

Enhancing Quality and Efficiency of Public Investment in Vietnam up to 2020

DIEP GIA LUAT

University of Economics HCMC – gialuat@ueh.edu.vn

DANG VAN CUONG

University of Economics HCMC – dangcuong@ueh.edu.vn

BUI DUY TUNG

University of Economics HCMC – tungbd@ueh.edu.vn

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ABSTRACT

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Based on the theories on quality and efficiency of public investment and on the ground of a new economic model, this study carries out an analytical assessment of the management of Vietnam's public investment, with the primary aims to detect limitations on management, carry evaluation of the investment, and propose solutions to improving its quality and efficiency. The findings indicate that both the public investment quality and efficiency of Vietnam reveal certain limitations, and no evidence can be found for the effectiveness of investment expenditures in short terms, although a long-term relation exists between the public investment and economic growth. A few comprehensive solutions to investment enhancement until 2020 are as follows: (i) Rationally adjusting investment structures and portfolios, (ii) Improving institutional environment; (iii) Controlling investment efficiency; and (iv) Modernizing the monitoring system for the public investment.

1. Introduction

In Vietnam public investment plays a significant role in total social investment. Recent years saw its positive contribution in domestic socioeconomic development along with its beneficial effects, such as on attracting foreign capital investment, promoting rapid economic growth, enhancing living standards of citizens, stabilizing macroeconomic performance, and significantly facilitating poverty reduction. It also contributes to speeding up economic restructuring, creating jobs, and positioning and strengthening the country's economy in its association with regional and world economic systems. However, some discrepancy arises in assessing the quality and efficiency of public investment. Barro (1990) based his research on endogenous growth models to consider government spending, finding that under specific circumstances productive government spending maximizes the growth and welfare. Mandl et al. (2008) suggested that effective assessment focuses on evaluating the success in utilizing resources to achieve the goals. Transmission mechanisms are investments in education, research and development to raise human capital, and new technological advancements, thereby increasing labor productivity and production accordingly (Afonso et al., 2005). Assessing public investment quality also involves measuring its efficiency (Mihaiu et al., 2010). Adopting a theoretical framework to adequately highlight the issues, we attempt to:

- (i) Identify the theoretical bases toward public investment efficiency;
- (ii) Assess the effectiveness of Vietnam's public investment between 2005 and 2012;
- (iii) Empirically examine and/or verify certain contributory factors to reduced efficiency; and
- (iv) Propose solutions to reforming institutional and legal frameworks and improving the current status of public investment.

To address the above issues, this study is conducted using statistical data and statements on assessing public investment efficiency besides empirical analyses of public investment and economic growth in an effort to bridge the gap between theoretical and practical concerns over the adoption and implementation of public investment policy.

2. Theoretical bases of quality and efficiency of public investment

2.1. Theoretical framework for assessing quality and efficiency of public investment

Concerning the theoretical investigation into public finance and economic growth, Afonso et al. (2005) proposed four key channels, namely: (i) institutional framework (standard definitions of law and regulations); (ii) tax system; (iii) macroeconomic stabilization policies; and (iv) public expenditures (such as investments in education, healthcare services, infrastructure, telecommunication, etc.). A number of fiscal policies are believed to be resulting in long-term growth, which, as regards modern endogenous models, is also contributed to or affected by public spending (Zaler & Durnecker, 2003).

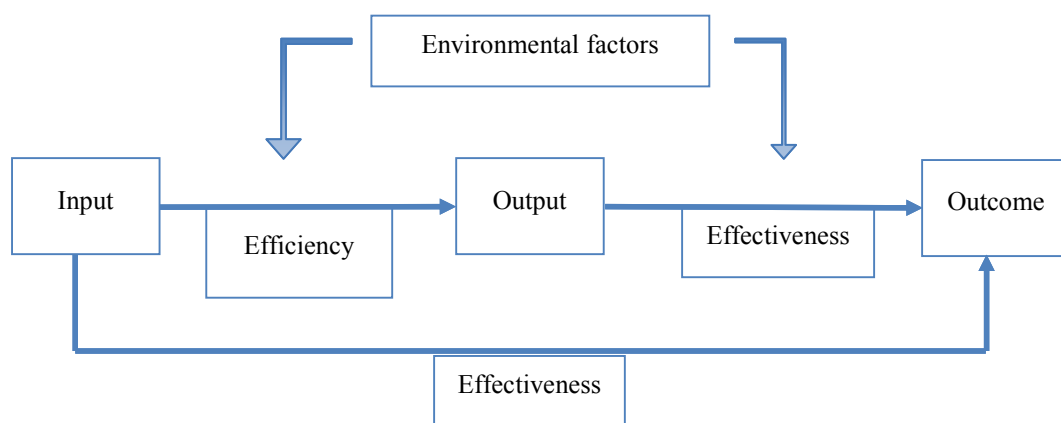


Figure 1. Theoretical framework of efficiency and effectiveness

Source: Mandl et al. (2008)

