

Central budget allocation regime and total factor productivity in Vietnam: a decomposition approach

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Abstract

Purpose – This study explores the effect of local budget retention rate changes (RER) on total factor productivity (TFP) and its components in Vietnam.

Design/methodology/approach – The study employs a two-system generalized method of moments (GMM) estimator and data from 2012 to 2019 across all 63 provinces/cities of Vietnam.

Findings – The study finds that local budget retention rates significantly influence public investment, affecting scale and allocation efficiency. The reallocation of budgets between regions and from the central government to local levels incurs certain costs, often resulting in economically robust provinces experiencing reductions in their retention rates.

Practical implications – Recognizing the challenges of immediate structural budget changes due to cultural and historical factors, the study suggests a more gradual policy approach. It emphasizes the importance of policy predictability, as abrupt reductions in the retention rate lead to higher costs than gradual reductions, thus implementing budget policies with a clearer timeline. This study provides insight into local budget allocation regimes and their impact on productivity in transitioning countries.

Originality/value – First, the study provides fresh evidence of the impact of retention rate changes on TFP and its components in Vietnam. Second, the study provides insights into the mechanisms of the nexus of increased budget spending, capital efficiency and, most importantly, attaining improvement in education. We also offer further insights into inefficient budget allocation agents in Vietnam, especially in large cities, which should alert scholars to explore this topic further in the future.

Keywords Stochastic frontier analysis, Budget government allocation, Total factor productivity (TFP), Retention rate

Paper type Research paper

1. Introduction

The decentralization of fiscal policy is regarded as a central and critical task for nations to achieve economic efficiency, particularly in enhancing local productivity (Bui, Le, & Park, 2023; Martínez-Vázquez, Lago-Peñas, & Sacchi, 2017; Thanh, Hart, & Canh, 2020). Effective fiscal decentralization among localities/states can be considered through two classical theories: the public goods provision theory (Musgrave, 1959; Samuelson, 1954; Tiebout, 1956) and the policy diffusion theory (Graham, Shipan, & Volden, 2013; Shipan & Volden, 2008, 2012). Specifically, allocating additional financial resources for expenditure, when done rationally and efficiently, can result in notable productivity enhancements through effective public investment; while local governments have access to additional funds, they can learn from the successes and best practices of more advanced regions. Notably, in transitioning

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countries (e.g. Vietnam and China), efforts to establish a fiscal decentralization system for localities, given political centralization, have led to various forms (e.g. Chinese-style fiscal decentralization), intricately affecting economic performance (e.g. TFP) (Yu & Liu, 2018). Indeed, the political negotiation did affect the budget allocation process, as equal treatment at all localities in Vietnam, through changes in the local budget retention rate.

Vietnam is a nation in transition, experiencing rapid growth and achieving numerous economic and social milestones, such as poverty reduction and reduced inequality (Van Le & Tran, 2022; Van Le, Tran, & Doan, 2022). During the COVID-19 pandemic, the increasing strain on the healthcare infrastructure in Vietnam's most dynamic city, Ho Chi Minh City, drew the attention of scholars to the public investment process. Alongside concerns about expenditure structures and corruption, local budgets allocated for investment in development have become a top priority (Thanh & Canh, 2020). In Ho Chi Minh City after 2017, the local budget retention rate, i.e. the proportion of the budget retained by the local government (with the remainder submitted to the central government), declined to 18%. Similarly, in Hanoi, the capital city and the second largest in the nation, this rate stands at 35%. It is crucial to note that (1) the annual national budget is approximately 20% of gross domestic product (GDP), and (2) the 2002 State Budget Law outlines mechanisms for fiscal balance among localities (detailed in Articles 30 to 33 of the law), implying a reverse incentive mechanism (i.e. "do less, get more").

Thus, it is essential to examine the impact of the budget allocation process on national economic efficiency. Assessing a nation's economic efficiency encompasses various aspects, such as GDP growth, capital, and labor utilization efficiency. For instance, Thanh and Canh (2020) investigate the impact of financial allocation on GDP growth. In this study, we leverage total factor productivity (TFP) and its components to assess budget allocation efficiency. To achieve this goal, we apply a technique that decomposes total factor productivity into several components, such as (1) technical efficiency, (2) allocative and scale efficiency, (3) other efficiency indices, as proposed by O'Donnell (2018), and supported by a large body of empirical evidence (Njuki, Bravo-Ureta, & O'Donnell, 2018; Thanh, Simioni, & Dao, 2019; Trinh Thanh *et al.*, 2023; Van, Van Dao, Hoang, & Van Hien, 2023). It should be noted that assessing productivity is a superior method for predicting a nation's development, as it provides a better reflection of quality (as opposed to quantity) and of the well-being of its citizens (Thanh *et al.*, 2019).

Although Vietnam's government operates within a hierarchical top-down administrative framework (where local governments are subordinate to the central government), the aim is to decentralize the fiscal budget concurrently. Indeed, local governments can retain certain revenue streams based on their negotiation abilities with local authorities and economic-social performances. The challenge of maintaining both centralized public administrative power and fiscal decentralization may thus entail ineffective public investment within the Vietnamese context. According to Article 32 of the State Budget Law of 2002, No. 01/2002/QH11, two main sources for local budgets are explicitly mentioned: (1) locally retained revenue, which refers to funds derived from local taxes and fees that are kept entirely by the local government, and (2) revenue-sharing, which pertains to funds that must be shared with the central government at a specified rate and commonly referred to as the "retention rate" (RER). In addition, a small portion of the budget is supplemented by (3) central government grants and (4) social mobilization (if available). This study evaluates the impact of changes in the retention rate (ΔRER) on TFP and its components. The core argument of the current paper is that reallocating budgets among localities (through retention rate) will, on the one hand, improve the "learning-by-doing" of provinces with high retention rates but on the other hand, reduce the allocative and scale efficiency of other provinces (low retention rate). Thus, this trade-off forms varying equilibria.

This paper makes three primary contributions. *First*, it has a significant contribution to the literature on fiscal policy settings and the influence of local productivity; Indeed, the study provides fresh evidence of the impact of retention rate changes on TFP and its components in Vietnam. The determination of the local budget retention rate directly impacts the annual expenditure budget, vividly reflecting the negotiations between central and local authorities based on political jurisdiction and the outcomes of socioeconomic development. Notably, Vietnam's status as a transitioning nation with a highly centralized budget allocation mechanism will provide valuable insights into budget allocation worldwide, while the decomposition approach to TFP allows verification of two effects of the retention rate on (1) interprovincial knowledge diffusion (as predicted by policy diffusion) and (2) the outcomes of underinvestment in public infrastructure (as predicted by public goods provision theory). *Second*, the study provides insights into the mechanisms of the nexus of increased budget spending, capital efficiency and, most importantly, attaining improvement in education. We also offer further insights into inefficient budget allocation agents in Vietnam, especially in large cities, which should alert scholars to explore this topic further in the future. *Third*, the study employs the two-system generalized method of moments (GMM) to handle the heterogeneity, dynamic potential endogeneity, and simultaneity of the nexus. Thus, in conjunction with studies considering the spatial effects among provinces (De Siano & D'uva, 2017; Pan, Li, Guo, & Pu, 2020), the finding further supplements the existing literature to achieve consistent coefficients in future analyses.

