



Management decentralization in public investment and economic growth in Vietnam

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Abstract

Empirical evidence obtained using a vector autoregressive (VAR) model with quarterly data from the first quarter of 2014 to the third quarter of 2024 indicates that 1% increase in public investment management decentralization raises Vietnam's economic growth rate by 0.5% in the initial quarter. However, the effect diminishes and decays after eight quarters. At subnational tiers, decentralization at province and district tiers contributes positively to economic growth, whereas decentralization at commune tier exerts a negative effect. This result can be attributed to the fact that decentralization is most effective at province tier, where decision-making authority is appropriately aligned with investment responsibilities. While decentralization at district tier remains beneficial, its impact is weaker, and becomes least effective at commune tier.

Keywords: public investment, decentralization, Vietnam.

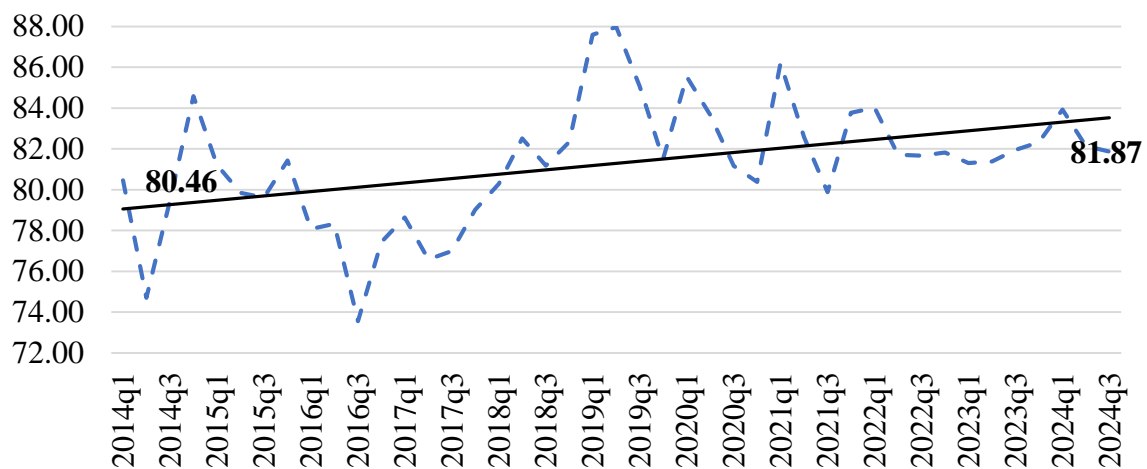
JEL classification: E62, H70, H77, O18, O40.

1. Introduction

Disbursement of public investment has long been regarded as a crucial fiscal policy instrument for fostering economic growth in Vietnam. However, following two years of robust economic expansion in 2022 and 2023, the growth rate of public investment disbursement declined sharply in 2024. As of October 2024, state budget investment increased by only 1.5% month-on-month and 1.8% year-on-year, a stark contrast to the 24.6% growth recorded during the first ten months of 2023 compared to the same period of the previous year. This sharp deceleration has raised concerns among experts and policymakers, highlighting the urgent need to strengthen the decentralization in public investment management. Such reforms are particularly relevant in the context of preparing a new Law of Public Investment to replace the 2019 version. The objective is to establish a legal framework that can accelerate capital disbursement, thereby generating stronger momentum for socio-economic development (Hai Giang, 2024).

FIGURE 1: Decentralization rate of public investment management in Vietnam

Unit: percent



Source: General Statistics Office (2024).

Recent practice shows that the decentralization in public investment management in Vietnam has increased over time. Measured by the share of investment managed by localities relative to the total state budget investment, the decentralization degree has increased from 80.46% in the first quarter of 2014 to 81.87% in the third quarter of 2024 (Figure 1). However, over the past ten years, the increase was modest, and the decentralization degree exhibited strong fluctuations, with a standard deviation of 3.03%. A critical research question is: Is the decentralization in public investment management a driving force for economic growth in Vietnam? This article aims to provide an analytical response to this fundamental question.

The findings contribute to the literature on the impact of public investment on economic growth. Along with other types of capital, public investment supports the process of capital accumulation in the economy, thereby fostering growth. While both theoretical models and empirical evidence across economies indicate the exact mechanism, the impact channels are diverse. In particular, the disbursement of public investment stimulates aggregate demand through the fiscal multiplier (Auerbach and Gorodnichenko, 2013). Meanwhile, capital accumulation driven by public investment can promote the convergence to the long-term equilibrium, as in the neoclassical model (Solow, 1956), or enhance efficiency in investment management processes (Frankel, 1962).

Building on these insights, this paper demonstrates that decentralization is a crucial channel through which public investment promotes economic growth. Decentralizing public investment management creates the initiative for management tiers to make investment decisions that are better aligned with local conditions and needs. Drawing on the influence of decentralization on other capital flows, such as bank credit and foreign direct investment (FDI), the research suggests that an appropriate limit to the degree of decentralization is necessary. This boundary is essential to ensure that the policy creates a beneficial spillover effect - activating and complementing other types of capital rather than eliminating or crowding them out.

2. Analytical framework

2.1. Theory

This article is based on the theoretical basis of public investment for economic growth, combined with the current practice of management decentralization in Vietnam.