Public investment effectiveness in principle associates both the input and output to the target to aim for. In the field of public investment the capital sources (input) should be efficiently used to attain multiple growth objectives, thus enhancing people's welfare. These objectives set by the state sector highlight social richness or economic growth, specifically affected by numerous factors (regarded as being exogenous). On account of this link, Mandl et al. (2008) argued that the effectiveness reflects the success in using resources to reach the goals established. It is, however, not at all easy to determine the relation between such input factors as capital or human resources and the achievement of the objectives like growth in GDP per capita. Such a difficulty arises because: (i) public spending and investment should meet multiple objectives concurrently; and (ii)

non-market goods are mostly provided by the public sector, implying the unavailability of their market value (Mandl et al., 2008).

Quality of public investment is a complex concept, and establishing sufficient criteria for assessing the factor seems to be a challenging task. Estimating public investment quality involves considering whether public products/services satisfy the demands from citizens. In this context the issue of quality also covers effectiveness (Mihaiu et al., 2010).

ECB (2001) maintained that the goals of using public investment funds for economic growth can be achieved through increasing marginal product of capital and labor in the private sector. The government may improve human capital and technology via investments in education and research and development (R&D), the transmission mechanism of which can be summarized as follows: Investments in educational and R&D activities increase human capital and facilitates new technological advances, which thus helps raise labor productivity and ultimately production (Afonso et al., 2005). Likewise, other kinds of investments come up with specific transmission channels; however, some may not have any effect on the growth.

In addition, the quality of public expenditure can be regarded through two dimensions: (i) composition of spending; and (ii) effectiveness of policies (Busatto, 2011). Only a few governmental activities and public spending, as stated by Afonso et al. (2005) are essential to economic growth. This kind of 'productive' spending plays a major part in promoting growth just like private capital and labor. If expenditures exert a direct impact on the growth, they are then characterized as being productive, but is considered 'unproductive' otherwise (Barro & Sala-i-Martin, 1995). Thus, reforming public expenditures to profitable investments would be positively promoting growth rate without an adverse effect whatsoever (Zagler & Durnecker, 2003).

The theoretical model proposed by Devarajan et al. (1996) allows for effective estimations in accordance with Busatto's (2001) definition by adopting the production function (y) dependent on capital (k) and government expenditures (g_1, g_2, \dots).

$$y = f(k, g_1, g_2, \dots) = [\alpha k^{-\zeta} + \beta g_1^{-\zeta} + \dots]^{-1/\zeta}$$

Earlier findings indicate that: (i) when changes are made to the structure of government expenditures, growth rate can be improved; and (ii) the expenditures feature

an optimal proportion (to total expenditures), which would, if exceeded, either impede or adversely affect the growth.

2.2. Previous studies on quality and efficiency of public investment

Existing empirical researches focused on the efficiency of public investment in the core sectors such as education and health care services. Moreover, some authors attempted to quantify the losses caused by poor management of public expenditure systems (Leruth & Paul, 2006). Inefficiency may be partly derived from high costs, including transaction and agency costs. Similar results were obtained in a study of Ghana (Ye & Sudharshan Canagarajah, 2002), suggesting that 20% of public health expenditure and 50% of public education expenditure benefit the right facilities.

The problems arising in measuring public investment efficiency were further addressed in Leruth and Paul's (2006) empirical study of 25 poor countries with high public debt. Most of these countries were suggested to upgrade the efficiency of public expenditure management to control capital investment. The issues of internal management and post-auditing are also to be in contemplation (Leruth & Paul, 2006).

In developing countries public expenditures, capital accumulation, or economic growth is hindered by low efficiency in public investment. The theories on the trade-offs between public expenditures and capital accumulation assume that public sector investment is effective, which can easily be disproved in low-income countries. Degree of inefficiency, wastefulness, or corruption potentially distorts the impact of public expenditures on the accumulation of capital sources, thereby impairing the efficiency in implementing investment projects.

