



Does local public investment boost enterprise performance? Evidence from Vietnam



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ABSTRACT

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This paper seeks to deepen our understanding of how local public investment and the quality of institution impact enterprise performance in developing countries. The theoretical model presents two contrasting effects of public investment on enterprises. On the one hand, public investment can boost the marginal productivity of private capital. On the other hand, limited access to financing might crowd out private businesses. This study looks at enterprise survey data from 2011 to 2020 along with time series and cross-sectional data using a FEM (fixed effects model) across 63 provinces in Vietnam. The results show that the crowding-in effect is the most important. This effect is especially strong in provinces with robust institutions. The study underscores the crucial roles of local investment and institutional quality in enhancing business performance. Furthermore, macro factors like economic growth, inflation, and urbanization influence enterprise performance. The study also found that the number of employees has a positive impact on enterprise performance, while the age of the enterprise and its fixed assets have the opposite effect. To stimulate business growth, it is essential to sustain increases in local public investment, with a focus on infrastructure. The research findings highlight the importance of further enhancing the institutional environment.

Contribution/ Originality: Unlike previous studies, this research offers a more comprehensive analysis of the effects of local public investment on business performance by integrating both macroeconomic variables (GDP, inflation, quality of institution) and microeconomic factors (fixed assets, age, and number of employees in the enterprise).

1. INTRODUCTION

Public investment, or capital spending, are long-term expenditures aimed at increasing the country's physical infrastructure and promoting economic growth (Canning & Fay, 1993; Easterly & Rebelo, 1993). These expenditures are considered one of the significant policy levers to foster economic prospects in developing economies. As a developing country, Vietnamese government needs to invest in technical infrastructure, social infrastructure to improve the business environment. The investment in public goods and services attracts private investment, and therefore boosts the economic growth (Canh & Phong, 2018). Capital spending is considered "prime money" to stimulate production and business activities of the private sector (Andreoni & Payne, 2003). This spending creates more production capacity for the economy, having a long-term impact on the operations of businesses (Aschauer, 1990; Blejer & Khan, 1984).

Specifically, capital spending improves infrastructure, including transportation systems, telecommunications, and economic centers (Canning & Fay, 1993) creating favorable conditions, and helping businesses reduce transportation costs, while also increasing labor productivity and revenue for businesses.

There are two opposing perspectives regarding the impact of public investment on enterprises, which are reflected in private investment. The first one shows the evidence of positive impact of public investment on the output, productivity, and investment of private sector (Aschauer, 1988; Haque, 2013). On the other hand, the second group with research indicates the crowding-out effect or the negative impact of public expenditure (Bairam & Ward, 1993; Monad Jemi & Huh, 1998).

In Vietnam, capital spending is highly decentralized for the provisional government. The level and structure of local capital spending is driven by the social and economic characteristics of each province. Increasing local capital spending is always considered an important policy tool that has direct and indirect impacts on businesses, creating conditions for businesses to support and expand production and business activities (Cuong & Thanh, 2015).

The nature and magnitude of the relationship between public investment and private business remain unresolved. Additionally, the mechanisms through which local public capital influences private sector in developing countries like Vietnam have yet to be fully explored.

Our paper aims to improve our understanding of the factors that influence whether crowding-in or crowding-out occurs in specific countries such as Vietnam.

Excluding the introduction, the article is structured as follows: the first part provides a literature review of the research, the second part describes the analysis method and data, the third part discusses the analysis results, and finally, conclusions and some policy suggestions are presented.

2. LITERATURE REVIEW

In theory, large-scale government investment programs to provide public goods and services also play a particularly significant role (Keynes, 1936). Keynes's assertions of multiplier-accelerator principle show that private investment is driven by aggregate demand. The production function Douglas (1928) of Solow (1956) explains the direct impact of public investment (government expenditure) on aggregate demand and supply, which stimulate private investment and attract the private enterprises into production process.

The literature has identified several competing mechanisms by which public capital investment may impact the private sector, for example, by Blejer and Khan (1984); Aschauer (1989) and Ramirez (1994). One of the most significant mechanisms—and a key argument in favor of public investment—is that infrastructure investment can generate spillover benefits for private investment. When public expenditure in infrastructure complements private investment, it can boost the rate of return for the business sector, encouraging private investors to increase their capital investments. This phenomenon is known as the crowding-in effect of public expenditure.