The theory of public investment posits that public investment has a positive impact on economic growth. Specifically, public investment acts as a type of investment, supplementing the economy's capital accumulation and thereby promoting a higher economic growth rate, as measured by the expansion of real gross domestic product (GDP) over time. Capital accumulation generates economic growth through three main channels:

First, from an accounting perspective, public investment is classified as public expenditure, denoted as G , which is a component of aggregate demand in the economy. An increase in G raises aggregate demand, thereby stimulating output through the public expenditure effect, also known as the fiscal multiplier (Auerbach and Gorodnichenko, 2013). Second, when viewed as a form of capital, public investment contributes to the process of capital accumulation, which in turn generates new knowledge, specifically in terms of management practices that combine different types of capital. This accumulation of knowledge fosters technological advancement and drives economic growth. This idea has been explicitly expressed through the famous AK model in the theory of endogenous growth

(Frankel, 1956). Third, in line with the neoclassical growth model (Solow, 1956), an economy accumulates capital to converge towards a long-run equilibrium. During this convergence process, the level of capital per effective unit of labor becomes the key determinant of output per worker, thereby exerting a direct influence on the rate of economic growth.

Although current theory has established solid principles for the impact of public investment on economic growth, practical implementation often produces variations in outcomes. In Vietnam, the decentralization in public investment management has emerged as a significant factor, alongside public investment itself, in determining the role of this type of investment in the economy.

Within the framework of this article, management decentralization is understood as the separation of management work according to the tiers of state administration. Until June 2025, there were four administrative tiers in Vietnam: the central tier, comprising line ministries; and three subnational tiers, including provinces, districts, and communes. Decentralization in public investment management is the regulation of the responsibility for investment management between central and local authorities. This concept emphasizes capital management at the operational level, aligning closely with the decentralization in capital decision-making as stipulated in the Law on Public Investment (2019) and the Law on Organization of Subnational Government. The simplicity of the concept of capital management decentralization in this article is necessary for more convenient research on data exploitation and a focus on the economic aspect of investment management. In practice, this concept has been widely applied in statistical work in Vietnam. For example, the General Statistics Office (2024) has classified public investment capital management tiers by central and subnational tiers in its monthly socio-economic reports for many years.

In this research, management decentralization is measured by the ratio of public investment managed at the subnational tiers to total public investment. A higher ratio indicates a greater degree of management decentralization toward subnational authorities. Another measure of management decentralization is based on the highest and closest management tier. Accordingly, decentralization in public investment management at the province tier is calculated by the ratio of provincial public investment capital to central public investment. Similarly, the decentralization in management at the district tier is calculated by the ratio of district public investment to provincial public investment, and the decentralization in investment management at the commune tier is measured by the ratio of commune public capital to district public investment.

Although decentralization has been measured in various ways, its economic efficiency remains ambiguous in Vietnam. Decentralization is essentially a top-down approach to

public investment (Pham, 2020). When capital flows are managed at a tier closer to reality, the investment effectiveness in promoting socio-economic development is expected to align more closely with the actual needs of the population. However, the allocation of public investment must be comprehensive, taking into account the need to balance between different geographical areas. This allocation requires attention to horizontal linkages between management tiers, such as among different communes within a district, different districts within a province, and different provinces in the national economy. However, balancing interests across geographical areas is a challenging task. As a result, decentralizing investment management in practice is difficult, which could potentially lead to delays in project implementation (Vu, 2015; Vu, 2010).

Parallel to management decentralization is authority decentralization, which refers to the delegation of decision-making power over investment projects. Decentralization in this sense relates not only to the scale and nature of projects, but also to their role in socio-economic development. In projects with mixed investment, including the investment from the central government and counterpart investment from localities, decision-making authority generally remains at the central tier, with no delegation to localities (Bao Yen, 2019). According to the Law on Public Investment (2019), projects are classified into three categories: A, B, and C. Even if a project falls under local management and is financed entirely by local resources, it may still require central approval if it involves areas under the central government's authority, such as protected forests. The overlap between management decentralization and decision-making decentralization in practice shows that investment management at the commune tier is the most passive (Nguyen, 2021).

In this context, together with the scarcity of reliable data, the limited and inconsistent research findings on the decentralization in public investment management underscore a significant gap, which is the basis and motivation for this study.

2.2. Model

The regression model, with t corresponding to quarterly time points, from Q1-2014 to Q3-2024, is written in the reduced form, as follows:

$$Y_t = A_1 \cdot Y_{t-1} + C + \varepsilon_t \quad (1)$$

Where, $Y_t = (y_1, y_2, y_3, y_4)$ is a vector (4x1) of four endogenous variables, in order, including: public investment management decentralization ($y_1 = \text{GinvMN}$), bank credit capital ($Y_2 = \text{Credit2y}$), foreign investment capital ($y_3 = \text{Fdi2y}$), and economic growth ($y_4 = \text{VNgdp}$).

Regarding the stationarity test, the threshold index with a significance level of 5%, or equivalent to a confidence level of 95%, is (-2.95) and the significance level of 1% is (-3.63).

The Dickey-Fuller test value of the four variables is all smaller than this threshold value, in which: $GinvMN = (-3.26)$, $Credit2y = (-8.37)$, $Fdi2y = (-6.56)$, and $VNgdp = (-5.04)$. Because the Dickey-Fuller test value is lower than the threshold index at 1% significance (except for $GinvMN$, which is lower than the threshold index with a significance level of 5%), the initial hypothesis is rejected. Thus, decentralization of public investment management, bank credit capital, foreign investment and economic growth are all stationary.

The number of lags is selected from the results of the AIC test. With lag 1, the AIC value is 19.91, the lowest compared with lag 0 (20.19), lag 2 (20.03), lag 3 (20.17), and lag 4 (19.97).