It is important to identify the quality and efficiency of public investment in order to determine the marginal productivity of investment as well as its effect on growth. Barro (1990), based on an endogenous growth model, found that effective public expenditure raises long-term growth by increasing returns on production factors. Inefficiencies and corruption in public infrastructure investment reduces the quality and effectiveness of public capital, negatively affecting the motives for firms' investment (Chakraborty & Dabla-Norris, 2009). Investment decisions are made in broader institutional frameworks, and the quality of adopting, managing, and implementing investment projects plays a major role when measuring returns on capital (Esfahani & Ramirez, 2003; Haque & Kneller, 2008; Flyvbjerg et al., 2003). High costs, wastefulness, and low fulfilment rates frequently recorded in key infrastructure projects in developing countries may

negatively influence the adoption, moderation, and evaluation. Remarked by Collier (2008), investment returns in low-income countries are limited by information and technical capacity in assessing the feasibility of projects, as well as corruption and bribery. Investment in the public sector, especially in infrastructure development, is significantly associated with not merely economic but also political issues. Interest group pressure and the structure of political institutions have impacts on infrastructure deployment (Henisz & Zelner, 2006). A bad regulatory framework has a tendency to bring about increasing political interference and disable the anticipation of mid-term results (Guasch et al., 2007), which is often seen in countries with low income levels.

Empirical studies on public investment with its impact focused on analyzing the long-term nexus with growth in total production or productivity. Most findings indicated the positive relation, notably in public infrastructure investment, and so did those of recent works, using qualitative indicators of infrastructure adequacy as proxies for infrastructure quality.

Others on the structure of public expenditures also provided empirical evidence of its effects on growth. Aschauer (1989) suggested that one major component positively affecting growth is investment expenditure. The findings from Barro (1990), Easterly and Rebelo (1993), and Devarajan et al. (1996) concluded the positive influence of physical capital accumulation on growth rate. However, in view of Afonso et al.'s (2005) arguments, whether the investment expenditure is "productive" depends on the project itself as well as its institutional framework.

Contributory elements to economic growth also comprise investments in human capital and research and development (Romer, 1990), in security of property rights (Keefer & Knack, 2002), in education (Barro, 1991), and in healthcare services (Kneller et al., 1999; Bloom et al., 2001).

In short, previous investigations highlight the crucial importance of increasing public investment in developing countries, and its impact on economic growth heavily depends on its quality as well as efficiency.

2.3. Research models of public investment quality and efficiency

Efficiency in using invested capital can be assessed through the relation between total government spending and economic growth. On the ground of previous findings, we compile the ARDL and cointegration testing for the variables via the

bound testing approach as advanced by Pesaran et al. (2001). The approach offers three following advantages: (i) applicable to a set of variables at $I(0)$ and $I(1)$; (ii) convenient for result testing by employing one single equation; and (iii) applicable to variables with different lags.

Regarding the issue, we adopt Loizides and Vamvoukas's (2005) technique, presented as below:

$$\Delta Y_t = \beta_0 + \lambda EC + \sum_{i=1}^p \beta_1 \Delta Y_{t-i} + \sum_{j=1}^q \beta_2 \Delta X_{t-j} + \varepsilon_t \quad (1)$$

where Y is log of GDP, λ is vector of short-run adjustment coefficient, EC is error-correction terms in equation of cointegration between GDP and investment expenditure, X is log of investment expenditure, and ε represents exogenous shocks.

Also, to test for efficiency of different kinds of public capital, we follow approaches as earlier employed by Devarajan et al. (1996), Busatto (2011), and Singh and Weber (1997). The following equation also highlights government expenditures on GDP:

$$Y_t = \beta_0 + \beta X + \sum_{j=-q}^p d_j \Delta X_{t-j} + u_t \quad (2)$$

where Y_t is GDP, X is a vector including variables of proportions of government expenditures to total investment.

Proposed by Stocked and Watson (1993) and utilized in this study, dynamic OLS technique improves OLS estimations, applied to a small sample size along with dynamic sources of bias. Although the Jahansen's method is deemed as informative, results of one equation may be negatively affected by wrong measurements in others. On the contrary, Stock and Watson's estimator centers on the sole equation, yet ensures the robustness and, by adding to it different leads and lags, overcomes the problem of endogeneity. The method, moreover, has similar asymptotic optimality properties to the Johansen distribution (Al-Azzam & Hawdon, 1997). Finally, to handle spurious regressors, unit root tests will be performed for the error terms (Choi et al., 2008).

