al.*, 2021; Hoang, 2024). However, the proportion of SOEs in the economy is declining. According to the General Statistics Office of Vietnam [2], by the end of 2023, SOEs represented less than 0.1% of the 921,372 active enterprises in the country. This trend is expected to persist as the government continues its privatization initiatives, signaling a diminishing role for SOEs in the national economy. Conversely, the private sector has experienced rapid growth, with the number of private firms rising consistently, underscoring their increasing contribution to Vietnam's economic development. The necessity of promoting the private sector has been stressed in many recent official documents released by the Vietnamese government, such as Resolution No. 10/NQ-TW issued on June 3, 2017, and Resolution No. 45/NQ-CP issued on March 31, 2023. In addition, private enterprises are often characterized by greater efficiency and innovation than their public counterparts due to the market pressure and the need to generate profit, enabling them to stay competitive and contribute to the overall economy (Tatahi, 2006; Palumbo *et al.*, 2023). Therefore, it is logical that innovation support strategies should prioritize the private sector to capitalize on its potential as the engine of economic growth. Given these considerations, it is reasonable to expect that private firms may derive greater benefits from NIS improvements. In that light, we propose the second hypothesis as follows:

H2. National innovation system improvements are more beneficial to the private sector.

3. Methodology

3.1 Model design

This study examines the impact of NIS on corporate investment using the panel data analysis approach. We take advantage of the fixed-effect approach, which is effective at removing time-constant unobserved heterogeneity from the model, thereby reducing potential bias caused by the correlation between these unobservables and the explanatory variables (Wooldridge, 2010). This method allows us to explore the impact contingent on both cross-section and time series, thus improving the reliability of the findings. The model employed to examine the impact of NIS on firms' investment efficiency is designed as follows:

$$INVEFF_{i,t} = \beta_0 + \beta_1 GII_{t-1} + \beta_2 \sum Controls_{i,t-1} + f_{industry} + \varepsilon_{i,t} \quad (1)$$

In Model 1, investment efficiency (*INEFF*) is measured using [Chen et al.'s \(2011\)](#) approach (see the computation in Model 2). The mainstream literature suggests that there is an optimal level of investment derived from firms' specific characteristics, and greater investment efficiency is achieved when a firm's actual investment aligns closely with this optimal level ([Richardson, 2006](#); [Biddle et al., 2009](#); [Chen et al., 2011](#)). The higher the deviation from the optimal level, the lower the investment efficiency. Conversely, deviations from the optimal level, whether in the form of overinvestment or underinvestment, lead to a decline in investment efficiency. [Chen et al. \(2011\)](#) consult [Richardson \(2006\)](#) to measure investment efficiency by the deviation of current investment from the expected level of investment. While [Biddle et al. \(2009\)](#) define investment efficiency as the residual obtained from the regression of total investment in year *t* on sales growth in year *t*–1, [Chen et al. \(2011\)](#) extend [Biddle et al.'s \(2009\)](#) measurement by adding a binary variable representing the sign of revenue growth to the right-hand side function under the rationale that investment behavior differs in different scenarios of revenue growth (see [McNichols and Stubben, 2008](#)).

$$INVEST_{i,t} = \alpha_0 + \alpha_1 NEG_{t-1} + \alpha_2 \%REV GROWTH_{i,t-1} + \alpha_3 NEG_i * \%REV GROWTH_{i,t-1} + \mu_{i,t} \quad (2)$$

To ease exposition, we set our focus on the deviation of firms' investments from the optimal level by defining *INEFF* as the product of $|\mu_{i,t}|$ and negative one (–1). This transformation results in the value range of *INEFF* spanning from $-\infty$ to 0, with *INEFF* closer to 0 presenting greater investment efficiency. Although we primarily adopt the investment efficiency measure proposed by [Chen et al. \(2011\)](#) for the computation of *INEFF*, we utilize [Biddle et al.'s \(2009\)](#) measure (presented in Model 3) as an alternative proxy in robustness tests. Similar to how we derive *INEFF*, $|\vartheta_{i,t}|$ is multiplied with –1 to obtain the Biddle et al.-based investment efficiency (*INEFF_BIDDLE*).