This investigation, therefore, contributes to policy formulation regarding efficient budget allocation in Vietnam and transitioning countries, with several key findings. (1) *First*, reducing the retention rate diminishes both allocation and scale efficiency because it leads to a drop in budget expenditure and educational attainment. (2) *Second*, with the status quo (i.e. no budget reallocation or $\Delta RER = 0$), the marginal benefit gained by provinces is significantly smaller than the loss in marginal cost by other provinces in the budget reallocation process. (3) *Third*, provinces/cities with higher economic efficiency are the main target of reducing the retention rate. The structure of the paper is as follows. [Section 2](#) is divided into two parts: [Sub-section 2.1](#) presents theories and empirical evidence on the impact of national financial allocation on economic efficiency, followed by [sub-section 2.2](#) which provides context on budget allocation specific to Vietnam. [Section 3](#) displays the econometric model and data requirements, while [Section 4](#) presents the main findings and discussion. [Section 5](#) proposes policy implications based on the discussion mentioned above.

2. Literature review

Budget allocation belongs to the fiscal decentralization concept, in which the fiscal settings affecting economic performance are broadly discussed (Baskaran & Feld, 2013; Martínez-Vázquez *et al.*, 2017). In the context of transitioning countries such as Vietnam and China, characterized by high levels of central public administrative power and relatively decentralized budgetary authority to localities, scholars often refer to fiscal decentralization as Chinese-style (or Vietnamese-style) (Bui *et al.*, 2023; Thanh & Canh, 2020; Yu & Liu, 2018). Following this research strand, many studies primarily examine their impact on economic growth rather than productivity (i.e. more crucial indicators for enhancing the well-being of populations). Considering fiscal decentralization's effects on total factor productivity (TFP) and its component indices (e.g. technological progress and technical efficiency), Yu and Liu (2018) explain several positive mechanisms: (1) significant improvement in local infrastructure, reduced transportation costs, and enhanced scale efficiency (Thanh & Canh, 2019; Thanh *et al.*, 2020), (2) effective promotion of enterprise innovation behavior (e.g. investment in science and technology); (3) increased regional openness and resource allocation efficiency (Bui *et al.*, 2023; Miller & Upadhyay, 2000), and (4)

acquisition of critical resources such as human capital for short-term economic growth through talent competition (Bui *et al.*, 2023; Martínez-Vázquez *et al.*, 2017).

Conversely, fiscal decentralization under Chinese/Vietnamese style could impede the efficiency of resource allocation through several channels: First, local governments, driven by the imperative to outcompete others in economic growth, neglect their resource endowments, geographic advantages, and industrial structure constraints, potentially resulting in misallocation of credit resources (Yu & Liu, 2018). Second, excessive competition may (1) lead to insufficient provision of public goods (Faguet, 2014) and (2) incentivize local leaders to prioritize short-term economic objectives over long-term growth strategies (Anh, Thái, & Thang, 2007; Gainsborough, 2007). Third, this form of fiscal decentralization might induce market segmentation to some extent; local governments, mindful of their fiscal revenue, may restrict the unrestricted flow of resources and products, particularly in regions lacking competitive advantages, thereby opting for market segmentation as a rational choice (Gianakis & McCue, 1999).

2.1 Budget allocation and economic performance

Public goods provision theory and policy diffusion theory are two prominent theoretical frameworks that underpin an understanding of government budget reallocation and its implications for economic development. The first theory posits that allocating additional financial resources for expenditure, when done rationally and efficiently, can lead to significant improvements in productivity through effective public investment (Musgrave, 1959; Samuelson, 1954; Tiebout, 1956). This theory underscores the importance of well-planned public expenditure in promoting economic growth and well-being. Conversely, a lack of public investment can exert pressure on economic development, particularly in terms of the efficient allocation of resources. The second theory complements this perspective by highlighting how increasing budgetary expenditure can facilitate knowledge transfer and learning among local governments. It postulates that when local governments have access to additional funds, they can learn from the successes and best practice of more advanced regions (Graham *et al.*, 2013; Shipan & Volden, 2008, 2012). This learning-by-doing process often involves investment in areas such as education and infrastructure, allowing regions to benefit from the experience of others.

The budget allocation approach in China offers an insightful parallel to the context of budget distribution in Vietnam. Since the 1970s, under the influence of the “ladder-step theory” (*tidu lilun*), China’s government has promoted the rapid development of certain regions, particularly the coastal region, with the aim that achievements will spill over to other areas (Wei, 2007, 2013). Historically, the Chinese government has concentrated budget resources on developing the eastern coastal regions (e.g. Guangdong). While this inequality came at a cost, many scholars argue that it has been justified as economic achievements have become more evident (Wei, 2013). This phenomenon is not unique to China, and evidence from various countries worldwide indicates a preference for investing heavily in larger, resource-efficient cities. For instance, cities like Manila (50%), Jakarta (52%), Mumbai (59%), Bangkok (60%), Kuala Lumpur (64%), Taipei (68%), Shanghai (72%), Beijing (76%), Seoul (78%), Singapore (91%), Hong Kong (93%), and Tokyo (94%) have budget retention rates well above 50 (Thanh, 2021).

Research by Thanh and Canh (2020) asserts that Vietnam’s decentralization policy is crucial in maintaining sustainable economic momentum. Fiscal decentralization has positively affected the Vietnamese economy through various channels. It has promoted accountability in local government, enhanced competition in the efficient use of local budgets, and improved allocation efficiency and income distribution by expanding the jurisdiction of local administrators. However, fierce competition among provinces can potentially lead to a

“race to the bottom”. This highlights the need for fiscal decentralization to be accompanied by improvement in quality of governance, interregional collaboration, and financial management at the local level (Anh *et al.*, 2007; Pincus, Anh, Nghia, Wilkinson, & Thanh, 2012; Schmitz, Tuan, Hang, & McCulloch, 2015).

Beyond theoretical and policy considerations, certain key factors have significance in the relationship between government expenditure and productivity. First and foremost, maintaining a high-quality institutional framework free from corruption is essential to ensure the effectiveness of government expenditure (Thanh & Canh, 2020). Moreover, budget allocation processes can reduce inequality by fostering private sector development and encouraging migration (Van Le & Tran, 2022; Van Le *et al.*, 2022). Additionally, it is crucial to recognize that public investment in infrastructure projects, such as transportation and education, requires both time and sufficient scale to exert a positive influence on economic outcomes (Alesina, Favero, & Giavazzi, 2015; Barro, 1981; Romer & Romer, 2010).