3. Assessing quality and efficiency of Vietnam's public investment

3.1. The current state of public investment in Vietnam

From 2010 and before, public investment accounted for large proportions, but the state investment became less significant after 2010 (as compared to non-state investment). Differences in the two types, despite not being great, display a shift in the structure of social capital investment.

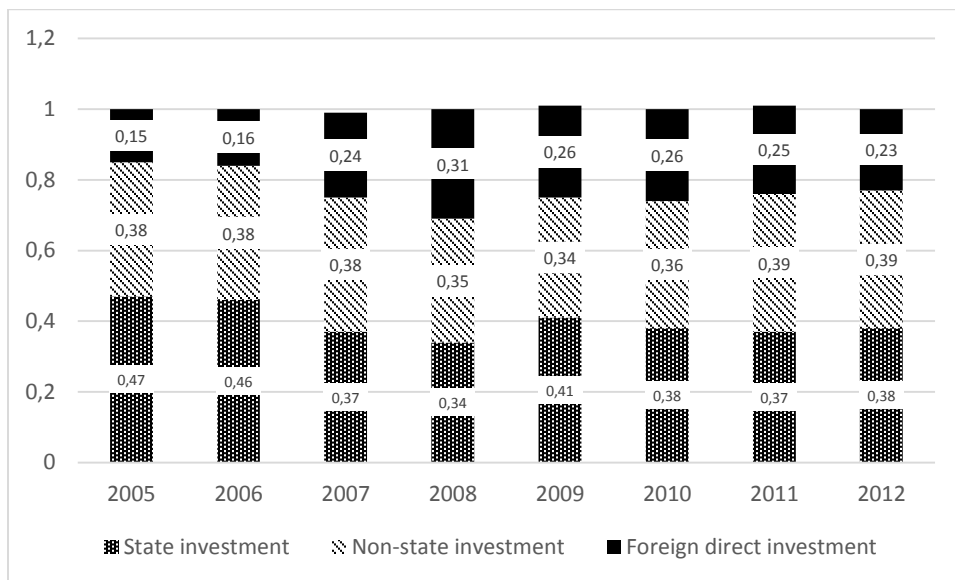


Figure 1. Structure of capital investment in Vietnam for 2005–2012
(in VNDbillion and real prices)

Source: authors' compilation from Ministry of Planning and Investment's statistics

For the period of 2005–2010 annual growth rates of public investment range between 0.34% and 0.47%. Investments in different sectors, however, reflected huge differences, and their proportions varied over each year. Accounting for the largest proportion was investment in economic sector (of above 70%), whereas that in social domains (healthcare, education, and socio-cultural activities) made up no more than 20% and was in a declining trend (at time reaching the lowest rate of about 15%). The rates of investment expenditures on the agriculture, forestry, and fishing industry, as a branch of that in economic development, revealed constant reduction from 12.2% in 2000 to 6.1% in 2010.

3.2. *Evaluating Vietnam's public investment by two criteria*

Reports by moderating agencies on the quality and efficiency of Vietnam's public investment reveal the following issues:

The state investment issue has become one primary motivation for stimulating growth and the process of economic reforms over the past years, encompassing projects on transport infrastructure development which triggered widespread effects on the economy. Positive shifts in the structure of public expenditures include: (i) enhancing public infrastructure investment for improvements in investment climate and growth rate in addition to redressing regional inequality; (ii) further investing in key sectors with competitive advantages; and (iii) laying more emphasis on developing human resources and sharpening labor skills. Constructing legal frameworks is found to be in unity in modifying both overall investment in general and state investment in particular. The legal system has in principal been covering most of the state investment projects besides closer monitoring in increasing extent. In 2011 the number of projects to have been put under control was 398, out of the total of 481 investment schemes, reaching the higher rate of 82.74%, compared to 62.58% and 58.8% as in 2010 and 2009 respectively. Thus, the supervision has significantly allowed for prompt detection of and adjustment to basic flaws in public investment. Improvements in final settlements of capital investment accounts would be noticed in spite of a rather high level of completed projects with no sufficient settlements.

Public investment in Vietnam, apart from substantial gains, reveals certain shortcomings, and to this respect these can be addressed from definition-related aspects. *First*, the investment has not clearly exhibited its roles and characteristics, thereby causing the incident of unconcentrated, scattering investment crowding out private sector investment. *Second*, if the public investment is viewed as a common kind of spending, its benefits are then scarcely living up to expectations. In terms of its characteristics, we now see no noticeable difference between state and non-state investment types. The former may interfere in the arenas in which the latter may be involved.