However, public investment also causes crowding-out effects, according to research by Barro (1974); Kormendi (1983) and Voss (2002). To compensate for the state budget deficit due to excessive spending, the government must borrow, increasing the demand for capital in the financial market. That increases interest rates, reducing the ability to access capital for investment to expand revenue of the business sector.

According to the Neoclassical approach to the Ricardian Equivalence Theory, increasing government spending and borrowing to finance the state budget deficit forces the government to find ways to increase taxes in the future to repay debt. Households tend to cut spending and save more in the present to have money to pay taxes in the future and compensate for future spending reductions. Therefore, household consumption demand and the business sector's investment demand decreased at present. Thus, increased government spending may offset the decrease in household spending, reducing investment and revenue in businesses.

Through different studies, empirical research on the impact of public investment on private investment has produced diverse results.

Many studies, especially those focused on developing and emerging economies, often report positive effects of public capital spending on private business. For example, Erden and Holcombe (2005) and Erden and Holcombe (2006) found that government investment tends to encourage private financing in low- and middle-income countries. Foye (2014) investigated public capital spending in Nigeria, finding that public expenditure complements private investment over time. In Vietnam, Nguyen (2023) analyzed the influence of public investment on firm operations, highlighting a positive impact of government investment on private sector development. However, this study relied on aggregated enterprise data by province rather than individual enterprise surveys. Industrialized countries have demonstrated similar results. Hatano (2010) examined Japanese empirical data and discovered that government spending stimulates investment in the non-state sector, as confirmed by ECM (error correction models). Aschauer (1989) using a neoclassical framework, argued that public capital accumulation can enhance private capital productivity and spur enterprise investment. His case study in the United States revealed that the crowding-in effect is more significant than the crowding-out effect. In a panel data study of 14 OECD countries (The Organization for Economic Cooperation and Development countries), Argimon, Gonzalez-Paramo, and Roldan (1997) identified a substantial catalytic effect of public investment on private investment, attributing this to the positive impact of infrastructure expenditure on the productivity of enterprises.

Conversely, Bairam and Ward (1993) examined the impact of government investment using annual time-series data from 25 OECD countries between 1950 and 1988, finding support for both the "accelerator principle" and the "crowding out" hypothesis. Monad Jemi and Huh (1998) analyzed private and public investment in three OECD countries using a VAR (Vector Autoregression) model with time-series data from 1971 to 1991, demonstrating that investment spending negatively affects the private sector, though their evidence for crowding-out effects was not robust. Rossiter (2002) employed a SVAR (Structural Vector Autoregressions) approach to assess the relationship between public and private funding in the United States. The findings indicated that, in the long run, public expenditure tends to crowd out private sector performance, although there was some support for the infrastructure hypothesis, suggesting an enhancing effect or crowding in effect.

It should also be noted that most studies focus on analyzing the impact of public investment on the private sector at the country level. In Vietnam, fiscal decentralization is clearly regulated, and localities have diverse levels of capital spending Cuong and Thanh (2015) thus affecting the operations of businesses in many ways. Therefore, the goal of this study is to test how local capital expenditure affects the performance of enterprises located in provinces, in which the characteristics of enterprises and macro environment are also examined to make clear the enterprises' outcome.

3. THE MODEL AND DATA

3.1. Quantitative Model and Methodology

Drawing from the theoretical foundation and empirical research on the impact of public investment on the operation of enterprises, the study's analytical model takes the following form:

$$\log REV_{it} = \alpha_0 + \alpha_1 \cdot CAP_{it} + \alpha_2 \cdot X_{it} + \alpha_3 \cdot Z_{it} + \varepsilon_{it} \quad (1)$$

In which:

The dependent variable ($\log REV_{it}$) measures the performance of enterprises. Based on the study of Selnes, Jaworski, and Kohli (1996) and Hudson, Smart, and Bourne (2001) the change in revenue of enterprise i at year t is selected to stand for the operating results of the enterprise.

The main explanatory variable (CAP_{it}): the average local capital spending per enterprise of enterprise i at year t .

The group of control variables (X_{it}): macro factors affecting each firm i at year t , including urbanization rate, inflation rate, and the PCI (The Provincial Competitiveness Index) reflecting the institutional business environment of firms at local level.