A_1 is a (4x4) matrix containing the estimated coefficients, including four coefficients corresponding to four endogenous variables.

C is a (4x1) matrix containing fixed coefficients.

ε_t is a (4x4) vector of residuals, assumed to have a normal multivariate distribution as follows:

$$\varepsilon_t \sim \mathcal{N}(0, \Sigma_t) \quad (2)$$

ε_t independent but not identically distributed across different points in time. In particular, the covariance matrix Σ_t may change over time.

At each time point, the SV-BSVAR model can be written as follows:

$$y_t = \bar{X}_t \beta + \varepsilon_t \quad (3)$$

with the following components:

$$\bar{X}_t = I_4 \otimes X_t, X_t = (y'_{t-1} \ x'_t), \beta = \text{vec}(B), B = \begin{pmatrix} A_1 \\ C \end{pmatrix} \quad (4)$$

The standard SV-BSVAR model is built based on the proposal of Cogley and Sargent (2001). In which the covariance matrix is decomposed into two components, including F , a lower triangular matrix with value 1 on the diagonal, and Λ_t , a diagonal matrix with value changing over time.

$$\Sigma_t = F \Lambda_t F' \quad (5)$$

Regarding the selection of variables, the article mainly focuses on the role of investment in promoting economic growth. The model focuses on the decentralization of public investment management for economic growth, so the variables related to decentralization of management ($GinvMN$) and economic growth ($VNgdp$) play a central role. In addition to public investment, other sources of investment in the economy include credit capital from the banking system ($Credit2y$) and foreign direct investment ($Fdi2y$). These types of investment contribute to the capital accumulation process of the economy.

Regarding model construction, the article employs a vector autoregressive model with random variance (SV-BSVAR). In which the vector autoregressive (VAR) model is structural (S), directly expressed through the Cholesky decomposition of the covariance matrix (Blanchard and Quah, 1989; Sims, 1980). According to this decomposition, the order of variables is arranged based on the assumption of decreasing exogeneity; in other words, variables appearing earlier in the sequence exert influence on those ordered later. In addition, the model incorporates random variance (SV). Estimation is conducted using Bayesian statistics (B), where the data sample is treated as fixed while the coefficients are regarded as random. This approach is suitable for small samples (Sims, 2007).

The SV-BSVAR model is suitable for an economy where macroeconomic variables fluctuate highly over time. In Vietnam, public investment and bank credit have demonstrated a continuous downward trend in both mean values and standard deviations, whereas foreign investment has shown a persistent increase over time. These dynamics suggest the presence of potential structural changes. Thus, a regression method with random fluctuations is one appropriate method for estimating the coefficients.

The structure of the multiple regression equation, with four endogenous variables and one lag, yields five coefficients to be estimated for each equation of an endogenous variable, including four coefficients of endogenous variables and a fixed coefficient. With four equations, the full SV-BSVAR model with four endogenous variables will have a total of 20 estimated coefficients. According to the estimation results, the model has no solution larger than 1 unit, thereby satisfying the stability condition. This outcome enhances the statistical reliability of the model estimates. Building upon this foundation, the analysis focuses on the impulse response function estimated from the quantitative model, derived from the Cholesky decomposition of the variance matrix (Σ). This function represents the impact of the shock from a unit increase in an endogenous variable on each other variable. Additionally, the forecast variance decomposition reveals the contribution of each variable to the fluctuations in the forecast results of other variables.

2.3. Data

The dataset includes quarterly data on the Vietnamese economy, spanning from Q1 2014 to Q3 2024.

In this paper, public investment is measured by investment implemented from the state budget. This measurement links public investment to the budget's balance of revenue and expenditure, thereby reflecting the public sector's capacity to finance investment through its savings. This measure is narrower than the total state-sector investment, which encompasses

both budgetary investment and investment from state-owned enterprises, yet broader than public spending on infrastructure. These measures are currently being used simultaneously in both international and domestic studies.

The decentralization of management of public investment capital, denoted as $GinvMN$, is captured by the proportion of investment implemented from the state budget managed by local tiers compared to total investment, calculated in percentage.

To further assess management decentralization, the article explicitly distinguishes three tiers of subnational management: provincial, district, and commune tiers. Province-tier management decentralization, denoted as $GinvMNp$, is measured by the ratio of investment managed by the provincial governments relative to total investment, in percentage units. District-tier management decentralization, denoted as $GinvMNd$, is measured by the ratio of investment managed by the district governments relative to total investment, in percentage units. Commune-tier management decentralization, denoted as $GinvMNw$, is measured by the ratio of investment managed by the commune governments relative to total investment, in percentage units. The data for each tier is separated in the sense that the data at higher tiers does not include data at lower tiers.

The construction of the variable using total public investment mainly serves to eliminate scale effects on the measurement of investment. By doing that, the analysis focuses on the correlation between subnational public investment and the total investment, rather than the absolute size of subnational public investment itself. Moreover, this approach also aligns with the conceptual framework of management decentralization adopted in this article. Accordingly, the decentralization in public investment management involves the separation of management by state administrative tier, both at the central and subnational tiers. That is, the variable needs to be designed such that higher values indicate a greater degree of decentralization at subnational tiers, consistent with the variable in this article.

Another measure of the degree of decentralization in investment management at the provincial, district, and commune tiers is the ratio of investment managed at each respective tier to the total investment at the local tier, rather than to total national investment (i.e., the sum of central and local investment). This measure captures the degree of decentralization associated with the nearest higher management tier. The results of the analysis using this alternative measure are comparable to those obtained with the original measure employed in this article.