Most current public expenditures are not beneficial as expected. On the macro level, although the amount of public capital investment was increasing, the growth of GDP was not significant. This is easily identifiable by the ICOR related to investment effectiveness of the public sector and the entire economy. Public sector investment,

despite making up a large proportion, brought little efficiency in terms of the ICOR. During the period from 1996 to 2012, the public sector's ICOR was constantly higher than the average rate of the whole economic sector.

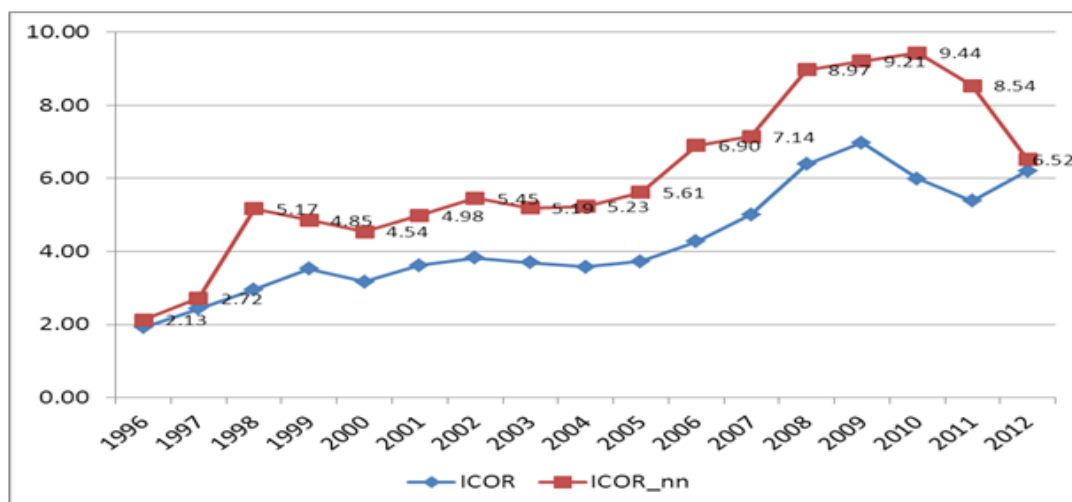


Figure 2. ICOR of public sector and the whole economy during the 1996–2012 period

Source: authors' compilation from GSO

Public investment projects themselves have not been remarkably effective; capital recovery for some completed projects was not as originally planned. Typically, a few construction projects imposed charges, but after many years of operation the fees collected were not even sufficient for maintenance or renovation of construction sites. Consequently, their quality would not be guaranteed, and hardly would beneficiaries feel satisfied with investment outcomes.

Implementation of public investment projects has been stagnant, entailing increased costs and reduced efficiency. Specifically, in 2010 the number of behind-schedule projects was 3,386, accounting for 16.6% of evaluating and monitoring projects, among which the rate of behind-schedule ones resulting from site clearance and capacity of investors, project managers, and contractors were 39.72% and 20.23% respectively; this figure for the year 2011 was 4436 (33.65%), besides a few works which lasted from five to seven years. Increasing rates of project adjustments not only led to rising investment costs but also affect the progress and/or duration of the project; limited or selective tendering grew as large proportions, whereas loopholes in bidding regulations have not been rectified (Vo, 2013).

The following reasons for the aforementioned issues shall be regarded:

First, public investment management in general, including the inspection and supervision of capital construction investment, is in slow progress; supervision processes approached by input indicators are costly but with low efficiency. The focus of inspection and auditing agencies has been on the issues of compliance with spending quotas and regimes. Estimated costs of the projects are based on these spending quotas and regimes established by the State, which are, nevertheless, often outdated or incomplete, and so are often being capitalized to push up estimated costs. These are then submitted to senior authorities for approval, succeeded by limited or selective tendering.

Second, input-based approaches let the agencies take excessive account of procedures, sequences, or project spending regimes or quotas, and so on, instead of its objectives and effectiveness.

Third, the roles of citizens, political institutions, and other social organizations like independent auditing and independent advisory and supervisory agencies have not been well promoted. Additionally, there has been a lack of well-defined responsibilities of publicized information providers dependent on whom Government's policies would conveniently be grasped by a large number of people. The oversight role of democratically elected agencies is not amply fulfilled, and a low rate of officers-in-charge has badly affected the quality of supervision.