The group of control variables (Z_{it}): characteristics of firm i at year t , including age of the firm, number of employees, fixed assets ratio of the firm. These variables are quantitative variables whose data change both spatially and temporally.

According to [Canh and Phong \(2018\)](#) public investment in Vietnam enhances infrastructure and stimulates overall private investment. However, local investment levels in Vietnam vary by region due to expenditure decentralization, leading to different impacts on enterprises in each region. In Vietnam, due to extremely high fiscal decentralization, local governments have autonomy in investment spending ([Cuong & Thanh, 2015](#)). Based on this context, we hypothesize that local investment spending will positively influence corporate performance.

To examine how local investment influences enterprise performance, our study employs panel data structured by regions and enterprises. Two main benefits of this approach are that it yields more accurate estimates of model parameters and enables the detection and measurement of effects that cross-sectional or time series data alone cannot capture ([Baltagi, 2008](#)). Unlike earlier research, our study specifically targets the impact of local investment on individual enterprises, providing a clearer view of how investment policies affect businesses in Vietnam.

Three approaches can be used for panel data in this case, including CEM (Common Effect Models), FEM (Fixed Effect Model), and REM (Random Effect Models) ([Baltagi, 2008](#); [Widarjono, 2013](#)).

In the CEM, it is assumed that both intercepts and slope coefficients are constant across all individuals and time periods, meaning that individual differences and temporal variations are not considered.

The REM allows for variation in intercepts among individuals while keeping slope coefficients consistent across time periods. If there is no link between the individual effects and the regressors, it may be okay to treat these constants that are unique to each person as if they were spread out randomly across cross-sectional units.

On the other hand, the FEM takes into account for individual differences by utilizing error terms, which can exhibit correlations within the same individual over time and across different individuals. The FEM examines how predictor variables influence outcomes within each entity (such as a country or company), recognizing that each entity may have unique characteristics that affect the relationship between predictors and outcomes.

As the characteristics of enterprises are varied by province and by time, according to the research of [Lian, Xu, and Zhu \(2022\)](#) to test for the effect of local investment on enterprises' performance, in this study, FEM and REM regression analysis are performed. The Hausman test is employed to determine whether the Fixed Effects Model (FEM) or the Random Effects Model (REM) is more suitable for a given analysis ([Baltagi, 2008](#)). The Hausman test formulates the following hypothesis:

H_0 : correlation $(\mu_i, X_{it}) = 0$ (REM is better model).

H_1 : correlation $(\mu_i, C_{it}) \neq 0$ (FEM is better model).

[Equation 2](#) displays the Hausman Test Statistics.

$$W = (\hat{\beta}_{FEM} - \hat{\beta}_{REM})' [var(\hat{\beta}_{FEM} - \hat{\beta}_{REM})]^{-1} (\hat{\beta}_{FEM} - \hat{\beta}_{REM}) \quad (2)$$

If the value of $W \geq X_{table}^2 = X_{(a,K)}^2$ or $p - value \leq 0.05$, the hypothesis H_0 is rejected, and FEM is chosen because this model is better than REM. And vice versa, if $W \leq X_{table}^2 = X_{(a,K)}^2$ or $p - value \geq 0.05$, the hypothesis H_0 is accepted and the hypothesis H_1 is rejected, REM is a better model than FEM.

3.1.1. Heteroskedasticity Test

The Breusch-Pagan Lagrange Multiplier Test is used to detect heteroskedasticity in panel data with random effects ([Breusch & Pagan, 1979](#)). This examination, which was also extended by [Cook and Weisberg \(1983\)](#) (Cook-Weisberg test), is based on the Lagrange multiplier test principle. It assesses whether the error variance in a regression depends on the values of the independent variables, indicating the presence of heteroskedasticity. The evaluation involves regressing the squared residuals on the independent variables. It is a chi-squared analysis, where the statistic value is distributed $n\chi^2$ with k degrees of freedom.

To assess heteroskedasticity in panel data with fixed effects, we use the modified Wald test (Baltagi, 2008). Heteroskedasticity is assumed if the test statistic yields a p-value below the specified threshold, leading to the rejection of the null hypothesis of homoskedasticity.

