The Linkage between Public, Private Investment and Economic Growth—Evidence for the Developing ASEAN and Asian Countries

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Abstract

This study used a quantitative method to assess the impact of public investment on private investment and economic growth based on data from 18 developing countries over a 21-year period (1995-2015) by applying PVAR model combined with GMM. The findings show that all public investment and public-private partnership investments affect private investment as well as affect economic growth but the effects vary cyclically, by time period, and by group of countries.

For the ASEAN developing countries, public investment crowds out private investment in short term and crowds in private investment in the medium and long term, but it crowds out public-private partnership investment. For the developing countries in Asia, public investment has a positive impact on economic growth with the inverted U-shaped pattern which stimulates growth in the short and medium term, but in the long-term effects of stimulation growth tend to decrease.

Keywords

public investment, private investment, economic growth, ASEAN and Asian developing countries

1. Introduction

Asian developing countries have seen relatively steady growth in recent years. Developing Asian economies are still the main driver of global economic growth since the crisis, according to Asian Development Bank (ADB) experts. The question is what is the role of public investment and private investment for economic growth in these countries?

Most of economists agree that investment has a positive effect on economic growth. However, they

have not yet agreed on the impact of public investment on private investment and economic growth.

There has been a change in the views of the economics profession as well as economic policy-makers over the past on the role of the government in the development process.

There is evident in the steadily declining importance of government activities in the economies of most of the developing world (Mohsin, 1996).

Reality is that public investment still represents a large share of total investment in the majority of developing Asian countries (such as Vietnam, China, Laos… public investment is accounted around 30%-50%), and the question is what role it plays in relation to private investment in stimulating economic growth. This research is to investigate whether there exists a relationship between public investment, private investment and economic growth in the developing Asian countries.

In this study, besides considering the role of public investment and private investment for economic growth in Asian Developing Countries, we also will test the hypothesis that there are significant differences in the differential effects of public and private investment on economic growth for two developing country regions—ASEAN developing and Non-ASEAN developing countries in Asia. This means we examine the relative effects of public and private investment on economic growth across all developing Asian countries and across countries in different region groups.

In ASEAN countries, besides Singapore, Brunei is a country having a higher income per capita like that of developed countries, other developing countries having a low income per capita, small size of economy and having transition economies like Vietnam, Laos, and Cambodia.

In particular, since 2016, ASEAN countries have been a member of the common economic community, and the implementation of the ASEAN Economic Community (AEC) will turn ASEAN into a single market and production base, which will contribute to enhancing the competitiveness of ASEAN. Thus, examine the relative effects of public and private investment on economic growth for two groups, ASEAN and non-ASEAN developing countries, we can see the difference in impacts in order to provide appropriate policy implications for ASEAN developing countries.

2. Literature Review and Previous Empirical Studies

The theory that explains the relationship between inputs and growth in a national product is called the production function. The production function is one of the key concepts of mainstream neoclassical theories, used to define marginal product and to distinguish allocated efficiency, the defining focus of economics. Cobb-Douglas production function (1928) represent the technological relationship between the amounts of two or more inputs, particularly physical capital (K) and labor (L), and the amount of output (Y) that can be produced by those inputs. Robest (1956) tried to explain the origin of growth by a different kind of production function that allows analysis of the different causes or origins of growth called the Solow model. The main assumptions of the Solow model relate to the characteristics of the production function and the evolution of the three inputs of product (capital, labor and knowledge) over time.

Public investment which affects strongly to economic growth is also reflected by aggregate supply and demand. Public investment directly impacts on aggregate demand as a government expenditure and aggregate supply as a production function (capital factor). Public investment has spillover effect and indirectly impacts to aggregate demand by stimulating private investment and to aggregate supply through attracting private investment. Public investment may facilitate and stimulate private investment through the provision of infrastructure and this can raise the productivity of capital and finally to increase economic growth. However, public investment may crowd out private investment. This because of additional public investment requires raising future tax, public debt and domestic interest rate and it may decrease economic growth.