2.2 The Vietnamese context

Gainsborough (2003, 2007) asserts that the political structure in Vietnam closely mirrors that of China, where local government leaders are intricately interconnected through the party hierarchy. Similarly, the foundation of the Party system in Vietnam relies on sharing interests among these leaders while simultaneously pursuing major corruption cases to constrain provincial leaders who wield excessive power. This decentralization process, in turn, provides limited internal incentives for competitiveness. Moreover, competitiveness among provinces and cities in Vietnam is curtailed by the hukou system (known as “ho khau” in Vietnam), which discourages the free movement of labor among regions due to the discriminatory treatment of individuals lacking hukou status (Malesky & London, 2014).

However, Malesky (2008) highlights that decentralization has been gaining strength in Vietnam through measures such as limiting the rotation and promotion of cadre officials to other provinces. For example, approximately 70% of high-ranking provincial officials in Vietnam remain in their birthplace, in contrast to China, where only 18% do likewise. Pincus *et al.* (2012) further emphasize that the prolonged service of local leaders links their careers closely with local economic development, as opposed to central bureaucracy. More importantly, the Communist Party of Vietnam has 17 Politburo members compared to the 7 of the Chinese Communist Party, and the former, therefore, exert strong influence through their right of veto in the country’s most significant decisions.

The budgetary system of Vietnam is organized on two levels, the central and local budgets. The local budget system includes the provincial, district, and commune budgets. As stipulated by the 2002 Budget Law in Article 32, local financial resources are categorized into distinct components: (1) retained revenues, (2) shared revenues, (3) budget transfers/additional allocations (if any) from the central government, and (4) capital mobilization for infrastructure construction projects (if any). Retained revenues constitute local tax revenues and fees associated with land usage and local user fees/charges, and local governing bodies retain them in their entirety. Shared revenues represent a portion of tax revenues distributed between the central government and local authorities, and comprise value-added tax, corporate income tax, personal income tax, and excise tax on domestic goods. Thus, these shared revenues yield a retention rate ranging from 0 to 100%.

The provincial government’s decentralized revenue is expanded/narrowed, depending on the retained and shared budget rates, through a process of negotiation between the center and local government. Figure 1 demonstrates government expenditure for development and social relief per capita, showing increased attention to the Northern regions.

2.2.1 Mekong Delta region and Ho Chi Minh city. The majority of migrant workers in HCMC come from hometowns in the Mekong Delta region. The impact of the Covid-19

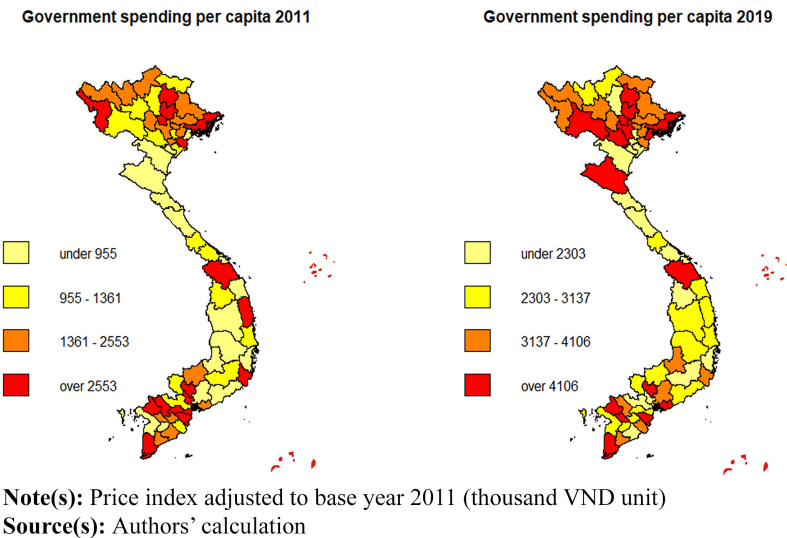


Figure 1.
Government spending
per capita during
2011–2019

epidemic has put heavy pressure on job opportunities for this group when they return to their hometown. This fact, combined with recent findings of severe economic and productivity decline in the Mekong Delta, raises questions about the recovery of growth in the region. Former Prime Minister Nguyen Xuan Phuc understood this problem and emphasized the provinces' need for transportation connections associated with the neighboring area (e.g. HCMC). The [Vietnam Chamber of Commerce and Industry \[VCCI\] \(2020\)](#) concurs that: (1) the Mekong Delta has not had a pillar of economic development, so it is not easy to build a regional structure with connectivity; (2) most of the economic links (i.e. labor and production markets, and places of consumption) are associated with Ho Chi Minh City; (3) meanwhile, the transport connections between HCMC and this region are still loose and subject to potential development. In addition, due to the division of river topography, the Mekong Delta's localities face difficulty connecting with each other. Therefore, for the economy of the Mekong Delta to recover and to improve productivity, focused investment and the strengthening of critical links (e.g. to HCMC) will be necessary.

3. Methodology and data

3.1 Total factor productivity (TFP)

This study decomposes the total factor productivity into several components, facilitating an examination of the channels through which fiscal settings influence the economy. Specifically, we investigate how changes in the retention rates of provinces/cities impact (1) technical efficiency, (2) technological progress, and (3) allocative and scale efficiency. Leveraging the advanced technique proposed by [O'Donnell \(2018\)](#) compared to its peer, Total Factor Productivity (TFP) is decomposed into (1) Output-oriented Technological Index (OTI), (2) Output-oriented Environmental Index (OEI), (3) Output-oriented Scale Efficiency Index (OSEI), (4) Output-oriented Technical Efficiency Index (OTEI) and (5) Statistical Noise Index (SNI). [Appendix 1](#) details the disintegration method, while the meaning and sources of each component are presented in [Table 1](#).

Components	Proxies	Explanation	Reference(s)
Output-oriented technological index (OTI)	Linear change over time (year dummies)	The OTI quantifies shifts in technological advancement, broader policy alterations, and energy-related aspects	Njuki et al. (2018) , O'Donnell (2018) , O'Donnell (2016) , Van et al. (2023)
Output-oriented environmental index (OEI)	We use the change (zj) in two variables, average temperature and average precipitation	OEI consists of external environmental variables that encompass climate-related elements, such as fluctuations in weather conditions, average temperatures, and precipitation levels	Njuki et al. (2018)
Output-oriented scale efficiency index (OSEI)	We use three conventional inputs: labor, land, and total capital in the economy	OSEI represents the effectiveness of utilizing inputs, including labor, capital, and natural resources, like land area. In economic terms, this is a combination of allocative and scale efficiency	Njuki et al. (2018) , Thanh et al. (2019) , Van et al. (2023)
Output-oriented technical efficiency index (OTEI)	This component is calculated using uit as a non-negative technical efficiency effect, separated from the error term (compared to the OLS estimator)	OTEI is well known as a “learning-by-doing” ability (Farrell, 1957). For details, see Equation (6)	O'Donnell (2018)
Statistical Noise Index (SNI)	This is calculated from vit accounts for stochastic error	SNI captures the change in unobserved factors in the model (e.g. economic structure). For details, see Equation (6)	O'Donnell (2018)
TECH = OTEI × OSEI	= OTEI × OSEI	TECH reflects the efficiency of the local economy after ruling out all unobservable factors and time trends	Recommended by the authors