3.1.2. Autocorrelation Test

For detecting serial correlation in linear panel-data models, which can bias standard errors and reduce result efficiency, it's essential to identify such correlations in the idiosyncratic error term. While various tests for serial correlation exist, this study employs the Wooldridge test (Baltagi, 2008) which is robust and relies on fewer assumptions about the individual effects.

3.2. Data

The General Statistics Office of Vietnam conducted the Annual Enterprise Survey conducted by the General Statistics Office of Vietnam for the period 2011-2020, requiring participation from all registered enterprises. The annual enterprise survey data is compiled into multi-year panels using business registration codes. Missing or mistaken observations were excluded. The panel dataset consists of enterprise-level data with more than 700,000 observations.

Table 1. Variable explanation.

Variable	Explanation
D.logREV	Change in the revenue of enterprise
D.CAP	Change in the local capital expenditure
GRDPr	Growth rate of gross regional domestic products
Inflation	Inflation rate
pci_rank	Rank of PCI score of each province
Urbanization	The urbanization ratio
Age	Enterprise age
log_labour	Number of workers employed by for the enterprise
Fixed_asset	Fixed assets ratio

Public report of provincial state budgets provide data on local investment expenditures. The institutional environment of local government, presented by the PCI index, is from the Provincial Competitiveness Assessment Dataset of the Vietnam Chamber of Commerce and Industry (VCCI) for the period 2011 to 2020. The General Statistics Office (GSO) releases inflation data every year. Table 1 presents the explanations for the variables.

In term of variable calculation, REV_{it} total revenue of enterprise i in the year t is defined as below:

$$REV_{it} = SALESREVS_{it} + FINANREV_{it} + OTHERREV_{it} \quad (3)$$

$SALESREVS_{it}$ stands for net revenue from sales of goods and services of enterprise i at the year t ; $FINANREV_{it}$ is net revenue from financial activities of enterprise i at the year t ; and $OTHERREV_{it}$ are other income of enterprise i at the year t .

To calculate the public investment in provinces, the research uses the budget data annually published in final settlement of local budget. Based on the enterprises' data surveyed and published by the General Statistics Office, the average capital spending per enterprise is calculated as follows:

$$CAP_{it} = \frac{TOTALCAP_{jt}}{E_{jt}} \quad (4)$$

In which, CAP_{it} : the average capital spending per enterprise of enterprise i at year t ; $TOTALCAP_{jt}$ is the total capital spending of province j at the time t (year), j (1,2,3 ... 63) represents 63 provinces of Vietnam. E_{jt} is the number of operating enterprises in province j at the time t . The public investment is general expenditure for local

development, not for individual enterprises, the study assumes that each enterprises enjoy equal levels of capital spending calculated by the average capital spending.

The local economic growth rate measured by Gross Regional Domestic Products (GRDP) is equal to $\frac{GRDP\ value_{jt}}{GRDP\ value_{j(t-1)}}$ or the ratio of the current year's GRDP value of province j to the previous year's GRDP value of that province. Each year the GSO calculates the inflation rate using the average CPI of twelve months and publishes the results. The variable "pci_rank" is the order of PCI - provincial competitiveness index (index calculated by VCCI (Vietnam Chamber of Commerce and Industry) with the support of USAID–United States Agency for International Development). The locality with a high PCI score means a better business environment and gets a lower pci_rank. About urbanization rate, the authors calculate it through the urban population divided by total population of that province. High urbanization rates reflect local economic development when most of the population lives in urban areas with diverse consumption and production markets.

In relation to characteristic variables of enterprises, the age, the labor number, and fixed assets value are published in the business survey data set of GSO (General Statistics Office).

Table 2. Descriptive statistics of variables.

Variable	Obs.	Mean	Std. dev.	Min.	Max.
D.logREV	709,536	0.041	0.790	-7.115	7.115
D.CAP	709,536	0.105	0.413	-4.212	4.224
GRDP _r	798,228	108.35	1.55	105.65	111.56
Inflation	798,228	5.736	5.103	0.63	18.58
pci_rank	798,228	21.55	14.57	4	51
Urbanization	798,228	0.486	0.247	0.138	0.827
Age	798,228	9.653	6.074	0	74
log_labour	798,228	2.594	1.257	0.693	5.111
Fixed_asset	798,228	0.455	0.493	0	1.685

Table 2 presents the descriptive statistics for the variables in the model. The dataset includes more than 700,000 observations, with the table providing detailed information such as the mean, standard deviation, minimum, and maximum values for each variable.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. The Model Selection and Testing

The authors run two models. Using the entire dataset, the first model examines the impact of local capital investment on firm performance. The second model conducts a robustness check with a sample of firms from delta regions and cities.