Some related studies have addressed the effects of public investment on private investment and the crowding-in hypothesis with applying OLS and VAR (Vector Autoregressive model) analysis. For instance, the study on the effect of public investment on private investment in developing economies was done by Lutfi and Randall (2005, 2006) with applying several pooled specifications of a standard investment model and panel data for period (1980-1997) has a result indicating that public investment crowds in private investment. Toshyya (2010) has a study investigating the effects of public investment on private investment based on Japanese empirical data. Estimating the error correction model, the author affirmed that the crowding-in effect of public investment on private investment. The study of Victoria (2014) is the impact of public capital spending on private investment in Nigeria showed that public investment is motivation of private investment growth. Christian and Han (2016) have a study to answer a question "Does public investment stimulate private investment in the euro area". In this study, the relationship between private and public investment by examining capital stocks as well as gross investment flows is investigated in a panel VAR framework, where the euro area member states constitute the cross section. The result indicated that the lack of public investment may have restricted private investment and thus GDP growth in the euro area. In addition to the above-mentioned studies that have resulted in the positive effects of public investment on private investment (public investment stimulates private investment);

On the contrary, there are also some studies that show the negative effects of public investment (public investment crowds out private investment). Some studies such as Bruno and Joan Iio (1999), Altin and Agim (2012) find that the private investment is crowded out by public investment in short-term, but in the long term these two variables complement each other. Erden and Randall (2005) and Altin and Agim (2012) conclude that public investment has positive affect private investment in developing economies or in Eastern European Countries, whereas, public investment has a negative affect private investment in developed countries or in Western countries.

A comprehensive study of the effects of public investment on private investment and economic growth has also been carried out in different countries and groups of countries, and results are not quite the same.

Some studies find negligible role of public investment on economic growth. Edward and Kon (1994)

582

used endogenous growth model by Barro (1990) suggest that there is no clear evidence that government spending can increase GDP per capita GDP in G7. Ejaz and Musleh-ud (2006) have studied the impact of public investment on economic growth in Pakistan with using the Vector Autoregressive Approach (VAR). The VAR consists of four variables including public investment, private investment, public consumption and GDP with data from 1973 to 2004. The result of this study showed that economic growth is largely driven by private investment and that no strong inference can be made about the effects of public investment and public consumption on economic growth. The results also showed the presence of long run causality from public investment, private investment, and public consumption to economic growth. Syed et al. (2007) examined the casual connection between public investment and economic growth in the Three Little Dragons (Korea, Singapore, and Taiwan) using a variety of econometric techniques with Heterogeneous Dynamic Panel Data in the period (1971-2000). The authors also used four variables model that includes public investment, public consumption, private investment and growth rate of GDP. The results indicated that both public and private investment and public consumption have a long-term dynamic impact on economic growth and the pair-wise analysis showed bidirectional causality between public investment and economic growth in all the countries. Rohan (2007), investigated the relationship between public investment and growth in Jamaica, with using VECM. The Granger causality result suggested that public investment does not cause GDP; however, GDP causes public investment. The VECM showed that in the long-run domestic private investment, FDI, and the REER all have a positive statistically significant direct impact on the level of GDP. Public investment has the effect of crowding-out net private investment. Andros Gregoriou and Sugata (2008), have a study on the impact of government expenditure on growth for 15 developing countries. Using GMM techniques, the authors showed that countries with substantial government expenditure have strong growth effects.