Source(s): Authors'

Table 1.
Components of TFPI:
proxies, explanations
and references

3.2 Econometric model

3.2.1 Basic setup. One of the key considerations pertains to the pre-existing adaptation of local policies to changes in the retention rate, given that retention rate changes may be anticipated. Thus localities may have already adapted their policies accordingly. As a result, the level effects of the retention rate on TFP change are likely to be negligible. Consequently, this study focuses on the impact of retention rate changes on TFPI and its components for several reasons: (1) *First*, this approach enables a more nuanced assessment of the “unexpectedness” of budget allocation policies that differ between local and central authorities, given that negotiating budget retention necessitates a negotiation process influenced by various factors beyond the scope of this paper’s analysis. (2) *Second*, significant variations in the retention rate partially mitigate the likelihood of local adaptation prior to changes in budget allocation

policies from the central government. In light of the arguments above, coupled with empirical research (Thanh & Canh, 2019, 2020), the experimental model takes the following form:

$$Y_{it} = \alpha + \beta_0 \cdot \Delta RER_{it} + \sum_{m=1}^m \delta_m \cdot Control_{mit} + \lambda t + \theta_i + \varepsilon_{it} \quad (1)$$

where *dependent variables* are TFPI and its components, utilizing the decomposition methodology discussed in detail in sub-section 3.1. ΔRER denotes the first differencing of retention rate. *Control variables* are sourced from previous references, such as literacy rates, labor quality rates (Griliches, 2000), urbanization rates, poverty rate (Ivanic & Martin, 2018), foreign direct investment (FDI) inflows (Liu, Agbola, & Dzator, 2016), the provincial competitiveness index (PCI) (Hiep, Trung, & Van Chien, 2022), the industrial level (Kim, 2002), private sector development, and other factors (Fan, Hazell, & Thorat, 2000; Ruttan, 2002). λ represents time trends ($t = 1, 2, \dots, 8$, spanning from 2012 to 2019), while province fixed effects are accounted for by $\theta(i = 1, 2, \dots, 63 \text{ provinces/cities})$, and ε signifies the error term.

3.2.2 Endogeneity. Besides local adaptability toward retention rate policy, the endogeneity issue, entailing coefficients in Model (1) to biases and inconsistencies, may arise from two primary sources. *First* is simultaneity, wherein a province/city with high productivity may be treated as a target for redistributing its budget to others. Put differently, the central government tends to increase the retention rate or, at least, not reduce the retention rate for provinces with lower productivity. This aspect is underscored in the 2002 State Budget Law to ensure “balance” in the revenue and expenditure of each province/city. *Second* is the potential dynamic endogeneity issue, where past productivity influences the current retention rate (RER). In such cases, the fixed-effect estimate of the current RER on TFPI and its components may exhibit a negative (or positive) bias (Wintoki, Linck, & Netter, 2012).

To address the endogeneity issue, this study focuses on the exogenous factors that affect local productivity solely through changes in RER channels. Accordingly, identifying factors as truly exogenous can be challenging, since economic variables tend to exhibit some correlation (i.e. between local productivity and budget allocation). Fortunately, Vietnam has a rich historical legacy in shaping the culture of its indigenous regions, particularly regarding budget allocation behaviors. It is worth emphasizing that the literature underscoring the exogenous nature of historical conditions on government conduct is well-documented and widely recognized (Acemoglu, Johnson, & Robinson, 2001; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1999).

In the Vietnamese context, there are at least two additional reasons to assess the impact of regional historical factors on TFPI through the budget allocation channel. *First*, during the colonial period, Vietnam was divided into various regional administrative units with budgetary systems established from as early as 1902 (Doumer, 1905). The colonial administration in Vietnam was interwoven with feudal elements, creating numerous “small colonies” within Vietnam, as noted by Cooper (2001, p. 2): “the system was a hotch-potch of traditional Vietnamese institutions, on which were superimposed modern French ones.” It is worth noting that cultural diversity among regions (e.g. the Cham people in the Central Highlands) led to varying budgetary mechanisms due to the differing behavioral tendencies of different ethnic groups.

Second, the division of North and South Vietnam following the Geneva Agreement (1954) resulted in two distinct economic systems with contrasting budgetary philosophies. North Vietnam adopted centralized planning and state ownership of land and resources, while South Vietnam maintained a capitalist economic system with a market-oriented approach, largely preserving private land ownership. Also, the central government is located in Hanoi (Northern region), which may have conferred advantages in budget negotiations among regions in the North compared to the South. This partly explains why government spending per capita in provinces/cities in the North tended to be higher than in the South.

Based on the discussion above, we identify the average retention rate typical for each regional location (j) as an appropriate instrumental variable for our model. The logic behind using an instrumental variable that represents the regional average is widely employed in various studies, as exemplified by Fisman and Svensson (2007). It is important to note that this instrument is a function of the inherent characteristics specific to that regional location, determining the extent to which a local government can retain a certain level of the retention rate. In mathematical terms, this can be expressed as follows:

$$RER_{ijt} = RER_{jt} + \eta_{ijt} \quad (2)$$

where RER_{jt} and η_{ijt} denote the mean retention rate characteristic of the regional location denoted as j and the idiosyncratic component, respectively. Our assumption is that the region-specific portion of the retention rate is influenced by the underlying geopolitical and historical factors of the local government. Consequently, this component is expected to be exogenous to the provinces/cities, given the inclusion of other control factors in Model (1), and therefore uncorrelated with variables unaccounted for. Notably, to address the issue of potential dynamic endogeneity, the current study utilizes the two-step generalized method of moments (GMM) estimator proposed initially by Blundell and Bond (1998) and applied in prior empirical studies (Van et al., 2023; Van Le & Tran, 2022; Van Le et al., 2022). This estimator effectively takes into account sources of heterogeneity, potential dynamic endogeneity, and simultaneity by incorporating lagged variables as instruments. The change in the retention rate ratio outlined in Equation (1) is determined from the fitted values derived from the initial-stage regression equation, as follows:

$$\Delta RER_{ijt} = f(\Delta RER_{jt}, \Delta RER_{ijt-s}, Control_{ijkt}) \quad (1')$$

3.3 Data

The study utilizes data from three primary sources. *First*, we collect economic and social variables from 63 provinces/cities from 2002 to 2019 from the general statistical yearbook. For the first step, for the computation of TFPI and its components (i.e. Equation [6]), data requirements are outlined in Table 1 and presented in detail in Appendix 2. Since capital stock is not available in existing datasets, we applied the formula proposed by Schreyer (2009) to estimate capital stock (K) using investment data, as follows:

$$K_t = (1 - \delta) \times K_{t-1} + I_t \quad (10)$$

where K_t and I_t represent capital stock and investment in year t , respectively. The initial-year capital stock (K_0) in the base year, 2002, is calculated as follows: $K_0 = I_0 / (\delta + \theta)$, where θ is the average annual growth rate over the research period, calculated as $\left(\frac{GDP_t}{GDP_0}\right)^{\frac{1}{n}} - 1 \times 100\%$, and δ represents the depreciation rate [1].