$$INVEST_{i,t} = \alpha_0 + \alpha_1 \%REV GROWTH_{i,t-1} + \vartheta_{i,t} \quad (3)$$

GII is the value of the innovation index computed for Vietnam from the WIPO's Global Innovation Index annual reports. *GII* is built upon seven key pillars, namely (1) institutions, (2) human capital and research, (3) infrastructure, (4) market sophistication, (5) business sophistication, (6) knowledge and technology outputs and (7) creative outputs, in which the first five pillars belong to the innovation input category, meanwhile the last two pillars are assigned to the innovation output category. All indicators in each pillar are then normalized into the 0–100 range and aggregated to form the pillar scores. Afterward, the innovation input and innovation output sub-indices are computed, and the overall *GII* score of a country in a year is computed by averaging the two sub-indices. Our *GII* employed in this research is the overall *GII* score.

To account for heterogeneity across firms, firm-level control variables are included in the model. A large pool of physical, financial and human resources might well assist managers in investment decisions. Thus, we account for this by controlling for firm size (*SIZE*). Next, we take into consideration that the leverage utilized by firms can alter their investment behaviors by including *DEBT* in Model 1 (see [Ling and Wu, 2022](#)). Since profitability can be an indication of efficient investment and excessive cash might be misused in value-destroying investments to serve managers' purposes, profitability (*ROA*), corporate cash holdings (*CASH*) and operating cash flows (*CFO*) are employed as controls in Model 1 ([Kalcheva and Lins, 2007](#)). Furthermore, because firms' investment behaviors differ across different stages of their development ([Abu hommous, 2024](#)), we make use of *RETE*, a common proxy for firms' life cycles, to capture such investment efficiency differentials. Moreover, the study's data span from pre- to post-COVID-19 health pandemic; therefore, it is necessary to properly control for the peak years of COVID-19. We therefore put forth the variable *COVID*, which takes a value

of 1 if the year is 2020 onward and zero otherwise. Last but not least, to control for time-invariant industry characteristics, this study introduces an industry fixed effect into Model 1.

For the second hypothesis, we employ Model 4 below to investigate whether investment efficiency differs between SOE and non-SOE contingent on the level of national innovation.

$$INVEFF_{i,t} = \beta_0 + \beta_1 GII_{t-1} + \beta_2 STATE_{i,t-1} + \beta_1 GII_{t-1} \times STATE_{i,t-1} + \beta_2 \sum Controls_{i,t-1} + f_{industry} + \varepsilon_{i,t} \quad (4)$$

in which *STATE* is measured in three thresholds of 5% (*STATE* (5%+)), 36% (*STATE* (36%+)) and 50% (*STATE* (50%+)) since they mark turning points in shareowners' influence on corporate affairs (see [Hoang et al., 2022](#)).

Following the conventional approach in finance studies, we winsorize all firm-level continuous variables at the 1st and 99th percentiles to mitigate the outlier bias for both models. Since *GII* only minimally varies by year and fiscal years are identical for most firms in the sample, we follow [Nguyen and Phan \(2017\)](#) to leave year fixed effect out of our model since it can absorb the explanatory power of *GII*. Instead, because all firms in the sample are subject to a uniform impact stemming from the current level of national innovation at the same time, robust standard errors are clustered by firms ([Nguyen and Phan, 2017](#)). The definition of variables used in this study is shown in [Table A1.1](#), Online [Appendix A1](#).

3.2 Data

The annual data used in this study stretch from 2012 to 2022 and are collected from several sources. The data of Vietnamese listed firms are collected from FiinPro-X, a data platform offered by FiinGroup, a Vietnamese financial data service provider. The *GII* and its components are manually collected from Global Innovation Index reports. Vietnamese government expenditure for education (*GOVEXPEDU*) is downloaded from the World Bank's open database.

The raw data are processed to generate variables used in the models. During the data generation procedure, we eliminate observations with missing or insufficient data to compute *INVEFF* and other firm-level variables. The final sample consists of 1,552 observations from 192 Vietnamese firms.