Some other studies find the positive role of public investment on economic growth. William (1993) applied VAR model to evaluate linkage between public investment and economic growth and found that Government consumptions for Education and Labor training have clear positive effects on economic Growth. Mohsin's (1996) also conclude that the private investment has a much stronger impact than public sector investment in the Developing World. Ramirez and Nazmi's (1997 and 2003) studies on public investment and economic growth in Latin America with using OLS and data for the period (1983-1993) showed that the openness of economy, human capital and government consumption/public health significantly affect private investment. Research results also indicated that both private investment and public investment contribute to economic growth. Pooloo (2009), investigated the role of public investment in promoting economic growth in Mauritius, used dynamic econometric framework, and Vector Autoregressive (VAR) model. The link between public capital, as measured by transport and communication infrastructure and economic performance has been analyzed in a multivariate dynamic framework. Results from this analysis revealed that both transport and communication infrastructure is important elements promote the Mauritian economy. Kongphet and

583

Masaru (2012), have a study on the impact of public and private investment on economic growth in developing Asian Countries, The author analyzes the factors affecting economic growth and the interrelationship of public investment, FDI, and private domestic investment using a panel data covering the period 1984-2009. The study found that both public investment and private domestic investment positively affect economic growth. Therefore, any increasing in public investment more than 4.9%-8%, the public investment will reduce the positive effect of FDI on economic growth. Wolassa (2012) conducted pairwise Granger causality tests between infrastructure investment and economic growth in South Africa for the period 1960-2009 using bivariate Vector Autoregression (VAR) model with and without a structural break. The author found that there is a strong causality between infrastructure investment and GDP growth that run in both directions implying that infrastructure investment drives the long term economic growth in South Africa while improved growth feeds back into more public infrastructure investments. Sheikh (2013) investigated the effect of public and private investment on economic growth in Bangladesh, using the new neo-classical growth model of Cobb Douglas production function utilizing the Error Correction Model (ECM). The findings of the study concluded that there exist a short-run and long-run relationship between public and private investment and economic growth in Bangladesh.

Our research will inherit previous studies but has some differences including (1) to evaluate effect of public investment we use General government investment as well as General government capital stock. Besides this we also add another variable such as Public-Private Partnership (PPP) investment; (2) the relationship is investigated in a panel VAR framework where every country states constitute the cross section. The large sample allows for consideration of the hypothesis that there are significant differences in the differential effects of public and private investment on economic growth for two developing country regions—ASEAN developing and Non-ASEAN developing countries. This means we examine the relative effects of public and private investment on economic growth across all developing Asian countries and across countries in different region groups.

3. Research Method, Model and Data

In this study, the authors use research variables to assess the interactive relationship between public investment and private investment and economic growth, along with other macro variables, according to studies done by Mohsin and Manmohan (1997), Ejaz and Musleh-ud (2006), Kongphet and Masaru (2012) or Pooloo (2009).

Unlike previous studies, they were using the VAR method as studied by William (1993), Edward and Kon (1994), Ejaz and Musleh-ud (2006), Pooloo (2009) or study by Wolassa (2012). Our study used the PVAR method for panel data from 1995 to 2015 on 18 Asian developing countries, among them there are 7 ASEAN developing countries. The total set of data table in our study including a sample of 378 observations is suitable for applying PVAR.

Panel VARs are designed to capture both static and dynamic interdependencies across countries or

regions using some set of restrictions, treat the linkages across units, and can account for cross sectional heterogeneities (Canova & Cicarelli, 2013). According to Abrigo and Love (2015), estimation and inference of homogeneous panel VAR models in a Generalized Method of Moments (GMM) framework, by using standard Stata datasets.

To analyze the impact of public investment, we use four variables such as GDP, General government investment, private investment and Public-Private Partnership (PPP) investment. The public and private investment capital is calculated on average for one year. All data can be obtained from IMF source, which is calculated in US dollars. The variables used in this study are described in the following Table 1.

Table 1. Describe the Variables Used in the Model

Variable name	Notation	Data Source	Unit
Gross domestic product for i country at year t	Y_{it}	IMF	In billions of constant 2011 international dollars
General government investment for i country at year t	$IGOV_{it}$	IMF	In billions of constant 2011 international dollars
Private investment for i country at year t	$IPRIV_{it}$	IMF	in billions of constant 2011 international dollars
Public-Private Partnership (PPP) investment for i country at year t	$IPPP_{it}$	IMF	in billions of constant 2011 international dollars