Data utilization in the first phase (i.e. measuring TFPI and its components) is subject to two important considerations. First, measurement errors, such as underestimating labor data, can introduce bias into the estimates. Second, Vietnam's shadow economy is substantial, and its potential economic growth rate falls behind its actual growth rate. Thus, we acknowledge that the assessment of productivity changes in this context only considers the official sector. For the second step (i.e. estimating the impact of changes in retention rate on productivity), other socioeconomic data are collected, based on previous studies and summarized in Appendix 2.

The *second* data source is the PCI Vietnam, accessible at <https://pcivietnam.vn/>. This source serves as a comprehensive reflection of the private business community's perception of the business environment across various provinces and cities in Vietnam. This dataset has

been available since 2006, with the most recent data dating to 2022. The *third* data source pertains to various budget-related indicators, including retention rates and supplementary budget ratios, which were compiled annually by the [Ministry of Finance \[MOF\] \(2021\)](#). This dataset covers the period from 2012 to 2019. Thus, we are left with a final balanced panel dataset from 2012 to 2019. It is important to note that to ensure homogeneity in productivity measurements and demand-related indices, data was not collected during and after COVID-19. As previously discussed regarding data limitations, Vietnam has a sizable informal economy, where the shift of businesses between formal and informal sector data during the COVID-19 period could be more pronounced due to the avoidance of government regulations concerning costly insurance for employees.

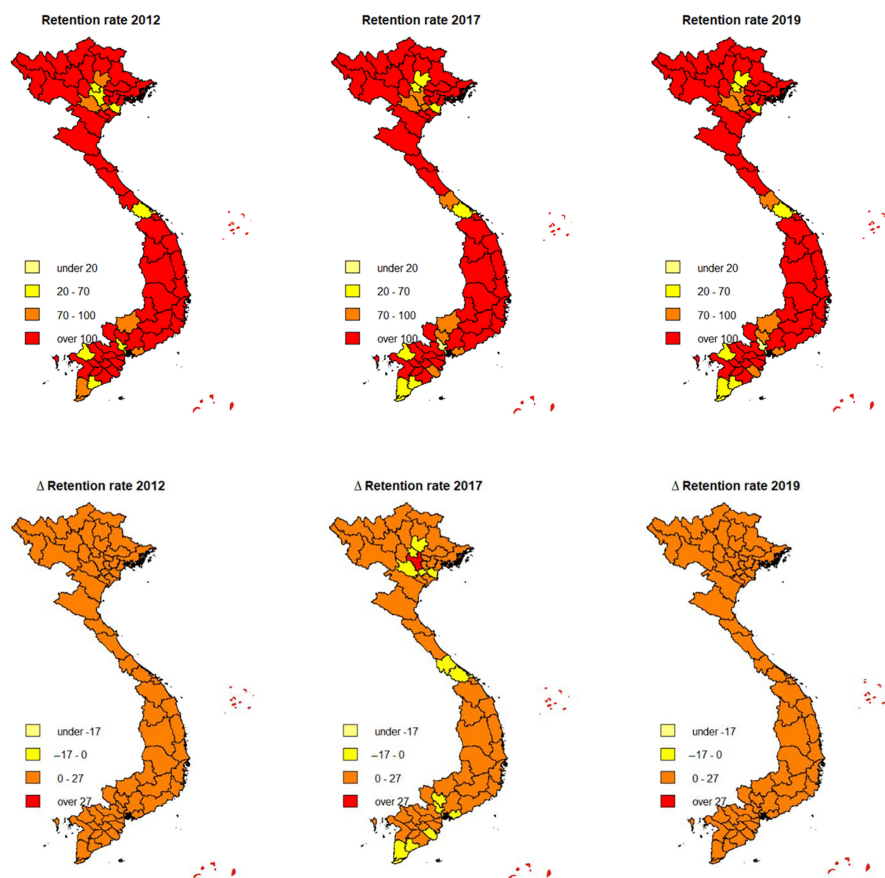
4. Results and discussion

4.1 Descriptive statistics

The change in a locality's retention rate unfolds rather slowly over time. Accordingly, the central government gradually reduces the rate for localities, particularly provinces/cities with ample budget revenue sources, in order to provide subsidies or additional support to regions facing budget deficits. Regions such as the Northern Midlands and Mountainous Area, the Central Highlands, and the North Central Coast are often characterized by high budget deficits, primarily due to limited tax from the private sector, while other sources are less significant. The retention rates for these provinces remained relatively unchanged throughout the period.

In contrast, the Mekong Delta (including Hanoi) and the Southeast region (including Ho Chi Minh City) yielded abundant budget revenues, with recorded reductions ranging from 1% to 17%. It is worth noting that the total national budget revenue averages approximately 20% of GDP in the same year, with nearly 50% of revenue coming from taxes paid by various business sectors (i.e. state-owned enterprises, domestic private enterprises, and foreign-invested enterprises) ([General Statistical Office \[GSO\], 2023](#)). Notably, Ho Chi Minh City and Hanoi have the lowest budget retention rates in the country, estimated at approximately 18% and 35%, respectively (as of 2023). From 2012 to 2019, their contributions to the national budget averaged around 20% and 17%, respectively. As of 2021, their populations comprised approximately 9.2 and 8.3 million people, respectively, accounting for approximately 9.3% and 8.4% of the total national population ([General Statistical Office \[GSO\], 2023](#)). In terms of economic scale, Ho Chi Minh City and Hanoi led the country in 2021, contributing approximately 22% and 17% of the national GDP, while their total capital estimates in 2019 were 2,580.9 and 2,400 trillion VND, respectively (compared to the average for the rest of the country of 289.3 trillion VND). This implies that more efficient provinces tend to have higher budget retention rates. [Figure 2](#) presents the evolution of the retention rates for all 63 provinces/cities of Vietnam from 2012 to 2019 (see more in [Appendix 3](#)).

To illustrate the relationship between changes in retention rates and productivity, we examined a Pen's Parade graph. Accordingly, [Figure 3](#) compares the OSEI efficiency indices at the same percentile level between two groups: (1) the first group with increased retention rates and (2) the second group with decreased retention rates. For instance, a province with the lowest OSEI at the 1st percentile in group 1 is compared to a province with the lowest OSEI at the 1st percentile in group 2, and likewise for provinces with the highest OSEI at the 100th percentile in both groups. The results show that at each corresponding percentile level, the group with increased retention rates has higher OSEI than those with decreased rates. In economic terms, OSEI can be viewed as allocation and scale efficiency in using inputs (i.e. labor, land, and total capital). Furthermore, the linear relationship between changes in retention rates and TFPI and its components is also illustrated in [Appendix 4](#).