4.1.1. Hausman Test

Based on the above theories, the authors performed the FEM and REM regression on the processed dataset. The authors conduct Hausman tests to determine which statistical model best fits the data. The test results show that the p-values of the tests are less than 0.05. **Equation 2** rejects the hypothesis H_0 and selects the FEM for both models.

4.1.2. Heteroskedasticity Test

The results of Wald tests reveal that the models exhibit heteroskedasticity. The p-value of both models are 0.000 (i.e., less than 0.05) so the null case is rejected. Therefore, we run the FEM model and include an option to account for the heteroscedasticity problem.

4.1.3. Autocorrelations Test

The Wooldridge test results in both models have p-values of 0.000, indicating autocorrelation in the models.

To address this issue, one approach is to use robust standard errors, which account for both heteroskedasticity and autocorrelation. To compute robust standard errors, we can employ various methods such as the White method, the Newey-West method, or the cluster-robust method.

4.2. Discussion of Results

The Fixed Effects Model (FEM), with autocorrelation and heteroscedasticity correction, emerged as the final choice. The quantitative results are presented in Table 3. The estimation shows that, ceteris paribus and at a statistical significance level of 1%, the change in average capital spending per enterprise has a positive impact on the enterprises' performance (change in revenue). The results support the theory of crowd-in effects of public investment on non-governmental business. In other words, local public investment has a positive impact on business performance. This result supports the crowding-in effect, as evidenced by the studies of Argimon et al. (1997); Erden and Holcombe (2005) and Erden and Holcombe (2006). Our research shows that crowding in effects of public capital investment exist at the local level.

Compared to previous studies, this research offers a more comprehensive analysis of the impact of local investment on business performance by incorporating both macroeconomic and microeconomic variables.

As a developing country, Vietnam's economy requires huge expenditure in the various sectors. The local government continuously increases capital spending to improve infrastructure. The modern infrastructure helps enterprises save time and cost in operations, therefore enhancing their productivity.

On the other hand, in some areas where the state invests, businesses can take part in some projects, so companies can increase revenue and operating profits.

Table 3. Estimated FEM results on the impact of capital spending on business performance.

Variables	FEM	FEM robust
D.CAP	0.0070*** (2.78)	0.0070*** (2.70)
GRDP _{it}	0.0007 (0.73)	0.0007 (0.85)
Inflation	-0.0085*** (-15.7)	-0.0085*** (-18.26)
pci_rank	-0.0005*** (-3.99)	-0.0005*** (-4.02)
Urbanization	0.161*** (3.43)	0.161*** (3.44)
Age	-0.0182*** (-30.73)	-0.0182*** (-38.78)
log_labour	0.131*** (65.45)	0.131*** (54.21)
Fixed_asset	-0.0573*** (-17.07)	-0.0573*** (-18.17)
Constant	-0.195* (-1.87)	-0.195** (-2.16)
Observations	709,536	709,536
R-squared	0.010	0.010
Number of enterprises	88,692	88,692

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The economic growth at the provincial level has a positive effect on the revenue changes of enterprises operating in the area. However, this effect on corporate performance is not statistically significant. This suggests that while economic growth in these provinces positively influences business development, the impact is not clearly defined. This finding aligns with the research of Earle and Sakova (1999) and Smallbone and Welter (2001). As GRDP rises,

job creation increases, leading to higher income and greater consumer spending. Provinces with high economic growth attract more businesses due to the expanded market for products, allowing companies to boost their market share and operating revenue.

This study confirms the negative impact of inflation on businesses. This finding aligns with many earlier studies by Earle and Sakova (1999) and McMillan and Woodruff (2003). In general, the inflation rate is well controlled during the period 2011–2020, the effect of inflation on enterprises' performance is negative but at a minor level.