Research model with PVAR method (a panel VAR framework) for assessing the impact of public investment on private investment and economic growth is a set of the following equations (with optimal expectation of lag and difference of order 1):

$$D.Y_{it} = \alpha_0 + \alpha_1 D.IGOV_{it-1} + \alpha_2 D.IPRIV_{it-1} + \alpha_3 D.IPPP_{it-1} + \alpha_4 D.GDP_{it-1} + \varepsilon_{it} \qquad (1)$$

$$D.IGOV_{it} = \beta_0 + \beta_1 D.IGOV_{it-1} + \beta_2 D.Y_{it-1} + \beta_3 D.IPRIV_{it-1} + \beta_4 D.IPPP_{it-1} + \varepsilon_{it} \qquad (2)$$

$$D.IPRIV_{it} = \gamma_0 + \gamma_1 D.IPRIV_{it-1} + \gamma_2 Y_{it-1} + \gamma_3 D.IGOV_{it-1} + \gamma_4 D.IPPP_{it-1} + \varepsilon_{it} \qquad (3)\gamma$$

$$D.IPPP_{it} = \lambda_0 + \lambda_1 D.IPPP_{it-1} + \lambda_2 D.Y_{it-1} + \lambda_3 D.IGOV_{it-1} + \lambda_4 D.IPRIV_{it-1} + \varepsilon_{it} \qquad (4)$$

Where:

$\alpha, \beta, \gamma, \lambda$ are coefficient of marginal impact between variables

$D.()$ is the year-to-year difference of order 1

ε is the contingent error

4. Research Results

The statistical descriptive table from the research data (Table 2) shows that there are significant differences in variables such as Y (GDP), IGOV, and IPRIV between the two groups of Non-ASEAN developing countries in Asia and ASEAN developing countries. This is different because non-Asean countries have large GDP such as China and India. However, when considering the rest variable,

Public-Private Partnership Investment (IPPP), the result shows that there is no significant difference between the two groups of these countries. The public-private partnership investment has a small size in both groups of countries (on average $ 3.76 billion for ASEAN developing countries compared to $ 4.12 billion for Non-ASEAN developing countries in Asia).

Table 2. Descriptive Statistics of the Variables

Area	Variable	Obs	Mean	Std.Dev	Min	Max
Asean developing countries	y	147	525.45	572.86	9.64	2,669.00
	igov	147	25.85	23.21	0.40	89.77
	ipriv	147	108.25	157.80	0.48	765.21
	ippp	147	3.76	5.03	0.00	36.95
Outside	y	231	1,532.01	3,110.25	10.36	18,333.92
Asean	igov	231	181.12	485.78	0.44	2,536.71
developing	ipriv	231	253.36	726.06	0.41	5,132.57
countries	ippp	231	4.12	12.67	0.00	83.61
Total Developing countries in Asian	y	378	1,140.57	2,504.04	9.64	18,333.92
	igov	378	120.74	387.19	0.40	2,536.71
	ipriv	378	196.94	579.89	0.41	5,132.57
	ippp	378	3.98	10.38	0.00	83.61

Source: Author's calculations from Stata14.

In addition, the above analysis table describing the statistics of the variables shows that the standard deviation is greater than the mean value, so that most variables exhibit varying variance. In order to overcome this phenomenon, the author uses a combination of PVAR integrated with GMM according to the study done by Abrigo and Love (2015).

By using integrated GMM with PVAR, to ensure that data is stationary, the author applies fisher-type to test stationary of variables according to Abrigo and Love (2015). Test results are shown in Table 3.

Table 3. Test Results of the Stationary of the Variables

Area	Variable	P-value	Statistic value	Stationary/Non-stationary
ASEAN developing countries	d.y	0.00	90.19	Stationary
	d.igov	0.00	44.60	Stationary
	d.ipriv	0.00	81.08	Stationary
	d.ippp	0.00	50.29	Stationary
Outside	d.y	0.03	35.37	Stationary
ASEAN	d.igov	0.00	83.72	Stationary
developing	d.ipriv	0.00	49.25	Stationary
countries	d.ippp	0.00	59.56	Stationary
Total Developing countries in Asian	d.y	0.00	85.03	Stationary

d.igov	0.00	134.12	Stationary
d.ipriv	0.00	115.07	Stationary
d.ippp	0.00	89.06	Stationary

Source: Author's calculations from Stata14.