Fourth, managerial work boldly features the ask-and-grant mechanism, even though there has been implementation of decentralization and autonomy granted to investors and/or subordinates. All procedures are to be inspected and approved; hence, it is difficult to ascribe responsibilities in case of fault detection.

Fifth, inspectors' and supervisors' capabilities are limited, thus hardly meeting current financial management requirements. Insufficient information on targets to be inspected and loose connection and/or lack of coordination between agencies should be evident.

Sixth, state regulations on management of basic investments are too complicated and lacking in transparency, thereby causing multiple interpretations and hampering subsequent implementation.

Last, in organizing supervision agencies the independence and clear scope of operation have yet to be achieved. This involves mass participation yet little chance in claiming responsibilities.

4. Empirical checks on public investment efficiency

This study uses ADB's statistics and empirically examines the efficiency in invested capital use of Vietnam. The dataset covers Vietnam's state public expenditure and gross domestic product statistics over the period of 1986–2002.

Table 1

Statistical description of variables used to assess invested capital efficiency

Variable	Obs.	Mean	Std. dev.	Min	Max	Source
GDP in logarithm	27	12.43469	2.047861	6.395262	14.99275	ADB
Public investment expenditure in logarithm	27	9.703562	2.259734	3.496508	12.24676	ADB

Stationarity testing

Our test on data stationarity demonstrates that: (i) GDP is nonstationary with and without trend at level for the three significance levels of 1%, 5%, and 10%; (ii) State investment expenditure is nonstationary without trend at three significance levels, but is stationary with trend at 10% level; and (iii) the two variables at first differences are stationary both with and without trend.

Table 2

Stationarity testing for variables at level and first differences

Variable	ADF statistics	
	Without trend	With trend
GDP in logarithm – Ln(GDP)	1.3	-1.126
Investment expenditure in logarithm – Ln(CAE)	-1.64	-3.346*
First difference of Ln(GDP)	-3.31**	-3.49**
First difference of Ln(CAE)	-4.739***	-4.369***

Note: MacKinnon critical values for rejection of hypothesis of a unit root at 1% (***), 5% (**), and 10% (*) significance levels

As for this result, no variable is I(2). We thus rely on cointegration approach proposed by Pesaran et al. (2001) by initially assuming the following unrestricted regression:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta Y_{t-i} + \sum_{j=1}^q \beta_2 \Delta X_{t-j} + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + v_t \quad (*)$$

The above unrestricted model can be measured by simple OLS, followed by a test on ν_t . If no autocorrelation and heteroskedasticity is found for the case of ν_t , we continue with marginal tests suggested also by Pesaran et al. (2001) with the null hypothesis: $H_0 : \alpha_1 = \alpha_2 = 0$. If the results achieved from these indicate cointegration between the variables, Eq. (*) will then be used to examine short- and long-run relations of the variables in the model.

Table 3

Cointegration testing with marginal approach

	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	Lower 10%	Upper 10%	Lower 5%	Upper 5%	Lower 1%	Upper 1%
K=1	4.04	4.78	4.94	5.73	6.84	7.84
F-statistic	25.17					

Tables 3 and 4 display the results of testing for cointegration with R_2 , Breusch Pagan test for heteroscedasticity, and Breusch–Godfrey test for autocorrelation, suggesting that it is inappropriately restricted or no evidence can be found of the problems of heteroscedasticity and autocorrelation. The testing results based on Pesaran et al.'s (2001) marginal approach demonstrate that F-statistic is larger than all critical values at the three significance levels. Thus, a long-run nexus can be concluded between investment expenditure and growth, based on which we proceed with restricted regression of (*).

Table 4

Results of model testing

Dependent variable: log-differenced GDP				
	Unrestricted ARDL	Restricted ARDL	First model	Second model
L1. Log GDP	-0.430***			
L1. Log investment expenditure	0.416***			
L1. Error correction		-0.468***	-0.460***	-0.487***
L3. Log-differenced GDP	0.712***	0.718***	0.626***	0.709***