3.3 Descriptive statistics

The descriptive statistics of this study are reported in [Table A1.2](#) in Online [Appendix A1](#). An average firm in our sample is highly dependent on debt ($DEBT_{t-1} = 52.4\%$), unprofitable ($ROA_{t-1} = -0.4\%$) and holds more than 9% of total assets in the form of cash. Turning to the correlation between variables in Model 1 (see [Table A2](#), Online [Appendix A2](#)), the correlation coefficient of *INVEFF* and GII_{t-1} is positive at the 10% significance level, suggesting a potential positive association between the two factors [3]. It is also noticeable that some correlation coefficients are abnormally high (greater than 0.8); however, those variable pairs are not simultaneously present at the same time and hence, do not cause additional multicollinearity biases to our findings.

4. Empirical findings

4.1 Multivariate regressions

This section discusses the estimates from the regression of Model 1. Columns 1 to 6 in [Table 1](#) report estimates of *GII* with different specifications of Model 1 and with an alternative measure of investment efficiency from [Biddle et al. \(2009\)](#). Specifically, we first conduct bivariate regressions without and with the industry fixed effect (Columns 1 and 2), then perform

Table 1. Baseline model

Variable	Dependent variable: INVEFF			Full model	Bootstrapping 1,000 replications	Dependent variable: INVEFF_ BIDDLE	Dependent variable: INVEFF	Output measure of NIS
	Bivariate – no fixed effect	Bivariate – with fixed effect	Full model – no fixed effect			Full model	Input measure of NIS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GII _{t-1}	0.005* (1.865)	0.005* (1.938)	0.005* (1.872)	0.005* (1.946)	0.005*** (2.777)	0.002* (1.912)	0.001** (2.426)	0.000 (0.316)
SIZE _{t-1}			0.000 (0.298)	0.001 (0.610)	0.001 (0.592)	0.005*** (4.287)	0.001 (0.573)	0.001 (0.775)
DEBT _{t-1}			0.030* (2.120)	0.028* (2.028)	0.028** (2.077)	0.011 (1.227)	0.028* (2.054)	0.027* (1.948)
ROA _{t-1}			-0.032 (-0.392)	-0.049 (-0.612)	-0.049 (-0.645)	-0.091* (-1.996)	-0.045 (-0.550)	-0.057 (-0.702)
CASH _{t-1}			-0.012 (-0.418)	-0.010 (-0.363)	-0.010 (-0.407)	0.040* (1.942)	-0.007 (-0.249)	-0.014 (-0.485)
CFO _{t-1}			0.020 (0.860)	0.023 (0.958)	0.023 (0.996)	0.029* (1.997)	0.022 (0.963)	0.022 (0.857)
RETE _{t-1}			-0.003 (-0.087)	0.016 (0.436)	0.016 (0.355)	0.038 (1.462)	0.014 (0.381)	0.015 (0.408)
COVID _{t-1}			-0.006 (-1.369)	-0.006 (-1.304)	-0.006 (-0.784)	-0.003 (-1.208)	-0.014** (-3.026)	-0.002 (-0.343)
Constant	-0.283** (-3.069)	-0.287** (-3.162)	-0.309** (-2.911)	-0.329*** (-3.192)	-0.324*** (-4.244)	-0.333*** (-7.455)	-0.299*** (-3.978)	-0.190* (-2.220)
Industry FE	N	Y	N	Y	Y	Y	Y	Y
Cluster by year	Y	Y	Y	Y	N	Y	Y	Y
Observations	1,552	1,552	1,552	1,552	1,552	1,552	1,552	1,552

Note(s): Table 1 reports the estimates of GII_{t-1} and control variables with different model specifications in columns 1 to 6. Columns 7 and 8 report the estimates of Model 1 after replacing GII_{t-1} with $INNO_INPUT_GII_{t-1}$ and $INNO_OUTPUT_GII_{t-1}$, respectively. Robust standard errors are clustered by year. Robust t-statistics are in parentheses. All continuous variables are winsorized at 1st and 99th percentiles

Source(s): Authors' own work

estimations of Model 1 without and with the fixed effect (Columns 3 and 4). Next, because the Vietnam stock market is relatively smaller than other developed markets, our sample is liable to the “small sample” bias. Therefore, the bootstrapping technique, i.e. random sampling with replacement, is employed to account for unreliable inferences (Column 5). The estimates of *INVEFF* in all five estimations are significantly positive, indicating that the NIS impacts the investment efficiency of Vietnamese firms.