The article also utilizes additional variables, including public investment at different tiers compared to domestic output (GDP), to further clarify the structure of management decentralization. These variables facilitate an assessment of the relative contribution of

each type of public investment to economic growth, particularly in comparison with other sources of capital, such as bank credit and foreign direct investment, which are also measured by the ratio of GDP. Specifically, public investment as a percentage of GDP, denoted as $Ginv2y$, is the ratio of state budget-financed investment to GDP. Similarly, by management tier, provincial public investment relative to GDP, denoted as $pGinv2y$, is the ratio of provincial state budget investment to GDP, in percentage units; district public investment relative to GDP, denoted as $dGinv2y$, is the ratio of district state budget investment to GDP, in percentage terms; commune-tier public investment to GDP, denoted as $wGinv2y$, is the ratio of commune state budget investment implemented to GDP, in percentage terms. These data are obtained from the General Statistics Office (2024).

One central variable in the model is economic growth, denoted as $VNgdp$, which is measured by the annual change in gross domestic product at 2010 constant prices. The data are obtained from the monthly socio-economic report published by the General Statistics Office (2024).

As a source of investment in the economy, public investment is analyzed in relation to two other sources of investment. The first is bank credit capital, denoted as $Credit2y$, measured by the ratio of outstanding credit value to GDP, in percentage units. Data on credit outstanding are sourced from the State Bank database (2024). The second is foreign investment, denoted as $Fdi2y$, measured by the ratio of disbursed foreign direct investment to GDP, in percentage units. These data are collected from the General Statistics Office (2024). By expressing these variables as ratios to GDP, the analysis emphasizes their real economic impact, as this construction effectively controls for the influence of general price level increases over time, i.e., inflation.

TABLE 1: Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Investment management decentralization ($GinvMN$, %)	81.29	3.03	72.56	87.96
Province-tier investment management decentralization ($GinvMNp$, %)	55.57	2.17	50.27	60.53
District-tier investment management decentralization ($GinvMNd$, %)	21.59	1.98	18.04	24.76
Commune-tier investment management decentralization ($GinvMNw$, %)	4.13	0.51	3.05	5.21

Public investment (<i>Ginv2y</i> , %)	6.30	2.08	3.35	13.05
Province-tier public investment (<i>pGinv2y</i> , %)	4.61	1.54	2.35	8.35
District-tier public investment (<i>dGinv2y</i> , %)	1.80	0.67	0.83	3.21
Commune-tier public investment (<i>wGinv2y</i> , %)	0.34	0.09	0.19	0.56
Economic growth (<i>VNgdp</i> , %)	5.73	2.63	-6.17	13.67
Bank credit investment (<i>Credit2y</i> , %)	22.42	11.89	-0.11	55.41
Foreign investment (<i>Fdi2y</i> , %)	5.73	2.63	-6.17	13.67

Note: Number of observations is 43.

Source: Author's calculation from data.

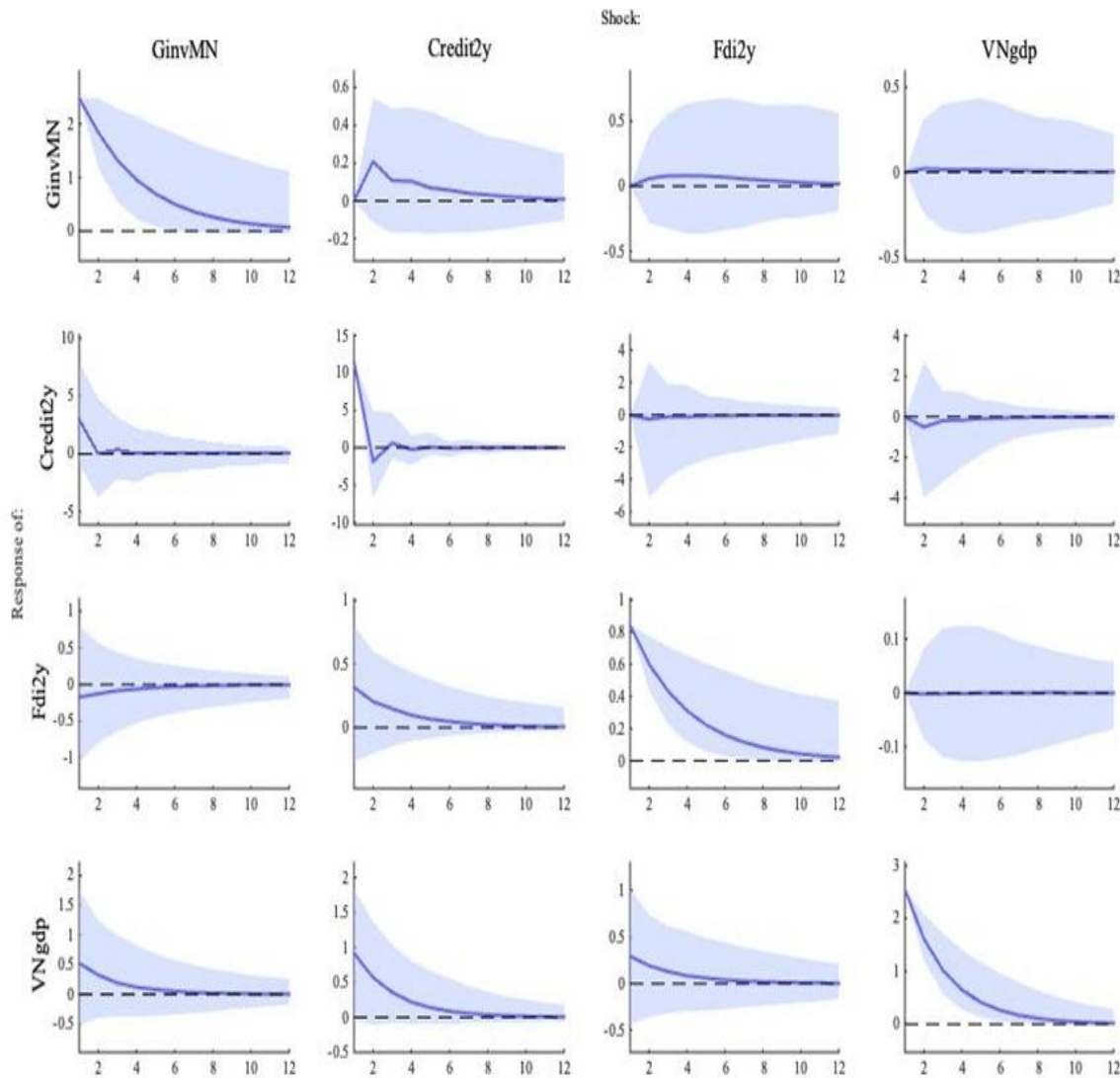
Table 1 shows the descriptive statistics of the variables in the dataset used in the article. The results indicate that the degree of decentralization of public investment management (*GinvMN*) is, on average, higher than the corresponding measures at province, district, and commune tiers. A similar pattern exists when examining the ratio of public investment to GDP at different tiers, where the average value of total public investment to GDP is the highest, with progressively smaller averages observed at lower tiers of decentralization. Overall, the descriptive statistics reveal substantial variation across variables, facilitating the analysis of the economic significance of public investment management decentralization in Vietnam's economy.