Source(s): Authors'

Figure 2.
Evolution of retention
rate in Vietnam,
2012–2019

4.2 Empirical results

Table 2 presents the estimation results of the nexus using ordinary least squares (OLS) and a fixed-effects model (FEM) for the basic setup. The full results of Table 2 are provided in Appendix 5. Regarding estimation effectiveness, when time-invariant unobservable factors, such as culture, geography, and history, influence productivity, the fixed-effects model (FEM) provides more robust estimates (i.e. unbiased and consistent) compared to OLS. The results show that the decrease (increase) in retention rate changes have no statistically significant effects on TFPI (columns [1] and [2]) and OTEI (columns [5] and [6]). This observation aligns with the empirical findings of Thanh and Canh (2020), Thanh *et al.* (2020), suggesting that the presence of government spending may not enhance the local economy in cases where institutional quality is low (e.g. due to corruption or allocating budgets to recurrent expenses rather than development). Notably, provinces with a higher retention rate are typically budget-deficient regions with inefficient institutional quality, located primarily in mountainous areas in the North and Central Highlands.

Additionally, at least two reasons explain the statistical insignificance of the retention rate's impact: (1) the slow and, in some instances, absent variations in the retention rate

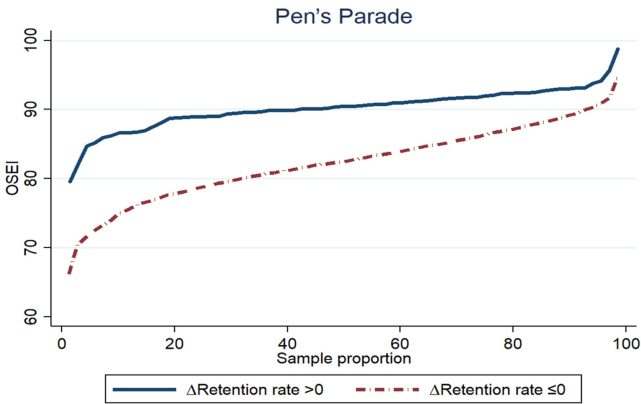


Figure 3.
Scale efficiency and
allocation efficiency of
teams, classified by
change in retention

Note(s): The sample used to draw this figure eliminated all provinces/cities that did not change in retention rate from 2012 to 2019, mainly in the Northern mountainous areas and Central Highlands

Source(s): Authors'

throughout the study period and (2) the adaptive capacity of provinces/cities in response. Furthermore, although macroeconomic fluctuations during the 2012–2019 period remained relatively stable, it cannot be denied that significant policy changes (such as privatization) could significantly influence the economic structure, thereby resulting in exogenous productivity shocks.

Columns (4) and (8) in Table 2 demonstrate the statistically significant positive effects of ΔRER on $OSEI$ (reflecting scale and allocation efficiency) and $TECH$ (reflecting efficiency after eliminating all noise and time trends). These findings are consistent with classical public investment theories (Barro, 1981; Samuelson, 1954) and empirical observations in Vietnam (Thanh *et al.*, 2020). Accordingly, increasing public investment through an increased retention rate gives support for (1) enhancing public investment and (2) catalyzing to stimulate private sector growth. In practice, the rapid congestion of public hospitals in Ho Chi Minh City during the COVID-19 period clearly illustrates the need for substantial infrastructure investment in areas such as (1) transportation and (2) healthcare, which are consistently prioritized. The rapidly growing traffic congestion in major cities further emphasizes the inadequacy of transportation development in keeping pace with population growth in Hanoi (approximately 2.5%) and Ho Chi Minh City (3%) annually. This implies that retaining budgets can serve as a valuable expenditure for resource allocation efficiency.

One common discussion regarding the effectiveness of public investment for economic outcomes is the time lag, especially for large public projects (Barro, 1981). Thus, we explore these arguments in Table 3 and the full results are given in Appendix 6. The results align with the theoretical evidence. Interestingly, the impact of the lag variable is greater in the second year than in the first year, which suggests differences in public investment management compared to the private sector, as framed by Meier and O'Toole Jr (2011). Besides, the positive impact of implemented Foreign Direct Investment (FDI) on TFPI (Column [1]) and OTEI (Column [5]) also partly underscores the role of foreign capital in Vietnam's productivity growth during the 2010–2019 period, consistent with studies by Ni, Spatareanu, Manole, Otsuki, and Yamada (2017). However, the results lack robustness when controlling for province-fixed effects (Columns [2] and [6]). It is worth noting that the setup of this study assumes the absence of spatial spillover effects of FDI.

Dependent variables	TFPI		OSEI		OTEI		TECH = OSEI × OTEI	
	Total factor productivity	Allocative efficiency and scale efficiency in the use of inputs (i.e. labor, capital, land)	Technical efficiency, known as learning-by-doing, denotes the effective dissemination of achievements between provinces/cities	Effective after ruling out all environmental shocks and other stochastic factors				
Meaning	OLS (1)	OLS (3)	OLS (5)	OLS (7)	OLS (6)	OLS (8)	OLS (7)	OLS (8)
Estimators	FEM (2)	FEM (4)	FEM (6)	FEM (8)	FEM (6)	FEM (8)	FEM (7)	FEM (8)
Δ Retention rate (RER)	−0.786 (1.610)	−0.093 (0.300)	0.292 (0.189)	0.076** (0.030)	−0.697 (1.040)	−0.100 (0.161)	0.630 (0.411)	0.185** (0.080)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	57.747 (170.410)	−84.322 (103.170)	129.475*** (23.415)	49.544*** (10.397)	13.891 (105.983)	30.567 (55.314)	227.960*** (47.892)	51.382* (27.357)
Observations	504	504	504	504	504	504	504	504
R-squared	0.173	0.589	0.305	0.830	0.097	0.059	0.691	0.957
Number of years	8	8	8	8	8	8	8	8
Number of provinces/cities	63	63	63	63	63	63	63	63
Note(s): Multidimensional poverty assesses various facets of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant considerations. Private sector development is computed as the total number of workers in both domestic and foreign-owned private enterprises relative to the total labor force. Data for this analysis was collected across 63 provinces/cities from 2012 to 2019. Robust standard errors are reported in parentheses, with significance levels denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$								
Source(s): Authors'								