The results of the testing stationary of the variables show that in the group of ASEAN developing countries, all of the variables are stationary after taking difference of order 1 (denoted by d.). The results for the group of non-ASEAN developing countries in Asia also show that all variables are stationary after taking the difference of order 1.

When consider whole sample for all Asian developing countries, the results show that the variable IPPP is stationary, the rest variables are stationary only when taking the difference of order 1. Thus, after taking the difference of order 1, all the variables are stationary, ensuring that to apply the PVAR integration with GMM is appropriate.

Table 4. The Result of Optimal Lag length Selection

Area	Lag	MBIC	MAIC	MQIC
ASEAN	1	-272.27	-73.22	-153.88
developing	2	-169.82	-37.12	-90.89
countries	3	-88.61	-22.26	-49.15
Non-ASEAN	1	-294.40	-61.45	-156.01
developing	2	-188.64	-33.34	-96.38
countries	3	-102.20	-25.17	-56.69
	1	-331.83	-61.95	-170.32
Whole Asian Developing countries	2	-220.26	-40.34	-112.59
	3	-116.05	-26.09	-62.22

Source: Author's calculations from Stata14.

The seeking result of lag length using in the model shows that the optimal lag is 1 because at this level the MBIC, MAIC and MQIC values are min (Table 4) for two groups of countries and for whole sample.

The results of Granger-causality and long run Co-integration test of variables are statistically significant, indicating that almost all variables have interaction effects in short, medium and long term (Table 5). This result is appropriate for assessing the interaction effect between variables using in the PVAR model in short, medium and long term.

Co-integration Test applying Westerlund (2007); this allows for complete check of heterogeneous characteristics of long run parts of error correction model. In Table 5, notation "a" refers to the estimate of the error correction, while "t" refers to the estimate the standard error of "a"; Gt and Ga are group mean tests, while Pt and Pa are panel mean tests.

Table 5. The Result of Granger-Causality and Long Run Co-Integration Test

ASEAN developing countries					Non-ASEAN developing countries					Total Developing countries in Asian				
Granger test			Co-integration test		Granger test			Co-integration test		Granger test			Co-integration test	
Equation\Excluded		Prob>chi2	Value	Prob>chi2	Equation\Excluded		Prob>chi2	Value	Prob>chi2	Equation\Excluded		Prob>chi2	Value	Prob>chi2
d.y	d.igov	0(*)	Gt	0(*)	d.y	d.igov	0(*)	Gt	0(*)	d.y	d.igov	0(*)	Gt	0(*)
	d.ipriv	0(*)	Ga	0(*)		d.ipriv	0(*)	Ga	0(*)		d.ipriv	0(*)	Ga	0(*)
	d.ippp	0(*)	Pt	0(*)		d.ippp	0(*)	Pt	0(*)		d.ippp	0(*)	Pt	0(*)
	All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)
d.igov	d.y	0(*)	Gt	0(*)	d.igov	d.y	0(*)	Gt	0(*)	d.igov	d.y	0(*)	Gt	0(*)
	d.ipriv	0(*)	Ga	0(*)		d.ipriv	0(*)	Ga	0(*)		d.ipriv	0(*)	Ga	0(*)
	d.ippp	0(*)	Pt	0(*)		d.ippp	0(*)	Pt	0(*)		d.ippp	0.4	Pt	0.4
	All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)
d.ipriv	d.y	0(*)	Gt	0(*)	d.ipriv	d.y	0(*)	Gt	0(*)	d.ipriv	d.y	0(*)	Gt	0(*)
	d.igov	0(*)	Ga	0(*)		d.igov	0(*)	Ga	0(*)		d.igov	0(*)	Ga	0(*)
	d.ippp	0(*)	Pt	0(*)		d.ippp	0(*)	Pt	0(*)		d.ippp	0(*)	Pt	0(*)
	All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)
d.ippp	d.y	0(*)	Gt	0(*)	d.ippp	d.y	0(*)	Gt	0(*)	d.ippp	d.y	0(*)	Gt	0(*)
	d.igov	0(*)	Ga	0(*)		d.igov	0(*)	Ga	0(*)		d.igov	0(*)	Ga	0(*)
	d.ipriv	0(*)	Pt	0(*)		d.ipriv	0(*)	Pt	0(*)		d.ipriv	0(*)	Pt	0(*)
	All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)		All	0(*)	Pa	0(*)