3. Evidence

3.1. Impact of decentralization on economic growth

The decentralization in public investment management to localities promotes economic growth in Vietnam. In Figure 2 at row 4 column 1, a 1% increase in the degree of decentralization in public investment management to subnational tiers raises the growth rate by 0.5%. This impact gradually decreases and is completely eliminated after eight quarters. With the degree of decentralization to lower tiers, the impact pattern is similar, with the order of influence on economic growth decreasing from the province tier to the district tier. Appendix A reveals a declining impact across administrative tiers: a 1% increase in decentralization boosts economic growth by 0.4% at the province tier, and 0.3% at the district tier, but reduces growth by 0.5% at the commune tier.

FIGURE 2: Impulse response function



Note: Variables in columns are impact variables; variables in rows are response variables. Estimated results from the SV-BSVAR model.

Source: Model’s estimated results.

The impact of decentralizing public investment management on economic growth is consistent with the influence of public investment on economic growth. As shown in Appendix B, public investment at subnational tiers, including provincial and district tiers, generally has a positive impact on growth. In contrast, public investment at the commune tier has negative consequences. Overall, public investment thus contributes to promoting economic growth, particularly when managed at higher tiers of local government.

These findings can be understood within Vietnam's institutional framework. Greater decentralization provides local authorities with more autonomy over investment decisions, including disbursement schedules, beneficiary selection, and resource reallocation across projects. Specifically, at each tier, such as province and district, People's Councils hold authority over the allocation of investment capital at the corresponding subnational tiers.

The quantitative results indicate that decentralization is effective at the provincial and district tiers, but has limited, and in some cases even negative, implications for economic growth at the commune tier. Such disparities can be attributed to institutional arrangements, in which provincial and district People's Councils hold authority over capital allocation while communes lack such a council, thereby constraining their autonomy. According to this explanation, investment allocation at the commune tier is more likely to respond to economic growth achievements than to drive them. In other words, at the provincial and district tiers, investment decentralization and the associated amount of public investment act as determinants of economic growth, whereas at the commune tier, economic growth appears to drive the degree of decentralization and the amount of investment.

The impact of decentralization in public investment management on growth across management tiers can be explained by Vietnam's current institutional framework. The results suggest that a deeper degree of decentralization brings about a lower impact on economic growth, with the provincial tier exerting the most decisive influence due to its role as a small-scale economy within the national system. Here, decision-making authority over public investment projects from multiple districts and communes is concentrated at this tier. Compared with district and commune administration, provincial authorities possess a more centralized and coherent management apparatus. Therefore, the governance of public investment in Vietnam is effectively concentrated at two main tiers, including the central government (through line ministries) and the provincial or centrally governed municipalities' administrations.