Table 2.
Δ retention rate on
TFPI and its
components

Table 3.
Lagged effects of Δ
retention rate on TFPI
and its components

Dependent variables	TFPI		OSEI		OTEI		TECH = OSEI $\times$ OTEI	
	Total factor productivity	Allocative efficiency and scale efficiency in the use of inputs (i.e. labor, capital, land)	Technical efficiency, known as learning-by-doing, denotes the effective dissemination of achievements between provinces/cities	Effective after ruling out all environmental shocks and other stochastic factors				
Meaning	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	FEM (8)
Estimators	FEM (1)	FEM (2)	FEM (3)	FEM (4)	FEM (5)	FEM (6)	FEM (7)	FEM (8)
One-year lagged Δ RER	0.230 (0.200)		0.047** (0.020)		0.066 (0.107)		0.118** (0.053)	
Two-year lagged Δ RER		-0.006 (0.198)		0.060*** (0.020)		-0.103 (0.106)		0.177*** (0.052)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-65.732 (104.140)	-83.323 (103.274)	52.478*** (10.522)	47.314*** (10.373)	36.561 (55.915)	34.136 (55.327)	58.828** (27.671)	45.139* (27.190)
Observations	504	504	504	504	504	504	504	504
R-squared	0.590	0.589	0.829	0.831	0.059	0.060	0.957	0.957
Number of provinces/cities	63	63	63	63	63	63	63	63
Note(s): Multidimensional poverty assesses various facets of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant considerations. Private sector development is computed as the total number of workers in both domestic and foreign-owned private enterprises relative to the total labor force. Data for this analysis was collected across 63 provinces/cities from 2012 to 2019. Robust standard errors are reported in parentheses, with significance levels denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$								
Source(s): Authors'								

Endogeneity may cause coefficients in [Tables 3 and 4](#) to be biased and inconsistent. Thus, in [Table 4](#), we investigate this nexus by employing the two-system GMM estimator following the discussion in [subsection 3.2](#). Generalized method of moments (GMM), on the one hand, can address heterogeneity, potential dynamics endogeneity, and simultaneity ([Wintoki et al., 2012](#)), but on the other hand, may generate spurious results when instrumental variables are unreliable (i.e. relevant and exclusion assumptions) ([Van Le et al., 2022](#)). Thus, in addition to theoretical discussions in [subsection 3.2](#), we perform technical tests to ensure the reliability of the instrumental variable: (1), (2) AR(1) and AR(2) serial correlation tests, (3) the Hansen test of over-identification, and (4) the difference-in-Hansen exogeneity tests. Rejecting the null hypothesis of no first-order serial correlation in first differences (AR[1]), while failing to reject the null hypothesis of (1), no higher-order serial correlation in first differences (AR[2]), (2) the Hansen test of over-identification, and (3) the difference-in-Hansen exogeneity tests, confirm the technical appropriateness of the instrumental variable.

Furthermore, the study conducts robustness checks by controlling for additional variables: (1) the local labor quality ratio, (2) government spending on investment and development (R&D), (3) economic scale, and (4) total agricultural land [columns (2 and 4)], affirming the robustness of the estimates.

To validate the theoretical mechanisms' explanation, we present results in [Table 5](#) and the full results are presented in [Appendix 7](#). In columns [1]–[3], we replace the current dependent variable with the GRDP per capita stock index, reflecting the efficiency of a province's capital utilization. Accordingly, the TFPI index and its components may yield spurious results due to its complexity and opacity. Therefore, considering the change in the retention rate's impact on the efficiency of using one unit of capital can provide a more intuitive interpretation.

Dependent variables	OSEI		$TECH = OSEI \times OTEI$	
	Allocative efficiency and scale efficiency in the use of inputs (i.e. labor, capital, land)		Effective after ruling out all environmental shocks and other stochastic factors	
Meaning	2sys-GMM	2sys-GMM	2sys-GMM	2sys-GMM
Estimator	(1)	(2)	(3)	(4)
Δ Retention rate (RER)	0.310** (0.151)	0.232* (0.127)	0.592* (0.316)	0.538* (0.313)
Covariates 1	Yes	Yes	Yes	Yes
Covariates 2	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes
Constant	142.952** (64.879)	110.806** (53.293)	241.791** (119.245)	165.466* (84.404)
Observations	504	504	504	504
Number of provinces/cities	63	63	63	63
Number of years	8	8	8	8
AR(1)	0.052	0.073	0.095	0.095
AR(2)	0.174	0.141	0.304	0.250
Hansen test of overidentification (<i>p</i> -value)	1.000	1.000	1.000	1.000
Difference-in-Hansen tests of exogeneity tests (<i>p</i> -value)	0.292	1.000	1.000	0.357

Note(s): Covariates 1 encompass all control variables specified in the initial design. Covariates 2 comprise additional control variables, namely (1) the local labor quality ratio, (2) government spending on investment and development (R&D), (3) economic scale control via GDP per capita, and (4) total agricultural land

Source(s): Authors'

Table 4.
 Δ retention rate on OSEI and TECH: two-step system-GMM

Table 5.
Robustness check:
Mechanism tests

	(1)	GRDP/capital stock FEM (2)	(3)	(4)	Budget spending FEM (5)	(6)	(7)	Literacy FEM (8)	(9)
Δ Retention rate (RER)	0.004* (0.003)			0.008*** (0.002)			0.000* (0.000)		
One-year lagged Δ RER		0.004** (0.002)			−0.001 (0.001)			0.001*** (0.000)	
Two-year lagged Δ RER			0.004** (0.002)			0.003 (0.002)			0.000 (0.000)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.922*** (0.926)	10.180*** (0.935)	9.788*** (0.926)	0.856 (0.610)	0.949 (0.624)	0.858 (0.625)	0.877*** (0.062)	0.892*** (0.061)	0.873*** (0.063)
Observations	504	504	504	441	441	441	504	504	504
R-squared	0.235	0.239	0.238	0.510	0.488	0.491	0.169	0.195	0.165
Number of provinces/cities	63	63	63	63	63	63	63	63	63
Note(s): Multidimensional poverty assesses various facets of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant considerations. Private sector development is computed as the total number of workers in both domestic and foreign-owned private enterprises relative to the total labor force. Data for this analysis was collected across 63 provinces/cities from 2012 to 2019. Robust standard errors are reported in parentheses, with significance levels denoted as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$									
Source(s): Authors'									

Columns [4]–[6] examine whether increasing (decreasing) retention rate changes genuinely increases (decreases) local budget expenditure. Columns [7]–[9] analyze this impact on educational attainment. Based on the previous estimates in [Tables 2 and 3](#), it is worth noting that educational attainment is considered a factor in improving national resource efficiency. The results in [Table 5](#) align with expectations.