To give further supporting evidence on this impact, we also replace *INVEFF* with an alternative measure of investment efficiency (*INVEFF_BIDDLE*) from Biddle *et al.* (2009), which has been elaborated in Section 3.1. The result is qualitatively similar to our previous ones, thus consolidating our finding on the positive impact of the NIS on corporate investment efficiency among Vietnamese firms. However, one thing to note here is that though the positive coefficients of *GII* are robust throughout our tests, the impact is not so much statistically conspicuous, as the significance level is consistently at 10%. Doubting that the input and output measures of innovation might impact firms' investment efficiency differently, we separately examine the innovation inputs (*INNO_INPUT_GII*) and innovation outputs (*INNO_OUTPUT_GII*) (see Section 3.1 for the specific categorization). As shown in Columns

7 and 8 in Table 1, the impact of the NIS stems from its input measure, as the estimate of $INNO_INPUT_GII$ is significantly positive, whereas we find a statistically insignificant coefficient of $INNO_OUTPUT_GII$.

In general, our results lend support to Hypothesis 1 and align with the theoretical foundations of the NIS framework, suggesting that the development of a comprehensive and balanced innovation ecosystem enhances corporate investment efficiency (e.g. Etzkowitz and Leydesdorff, 2000; Audretsch *et al.*, 2021).

4.2 State ownership

This section is dedicated to investigating Hypothesis 2, namely the moderating effect of state ownership. Although SOEs are considered a pillar of the Vietnamese economy and a channel for transmitting many state policies (Dang *et al.*, 2021), the Vietnamese government is pushing the privatization process to reduce the economic influence of powerful state corporations that may jeopardize the development of the private sector. As state ownership varies with firms, we disentangle the moderating effect of state ownership by making use of three significant ownership thresholds, namely, 5%, 36%, and 50%. According to the Vietnam Law on Enterprise, alongside the common threshold of 50% ownership stake, which allows a shareholder to assume control of a business, the 5% and 36% equity ownership also present significant thresholds. If a shareholder owns 5% of a firm's equity stake, the shareholder can convoke a general meeting of shareholders under specific circumstances. With a 36% ownership stake, a shareholder is provided with the veto right over significant corporate decisions. Using these three significant thresholds of ownership, we reveal that the investment efficiency of the private sector is comparably higher than that of firms having 36% or more of their shares owned by the state, since the coefficients of $GII_{t-1} \times STATE (36\%+)_{t-1}$ and $GII_{t-1} \times STATE (50\%+)_{t-1}$ are statistically negative at the 10% significance level (see Table 2). These results validate our Hypothesis 2 that private sector firms benefit more from NIS upgrades than firms from the public sector.

5. Discussions and conclusions

This study examines the impact of NIS on Vietnamese firms' investment efficiency and reveals that an improvement in the NIS, measured by GII, leads to greater corporate investment efficiency. This association is robust across different model specifications, an alternative proxy of investment efficiency and endogeneity tests. Our finding extends the work of Yan *et al.* (2022) by demonstrating that, in addition to the regional innovation system, the NIS also plays a pivotal role in driving firms toward optimal investment decisions, particularly in a developing economy that is currently undertaking early-stage policy initiatives to facilitate its transition toward a knowledge-based economy. Interestingly, the impact is fully attributed to the input measure of innovation. This result is not surprising since Vietnamese firms have not paid attention to innovation until recent years; hence, they do not possess innovation capacities that allow them to productively leverage the current innovation outputs to support their investment decisions. Operating under relatively weak competitive pressure to pursue innovation-driven strategies also limits their incentives to enhance investment efficiency. On the flip side, the Vietnamese government is unlocking the innovation bottleneck by supplying necessary inputs for innovation at the firm level. That focus is proven effective as evidenced by firms' improved investment efficiency [4].