Dependent variable: log-differenced GDP				
	Unrestricted ARDL	Restricted ARDL	First model	Second model
L5. Log-differenced GDP	0.186***	0.136**	0.169***	0.155***
L1. Log-differenced investment expenditure	-0.344***	-0.345***	-0.343***	-0.360***
L2. Log-differenced investment expenditure	-0.207***	-0.243***	-0.198***	-0.239***
Dummy variables			-0.0327*	-0.0493**
Intercept	1.358***	0.094***	0.114***	0.134***
R-squared	0.909	0.8289	0.8662	0.8882
Adjusted R-squared	0.870	0.7719	0.8088	0.8402
Breusch-Godfrey test				
Prob>chi ² (lag-1)	0.538	0.1716	0.7895	0.8408
Prob>chi ² (lag-2)	0.561	0.2721	0.5201	0.7734
Prob>chi ² (lag-3)	0.480	0.4454	0.5410	0.7935
Prob>chi ² (lag-4)	0.101	0.5370	0.1867	0.8918
Breusch-Pagan/Cook-Weisberg test	0.554	0.4214	0.5792	0.6855

Note: (***), (**), and (*) denote significance levels of 10%, 5%, and 1%, and L# denotes corresponding lag.

The ARDL test results show that concerning the coefficients of error correction term (statistically significant at 1% level.), the short-term gap between investment expenditure and sustainable economic growth is 54%. The difference from long-term equilibrium between economic growth and investment expenditure is adjusted in short terms. Furthermore, the regression coefficients of investment expenditure are significant but carry negative signs, implying that in the short run public expenditures have no significant impact on growth rates.

Empirical evidence shows that: (i) long-term relation exists between investment expenditure and economic growth; (ii) public investment expenditure can be employed

as a means to give rise to growth; (iii) in the short run, nevertheless, there is a negative expenditure-growth association; and (iv) the difference from the equilibrium point is settled in short terms.

In addition, to contrast the efficiency in investment expenditure in difference terms, we further introduce dummy variables to the models. For the first one we opt for the year 2005, when Law No. 59/2005/QH11 on investment was issued, to categorize observations into groups, whereby the ones in 2005 and before take the value of 1, and 0 otherwise. For the second model we choose the year 2009 to take similar steps when Decree No. 113/2009/ND-CP by the Government on investment monitoring and evaluation took effect. The signs and significance levels of dummy variables indicate that increasing public capital investment impacts more on economic growth for the years after promulgation of legal documents, implying that the promulgation has offered favorable conditions for improving public investment efficiency in the surveyed period.

Evaluating public investment efficiency

As discussed above, we use the following equation as were employed by Devarajan et al. (1996), Busatto (2011), and Singh and Weber (1997), including government expenditures on GDP

$$Y_t = \beta_0 + \beta X + \sum_{j=-q}^p d_j \Delta X_{t-j} + u_t$$

where Y_t is GDP, X is a vector including variables of proportions of government expenditures to total investment.

Particularly selected are the data for the period between 1990 and 2010 on fractions of government expenditures on education, healthcare services, transportation and telecommunication, mineral exploitation, and so on.

Table 5

Statistical description of variables used to assess invested capital efficiency in different fields

Variable	Obs.	Mean	Std. dev.	Min	Max
Log expenditure on education	21	12.0490	0.7654	10.8913	13.9779
Log expenditure on healthcare services	21	3.64489	0.5238	2.8056	4.9177
Log expenditure on transportation and telecommunication	21	16.3414	2.9446	12.7514	21.1671
Log expenditure on mineral exploitation	21	21.5968	3.2346	14.2749	25.8277
Log GDP	21	4.8237	0.4457	4.0899	5.5212

Source: authors' compilation from IFPRI's statistics

Table 6

Results of public investment efficiency testing based on DOLS

Variable	Log GDP
Investment in healthcare services	-0.2245
F1. Differenced investment in healthcare services	0.7340**
L1. Differenced investment in healthcare services	0.027
Investment in education	0.5628***
F1. Differenced investment in education	0.1338
L1. Differenced investment in education	-0.1662
Investment in transportation and telecommunication	0.0894***
L1. Differenced investment in transportation and telecommunication	-0.0814**
Investment in mineral exploitation	-0.0146
F1. Differenced investment in mineral exploitation	-0.0229
L1. Differenced investment in mineral exploitation	-0.0178
Constant	-2.3472

Variable	Log GDP	
R-squared	0.9574	
Adjusted R-squared	0.8794	
Breusch-Godfrey test	Prob>chi ²	0.7379
Breusch-Pagan/Cook-Weisberg test	Prob>chi ²	0.5635

Note: (***), (**), and (*) denote significance levels of 10%, 5%, and 1%, and L# denotes corresponding lag.