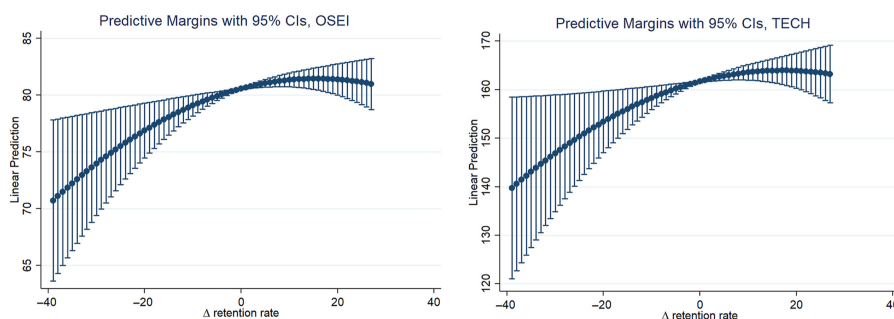
Last but not least, in [Figure 4](#) the study examines the marginal effects of the relationship at different levels of change in the retention rate (detailed regression results are presented in [Appendix 8](#)). The results suggest two crucial implications. *First*, with the status quo ($\Delta RER = 0$), the marginal benefit of increasing the retention rate for a province is smaller than the marginal cost to others that suffer from decreasing retention rates. This finding suggests that (1) reallocating budgets incurs costs, and (2) the aggregate marginal effects are less than 0.

Second, the marginal cost of provinces with more rapidly decreasing retention rates rises quickly, showing a steep gradient in [Figure 4](#) at the left estimation points, while the marginal benefit for provinces with rapidly increasing retention rates (up to 17%) tends to reverse the impact. This is consistent with conclusions regarding Vietnam's budget incentive mechanism, which currently operates under the premise of “do less, get more,” where underperformers receive more central government money through the budget allocation process (see more in [Appendix 9](#)).

4.3 Discussion

The empirical findings of this study highlight three notable points. *First*, the rapid decline in the retention rate has been observed predominantly in economically developed provinces/cities, such as Ho Chi Minh City, Hanoi, and Binh Duong. *Second*, the decrease (increase) in the local budget retention rate has a causally detrimental effect on allocation and scale efficiency (OSEI and TECH). This is attributed to the augmentation of local revenue facilitated by the mechanism of fiscal decentralization, which has led to (1) notable enhancements in local infrastructure, (2) heightened regional connectivity and resource allocation, and (3) facilitated acquisition of crucial resources, such as human capital (e.g. literacy), conducive to economic advancement ([Bui et al., 2023](#); [Martínez-Vázquez et al., 2017](#); [Miller & Upadhyay, 2000](#)). *Third*, with the status quo ($\Delta RER = 0$), the marginal benefit of increasing the retention rate for one province is smaller than the marginal cost of reducing the retention rate for another province ([Figure 4](#)). In other words, there are significant costs in redistributing budgets among localities.

An equitable budget allocation mechanism (i.e. treating provinces and cities equally) may have serious consequences when considering their scales. Indeed, HCMC's economy is the most dynamic in the country, as indicated by several metrics. It contributes 22% of GDP,



Source(s): Authors'

Figure 4.
Marginal effects of
 ΔRER on OSEI
and TECH

accounts for more than a quarter of the national budget, and has a workforce nearly 1.2 times that of Hanoi (General Statistical Office [GSO], 2023). These indicators also imply high and rapidly increasing depreciation (e.g. for infrastructure updates, security systems, and public services), necessitating substantial capital for reinvestment and the strengthening of the social security system, as Barro (1981) predicted. Moreover, the “reagent” of the Covid-19 pandemic has exposed the vulnerability of Ho Chi Minh City’s investment in employee welfare. Shortages in food subsidies, trickle-down financial support, and prolonged job losses have made Ho Chi Minh a disaster for migrant workers (Petty & Jones, 2021). This disruption immediately affects business operations, leads to a loss of competitive advantage, and can significantly reduce enterprise productivity in the long term (Malesky, 2020).

So, what constitutes an effective public investment allocation mechanism? And, how much of their budget should Ho Chi Minh and Hanoi allocate to other localities, given that these two cities account for approximately 40% of GDP, 20% of the population, and contribute up to 40% of the national budget? Returning to the theories of public investment, it is evident that efficient public investment projects must be on a sufficiently large scale at a particular time (Barro, 1981). Mazzucato (2015) adds that the government must be pioneering in creating innovative platforms for the private sector. Interestingly, Yu and Liu (2018) provide insight into a broader context where, given the framework of fiscal decentralization alongside political centralization, local governments may engage in intense investment competitions to bolster economic growth, often disregarding their inherent resources, geographic location, and industrial structure constraints. This behavior could result in a misalignment of credit resources. Additionally, local governments, mindful of local fiscal revenue, might curtail the unrestricted flow of resources and goods, particularly in areas lacking competitive advantages, thereby rationalizing market segmentation as a strategic choice (Gianakis & McCue, 1999).

Regarding real-world observations, budget allocation in China (Wei, 2013) and some countries listed in the literature (Thanh, 2021) suggests that countries either grant considerable autonomy to big cities in budget usage or accept short-term inequality to focus resources on other regions. However, discussions among parliamentarians in Vietnam – concerning decisions about the budget retention rate between localities – with equal weight given to the votes of all 63 provinces/cities, overly emphasize the inequality between provinces/cities but pay little attention to efficiency. Notably, inequality within provinces/cities is not significantly more pronounced in practice than inequality between provinces/cities, given that (1) migration among provinces has become increasingly practicable and (2), the difference has not been substantial since 2014 (Van Le & Tran, 2022). However, we acknowledge that it is harder to reach a compromise in political decisions, due to the structure of the national parliament and unexplored linkages (e.g. values of equality and the Confucian ethos or nationalist sentiment stemming from Vietnam’s lengthy wars).

5. Conclusion and policy implication

Employing the two-system GMM estimator, this study has aimed to assess the causal impact of changes in the retention rate (ΔRER) on total factor productivity (TFP) and its components. The effects are seen in improving capital efficiency, increased budget spending, and enhanced educational attainment. Drawing on data from 2012 to 2019 across the 63 provinces and cities of Vietnam, our findings underscore the following key points. *First*, local budget retention rates emerge as a crucial channel for enhancing public investment in improving scale and allocation efficiency. *Second*, the reallocation of budgets between localities and from the central to local levels involves certain costs. Notably, provinces and cities with solid economic performance tend to experience a reduction in their retention rates, thus creating a perverse incentive for growth (i.e. “do less, gain more”).

We acknowledge that changing the current budget allocation system is not practicable in the short term, due primarily to cultural and historical factors. Thus, we propose a more prudent policy approach for the near future, focusing on improving policy predictability. In this regard, abrupt, rapid reductions in the retention rate incur more significant costs than gradual reductions (as depicted in Figure 3, where the slope steepens when the reduction in the retention rate occurs rapidly). In other words, the implementation of budget policies can be slowed down with a more precise timeline. For less affluent localities, the question is whether they want equal slices of a small pie or a smaller portion of a larger pie.

Note

1. Available at: <https://www.rug.nl/ggdc/productivity/pwt/?lang=en>

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Appendix

The supplementary material for this article can be found online.

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