Delving into how this association is moderated in the presence of state ownership, we find that private firms benefit more than SOEs in terms of investment efficiency with the advancement of the NIS. Given that the private sector is a promising engine to fuel Vietnam's economy in the near future, the beneficial effect of the NIS on private firms' investment efficiency can accelerate the private sector development and pave the way for this sector to play a greater role in fostering the economic growth of the country. Moreover, this finding

Table 2. Cross-sectional test – state ownership

Variable	Dependent variable: INVEFF		
	(1)	(2)	(3)
GII _{t-1}	0.006 (1.423)	0.006 (1.381)	0.006 (1.311)
STATE (5%+) _{t-1}	0.234 (1.602)		
GII _{t-1} × STATE (5%+) _{t-1}	−0.006 (−1.571)		
STATE (36%+) _{t-1}		0.328* (2.120)	
GII _{t-1} × STATE (36%+) _{t-1}		−0.009* (−2.116)	
STATE (50%+) _{t-1}			0.357* (2.087)
GII _{t-1} × STATE (50%+) _{t-1}			−0.010* (−2.142)
SIZE _{t-1}	0.000 (0.120)	0.000 (0.189)	0.001 (0.506)
DEBT _{t-1}	0.027 (1.192)	0.015 (0.508)	0.018 (0.615)
ROA _{t-1}	−0.196 (−1.003)	−0.242 (−1.218)	−0.145 (−0.701)
CASH _{t-1}	−0.024 (−0.896)	−0.049 (−1.368)	−0.049 (−1.174)
CFO _{t-1}	0.017 (0.673)	0.034 (1.489)	0.037 (1.219)
RETE _{t-1}	−0.034 (−0.582)	−0.075 (−0.967)	−0.068 (−0.773)
COVID _{t-1}	−0.003 (−0.597)	−0.007 (−1.188)	−0.004 (−0.667)
Constant	−0.374* (−2.040)	−0.365* (−1.995)	−0.385* (−2.205)
Industry FE	Y	Y	Y
Cluster by year	Y	Y	Y
Observations	1,186	946	825

Note(s): Table 2 reports the estimates of Model 1 with STATE (5%)_{t-1}, STATE (36%)_{t-1} and STATE (50%)_{t-1} as moderating variables, respectively. Robust standard errors are clustered by year. Robust t-statistics are in parentheses. All continuous variables are winsorized at 1st and 99th percentiles

Source(s): Authors' own work

might also imply that the Vietnamese government seems to have designed its innovation campaign to target the private sector, which accounts for a vast majority of Vietnamese firms.

Our revelation of the impact of the NIS on Vietnamese firms' investment efficiency complements the Triple Helix model's literature, whose implications are mostly limited to corporate innovation and regional entrepreneurship (e.g. Kim *et al.*, 2012; Natário *et al.*, 2012). Although those past studies suggest increasing flows of investment in innovation and entrepreneurship in response to NIS upgrades, the efficiency of such investment remains unanswered. We offer insight into this gap by highlighting that the development of NISs, specifically their inputs, plays a critical role in improving firms' capital allocation decisions. The findings suggest that increasing institutional collaborations among key economic actors – as an important innovation input factor – might enable more efficient corporate investments through improved firms' access to knowledge and policy incentives. Additionally, the results resonate with the knowledge spillover theory of innovation (Audretsch *et al.*, 2021; Sun *et al.*, 2021), which posits that the externalities of publicly available knowledge, when effectively

absorbed by firms, can lead to better strategic decision-making. By showing that firms embedded in strong NISs are more likely to invest efficiently, our study bridges macro-level institutional structures with firm-level outcomes, enriching the theoretical understanding of how innovation systems translate into improved microeconomic performance.