Table 7

Stationarity test on residuals based on DOLS

Variable	ADF-statistics	
	Without trend	With trend
Residual	-3.30**	-3.24*

Note: MacKinnon critical values for rejection of hypothesis of a unit root at 1% (***) and 5% (**) significance levels

Given various tests on heteroskedasticity and autocorrelation, the null hypothesis cannot be rejected. The results of stationarity test on residuals suggest that they are stationary without trend and with trend at significance levels of 5% and 10% respectively.

The DOLS-based regression results indicate that: (i) a negative long-run relation is held between investment in healthcare services and the dependent variable, but its coefficient is not statistically significant; and (ii) investment in education exhibits efficiency in terms of signs and significance of regression coefficients. These two results are compatible with those of Devarajan (1996) and Singh (1997) yet are not with Busatto's (2011) findings.

Accordingly, the effectiveness of public investments in healthcare services and education is not consistent among various economies. Public infrastructure investment, realized through expenditures on telecommunication and transportation, reflect its positive association, consistent with Easterly and Robelo's (1993) results but inconsistent with those of Devarajan (1996) and Busatto (2011). Investment in mineral exploitation, additionally, is not effective as expected; its regression coefficients take negative signs and are not statistically significant.

5. Conclusion and policy implications

5.1. Conclusion

Public investment quality is such a sophisticated concept; it is thus difficult to construct adequate assessment indicators, and unsurprisingly, evaluating the quality of its also involves measuring its efficiency. Following the theories on capital investment–economic growth association with the use of ARDL and dynamic OLS approaches as advanced by Perasan et al. (2001) and Stock and Watson (1993) respectively, we illustrate that:

- (i) Public expenditure in Vietnam is perceived as being important to total public capital investment, and in the long-run scale is associated with growth;
- (ii) Promulgation of legal documents has indeed provided favorable conditions for improving public investment efficiency;
- (iii) Public investments in education, healthcare services, and infrastructure development exert positive impacts; and
- (iv) No corresponding effects are produced by investment in mineral exploitation.

5.2. Policy implications:

In the field of public investment it is necessary to:

- Focus on infrastructure development as one of the three major breakthroughs in social development strategies for 2011–2020;
- Aim resources allocation and mobilization at certain areas where non-state sector generates low efficiency in its performance;
- Prioritize strategic implementation over each period when planning the allocation and use of financial resources; and
- Enforce finance-related discipline and financial efficiency and effectiveness besides enhancing transparency and publicization.

It is also imperative that governmental agencies:

(i) concerning improvements in public investment climate

- Innovate decentralizing mechanism and management of public capital toward adequate approval and inspection by central agencies of state-funding projects, which confines uncontrolled project launch by local ones;

- Upgrade the planning quality by attracting widespread attention of scholars in domestic and international public investment and consulting experts about technical experience in appropriate areas;

- Transform the common growth model to intellect- and technology-based intensive development approaches;

- Alter public investment regimes in congruence with national development strategies by initially considering centralization of strategic long-term planning, then introducing changes to the current mechanism of decentralized investment decisions, and finally ensuring the presence of one which fosters the transparency and publicization of public investment projects; and

(ii) concerning improvements in public investment efficiency until 2020

- Orient public expenditure strategies to development of infrastructure, science and technology, and healthcare training as these foster domestic and foreign investments, enhancing people's welfare and living standards;

- Stimulate a shift from private to public investment portfolios with the participation of private sector, positively contributing to efficiency in capital use, creativity, and project management effectiveness, which is also part of public private partnership;

- Make selection and flexible and coordinative use of criteria for assessing public investment efficiency, that is, relate NPV, IRR, and ICOR or duration of capital recovery and sensitivity analysis to new institutional economics-based (NIE) evaluation frameworks in order to reduce investment costs, enhance political and social accountability, and improve community welfare and equality; and

(iii) concerning innovation in public investment monitoring system

- Adjust regulations on public investment in accordance with advanced systems that promote the role of independent supervisory agencies; adopt design-based tendering, a popular world-wide approach, whereby contractors do not have to follow ceiling prices, or state-approved quotas and norms, yet are entitled to make the appropriate solutions based on assigned technical standards and then to propose rational project amounts;

- Develop criteria for monitoring and measuring public investment risks and information systems and data analysis/assessment meeting inspection or supervision requirements in addition to management of basic construction investment of the state budget in line with criteria of budget management by output control; and

- Devise information systems and new technologies to capture the monitored targets with the sharing and coordination in information distribution among managerial agencies by using effective, proactive application approaches■

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