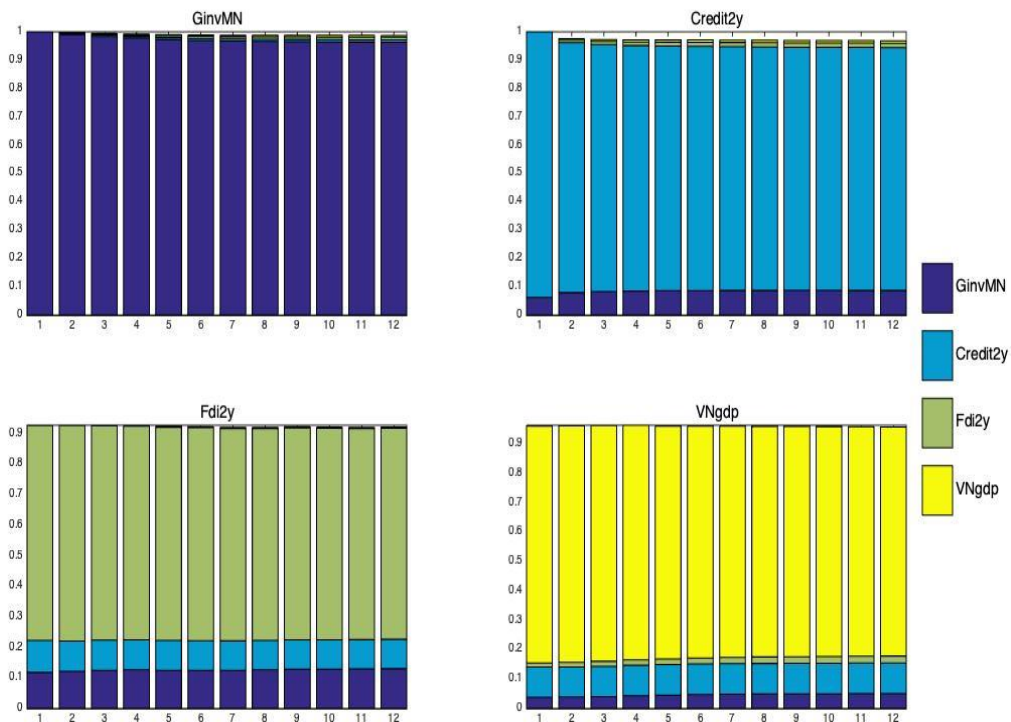
The impulse response function in Figure 2 indicates that public investment decentralization generates spillover effects on other types of capital in the economy. A 1% increase in decentralization raises the ratio of bank credit to GDP by 3% (as shown in row 2, column 1), highlighting its role as seed capital that stimulates domestic credit expansion. In contrast, the same 1% increase in decentralization reduces the ratio of foreign direct investment to GDP by 0.2% (as shown in row 3, column 1), suggesting a squeezing effect. Thus, decentralization of public investment simultaneously promotes domestic credit growth while constraining foreign direct investment.

3.2. Role of decentralization in economic growth

The contribution of decentralization in public investment management to economic growth remains modest compared with bank credit and foreign investment. As shown in Figure 3, the forecast for the next 12 quarters indicates that economic growth is primarily explained by the variation of this variable in the previous quarters, reflecting strong persistence over time. Decentralization of public investment management accounts for 3% of the variation in economic growth, a share lower than bank credit (9%) but higher than foreign direct investment (1%).

However, it is noteworthy that decentralization in public investment management plays a vital role in the fluctuations of two other types of investment in the economy. For bank credit investment, decentralization accounts for nearly 10% of the variation over the next 12 quarters. This level is much higher than the negligible contributions of the other two variables, including economic growth and foreign investment. For foreign direct investment, decentralization contributes up to 11% of the variation over the subsequent 12 quarters, surpassing the impact of bank credit (8%) and the minimal effect of economic growth.

FIGURE 3: Forecast error variance decomposition



Source: Model’s estimated results.

As shown in Figure 2, decentralization in public investment management promotes bank credit but constrains foreign direct investment. Combining these two pieces of evidence, the model further suggests that the impact of decentralization in public investment management is asymmetric. The spillover effect of decentralization on credit is relatively modest over time, but the constraining influence of decentralization on foreign investment is more pronounced and persistent. This asymmetry implies that decentralization of public investment management should be subject to certain limits. Excessive decentralization risks accelerating the decline of foreign investment more rapidly than the expansion of bank credit, thereby creating imbalances in the structure of capital flows.

4. Conclusion and policy discussion

Empirical evidence from a vector autoregressive model, using quarterly data from the first quarter of 2014 to the third quarter of 2024, indicates that a 1% increase in decentralization in public investment management leads to a 0.5% increase in economic growth in the first quarter, with the effect gradually decreasing and disappearing after eight quarters. At the subnational tiers, decentralization to the province and district tiers tends to foster growth, whereas decentralization to the commune tier tends to reduce it due to the concentration of effective authority over investment management at the provincial tier.

The research results suggest that decentralization in public investment management must be bounded. While greater decentralization stimulates bank credit, it simultaneously reduces foreign investment. Accordingly, policy planning needs to design an optimal decentralization mechanism, in which public investment can retain its spillover function as seed capital without undermining foreign capital inflows.

Future research should incorporate the effects of public investment management decentralization. Specifically, the delegation of authority regarding the planning, flow, and allocation of public investment funds represents a prerequisite for achieving effective decentralization. Subsequent investigations should further clarify the authority and responsibility assigned to each management tier to promote local growth and socio-economic development optimally.