At the 1% significance level, an improvement in the quality of local institutions, as measured by the PCI variable, leads to positive changes in business operations. A lower PCI rank means a higher PCI index reflecting an improved institutional environment that contributes to promoting the positive impacts of macroeconomic variables on business operations. The government's preferential policies enable enterprises to enhance production and business, thereby expanding operating revenue.

The estimated results also show that the higher the urbanization rate, the greater the change in the revenues of firms. Places with high urbanization rates reflect improved urban infrastructure and local socioeconomic development, which create a favorable environment for business production and operations. Enterprises in places with high urbanization rates such as Da Nang (87 percent), Binh Duong (84 percent), and Ho Chi Minh City (79 percent) have good infrastructure and a large market, which give them the opportunity to expand production and increase sales.

In terms of the operating age of the enterprises, with statistical significance, the older the companies are, the more likely they are to increase their revenues. Long-standing companies often experience saturation and retirement, with few preferential policies available to them. Newly established enterprises are often dynamic and can quickly grasp the market, use scientific and technological achievements to penetrate the market and thus increasing market share and raising revenue. This result aligns with Jovanovic (1982) findings and other empirical studies that identify a negative relationship between a firm's age and its growth.

The two main inputs of the firms, labor and fixed assets, show opposite results. For the labor variable, with the statistical significance level of 1%, under the condition that other characteristics of the firm for the school and the enterprise work in the same macro environment, if the firm increases the labor, this helps to increase the change in firm's revenue. The enterprise's turnover is negatively impacted by the proportion of fixed assets in its total assets. Getting more fixed assets will reduce the company's financial resources that can be invested in short-term production, the company's sales in the period will therefore be reduced.

4.3. Robustness Check

The distribution of businesses in geographical regions as well as the level of local capital spending is significantly diverse. Therefore, to check the robustness of the above result, the authors estimate the model with the subsample (data of enterprises located in delta provinces and cities). Table 4 details the result.

The result reconfirms that local capital spending has a positive effect on the enterprise's performance. Most enterprises are in delta regions, especially cities where there are favorable macroenvironments for their operation. In these regions, the local capital spending is significantly high, and the infrastructure is modern, enhancing the productivity of enterprises. Additionally, the enterprises can also take part in public investment projects to increase revenue and profits. In terms of other macroeconomic and enterprise variables, the estimation shows consistent results as the model of overall enterprises.

Table 4. FEM results on the impact of capital spending with sub data in delta regions and cities.

Variables	FEM	FEM robust
D.CAP	0.0069** (2.54)	0.0069** (2.46)
GRDPr	0.0007 (0.65)	0.0007 (0.75)
Inflation	-0.0098*** (-17.24)	-0.0098*** (-20.02)
pci_rank	-0.0004*** (-3.33)	-0.0004*** (-3.34)
Urbanization	0.155*** (3.23)	0.155*** (3.23)
Age	-0.0191*** (-30.95)	-0.0191*** (-38.91)
log_labour	0.127*** (60.60)	0.127*** (50.26)
Fixed_asset	-0.0552*** (-15.81)	-0.0552*** (-16.93)
Constant	-0.167 (-1.52)	-0.167 (-1.74)
Observations	658,935	658,935
R-squared	0.010	0.010
Number of enterprises	82,382	82,382

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05.

5. CONCLUSION

The study focuses on the changes in business revenue when the average capital spending per enterprise alters during the period 2011–2020, including the examination of macro and micro factors. Use data at the enterprise level; the study shows the positive impact of local capital spending on enterprise performance in Vietnam. The local capital expenditure has a crowding-in effect on enterprises. The main findings of the research are consistent with the conclusions of Aschauer (1989) and Lynde and Richmond (1992). The results have significant policy implications, indicating that local public investment can enhance enterprise performance. This suggests that increased capital spending may create a more favorable macroeconomic environment for businesses. To boost enterprise operations, future capital investments should prioritize infrastructure development to stimulate the private sector and promote sustainable economic growth. Additionally, these findings underscore the importance of provincial institutions in supporting business activities. As a result, business operations will be boosted by institutional reform and a reduction in compliance costs. Because the investment expenditure data is not available by sector, the future research should focus on examining the impact of each type of investment expenditure on business operations.

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Data Availability Statement: The macro data are available on the websites of GSO (General Statistics Office) of Vietnam and the website <https://pcivietnam.vn/en>, and the authors can provide supporting data upon reasonable request.

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