Furthermore, we move the literature forward by documenting heterogeneous changes in investment efficiency between private and public firms during NIS upgrades. This nonuniform distribution of NIS benefits can be theoretically disentangled via [Granovetter's \(1985\)](#) institutional embeddedness perspective, which denotes that firms' behaviors and performance are deeply influenced by their institutional environments. Unlike SOEs, which often rely on soft budget constraints and advantageous political connections ([Kornai, 1986](#)), private firms are vulnerable to stronger market pressures and lower resource capacity and thus, must exercise greater operational prudence and often underinvest ([Ha and Thai, 2023](#)). Therefore, private firms are more incentivized to leverage external assistance by being responsive to policy support and accelerating the exchange and absorption of knowledge with other economic actors. The proactive pursuit of external aids may enrich private firms with sufficient resources, enabling them to make more efficient investment decisions. Moreover, our state ownership examination also contributes by suggesting that the private sector is the main target of the government's innovation policy frameworks, especially in transitioning countries where the private sector remains relatively nascent and is inefficiently operated ([Cirera and Maloney, 2017](#)). This perspective is particularly relevant in the context of ongoing privatization efforts in economies with historically dominant SOE systems, where the shift toward a more market-oriented structure necessitates targeted support for the emerging private sector ([Radić et al., 2021](#)). These insights contribute to a more nuanced understanding of state ownership dynamics within the context of NISs and offer a theoretical basis for future empirical research aimed at validating and expanding upon these perspectives.

The study delivers several implications. First, as innovation is among the keys to unlocking firms' investment efficiency in this modern era, the government should extend its efforts to accelerate the pursuit of innovative activities across Vietnamese firms. The government could place its emphasis on developing dedicated innovation hubs or industrial zones equipped with advanced infrastructure (affordable land access, reliable electricity, high-speed internet and water supply) specifically tailored to support startups and innovative firms. Additionally, introducing streamlined procedures for startups to access these resources, such as digital portals for land leasing or simplified processes for utility connections, would reduce administrative burdens and enhance accessibility.

Second, while current efforts to improve the NIS have shown positive results, particularly for the private sector, there is still room for extension. Since young innovative firms, especially highly technology-oriented ones, are under financial shortage, the government could expand tax incentives for corporate innovation, such as increasing tax deductions for firms engaged in innovation activities or introducing subsidies for collaborative projects between firms and research institutions. Furthermore, establishing grant programs or low-interest loans for innovation-focused projects can provide firms with the financial support needed to drive technological advancements and competitiveness. Additionally, bureaucratic constraints and intellectual property protections should also be placed in high priority to encourage investment in high-tech sectors.

Interestingly, the observed efficiency gap between the public and private sector provides a critical insight into the sector that should be prioritized in the government's future development strategies. Although SOEs play a strategic role in certain industries, excessive state control may hinder firms' ability to fully capitalize on innovation system improvements. Policy reforms could focus on gradual divestment of state control in non-strategic sectors, greater adoption of public-private partnerships and the implementation of corporate governance enhancements that grant SOEs more operational autonomy while maintaining state oversight where necessary.

Some future research avenues can be drawn from this study's direction. Interested scholars may explore the impact of specific national innovation pillars (institution, infrastructure, business sophistication, human capital, etc.) on different business facets. Besides, looking into the moderating effect of related factors, such as industry-specific dynamics and regional differences, on the relationship between NIS and corporate investment efficiency can also yield some helpful policy implications.

Notes

1. As per Richardson (2006), when firms over-invest, they may allocate resources to low-return or even unprofitable projects, subsequently translating into poor future operating and stock performances. The opposite scenario, namely underinvestment, is also problematic as firms forgo valuable projects, thus jeopardizing their growth potential.
2. Data on the number of acting firms in Vietnam are retrieved from the General Statistics Office website: <https://www.gso.gov.vn/>
3. The correlation coefficient between the two variables is actually significant at 1% when we narrow down the significance level.
4. We further perform endogeneity diagnoses using the entropy balancing and two-stage least-squares methods. Estimates derived from these tests carry the same sign and significance as the main finding (see Online Appendix A3).

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Supplementary material

The supplementary material for this article can be found online.

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