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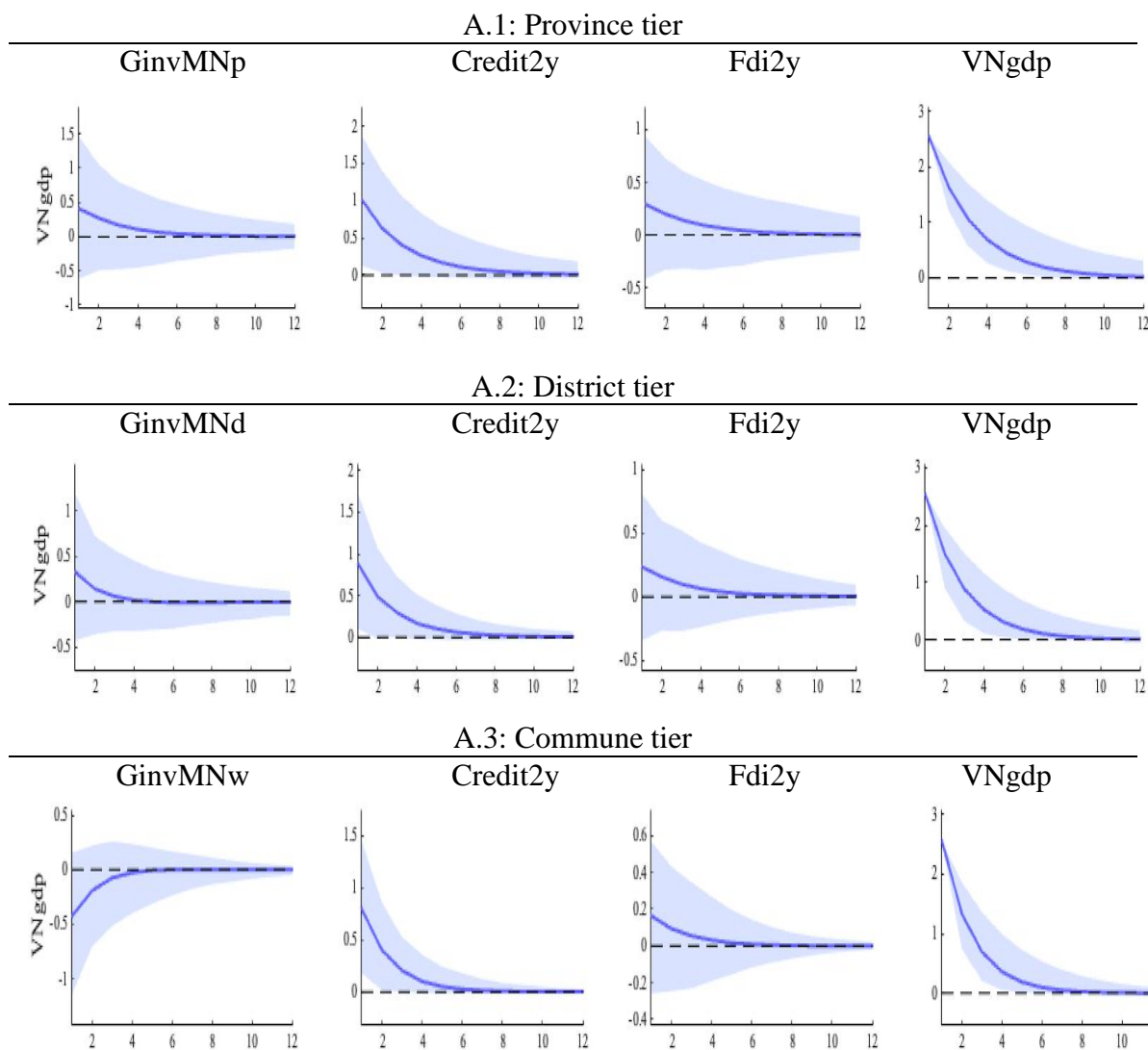
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APPENDIX

A. The model's impulse response function for decentralization in public investment management at province, district and commune tiers

Applying the same SV-BSVAR model in the article to the ratio of decentralization of public investment management at the province, district and commune tiers compared to total public investment, the empirical evidence is shown in Figure A.

FIGURE A: Impulse response function across subnational tiers of management



Note: The variables in the columns are the impact variables; the variables in the rows are the response variables.

Source: Model's estimated results.

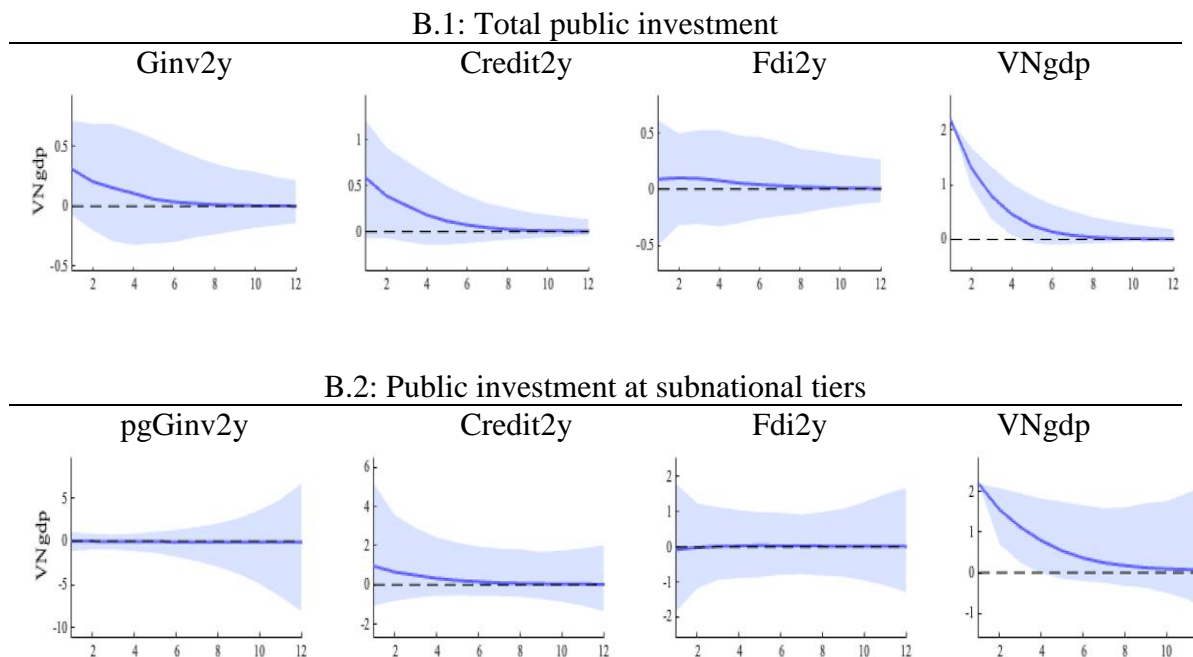
The results show that a 1% increase in decentralization at the province tier raises economic growth by 0.5% (Figure A.1), while a 1% increase in decentralization at the district tier generates 0.3% growth (Figure A.2). However, a 1% increase in decentralization in public investment management at the commune tier reduces economic growth by 0.5% (Figure A.3).

B. Results of analysis of public investment at provincial, district and commune levels

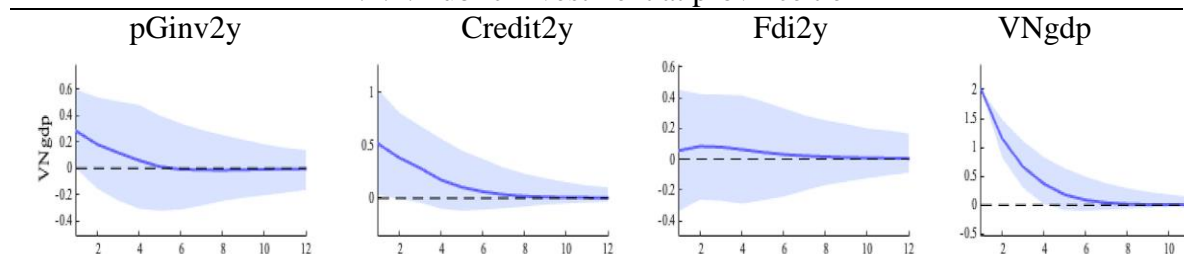
The appendix uses the SV-BSVAR model to analyze the impact of public investment value on economic growth. As shown in Figure B, total public investment (*Ginv2y*) promotes economic growth with a coefficient of 0.3% in the first quarter, with the effect gradually declining and disappearing after eight quarters (Figure B.1). In contrast, when considering the levels of management decentralization, public investment at the local level in general (*pgGinv2y*) exhibits no significant impact on economic growth.

At lower management tiers, public investment at the province tier boosts economic growth by 0.25% in the first quarter, with the effect gradually decreasing and completely disappearing after six quarters. Investment at the district tier (*dGinv2y*) initially has a stronger positive effect, raising growth by 0.4% in the first quarter, but the impact turns negative (-0.1%) by the fifth quarter before gradually recovering and vanishing after 18 quarters. Investment at the commune tier (*wGinv2y*) follows a similar pattern yet different in terms of flow, it increases growth by 0.1% in the first quarter, subsequently declines, and eventually turns negative (-0.1%) in the fourth quarter, before gradually increasing and disappearing after 12 quarters.

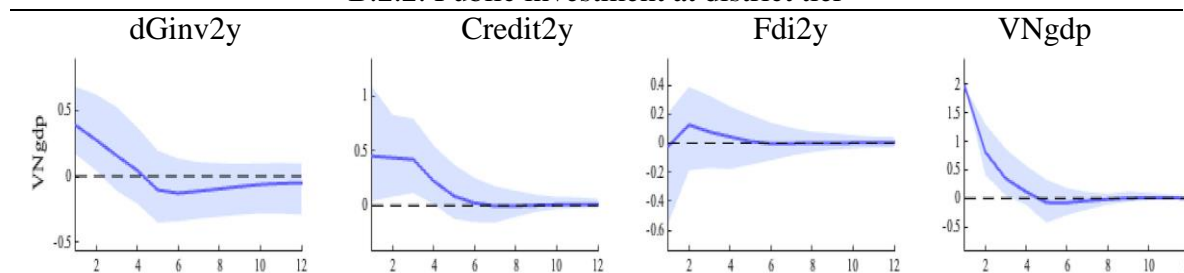
FIGURE B: Impulse response function on public investment at different tiers



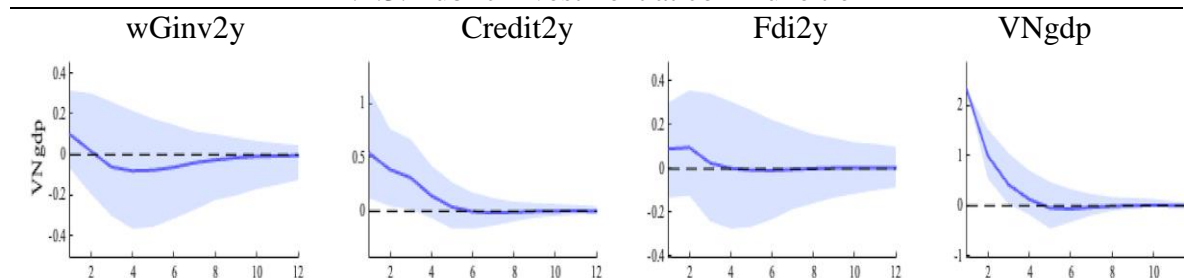
B.2.1: Public investment at province tier



B.2.2: Public investment at district tier



B.2.3: Public investment at commune tier



Note: The variables in the columns are the impact variables; the variables in the rows are the response variables.

Source: Model's estimated results.

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