Source: Author's calculations from Stata14.

(*), (**) Statistics those are significant at 1% level and 5% level.

Table 6. Estimation Results of Model Using PVAR Combined with GMM for Two Groups Countries and for Whole Sample of Asia Developing Countries

Asean developing countries				Non-Asean developing countries				Total Developing countries in Asian			
Variables		Coef	P>|Z|	Variables		Coef	P>|Z|	Variables		Coef	P>|Z|
d.y	Ld.y	1.23	0.0(*)	**d.y**	Ld.y	0.55	0.0(*)	**d.y**	Ld.y	0.27	0.0(*)
	Ld.igov	-1.90	0.0(*)		Ld.igov	0.72	0.0(*)		Ld.igov	0.87	0.0(*)
	Ld.ipriv	-1.07	0.0(*)		Ld.ipriv	1.24	0.0(*)		Ld.ipriv	0.52	0.0(*)
	Ld.ippp	1.65	0.0(*)		Ld.ippp	-1.24	0.0(*)		Ld.ippp	3.38	0.0(*)
d.igov	Ld.y	0.16	0.0(*)	**d.igov**	Ld.y	-0.44	0.0(*)	**d.igov**	Ld.gdp	-0.13	0.0(*)
	Ld.igov	-0.31	0.0(*)		Ld.igov	0.15	0.0(*)		Ld.igov	0.35	0.0(*)
	Ld.ipriv	-0.04	0.0(*)		Ld.ipriv	0.69	0.0(*)		Ld.ipriv	0.61	0.0(*)
	Ld.ippp	0.87	0.0(*)		Ld.ippp	9.47	0.0(*)		Ld.ippp	1.02	0.0(*)
d.ipriv	Ld.y	0.36	0.0(*)	**d.ipriv**	Ld.y	0.08	0.0(*)	**d.ipriv**	Ld.y	-0.03	0.0(*)

	Ld.igov	-1.46	0.0(*)		Ld.igov	0.39	0.0(*)		Ld.igov	0.58	0.0(*)
	Ld.ipriv	-0.32	0.0(*)		Ld.ipriv	0.92	0.0(*)		Ld.ipriv	0.51	0.0(*)
	Ld.ippp	-3.36	0.0(*)		Ld.ippp	8.64	0.0(*)		Ld.ippp	-0.35	0.0(*)
d.ippp	Ld.y	0.01	0.0(*)	**d.ippp**	Ld.y	-0.01	0.0(*)	**d.ippp**	Ld.y	-0.01	0.0(*)
	Ld.igov	0.19	0.0(*)		Ld.igov	-0.00	0.0(*)		Ld.igov	-0.01	0.0(*)
	Ld.ipriv	0.01	0.0(*)		Ld.ipriv	0.01	0.0(*)		Ld.ipriv	0.005	0.0(*)
	Ld.ippp	0.07	0.0(*)		Ld.ippp	-0.30	0.0(*)		Ld.ippp	0.98	0.0(*)

Source: Author's calculations from Stata14.

Note. * Statistics those are significant at 1% level; ** Statistics those are significant at 5% level.; *** Statistics those are significant at 10% level; Ld is lag 1 of order 1of variables; d. is difference of order 1 of variables.

The PVAR results show that almost the variables are statistically significant for all groups of countries. For ASEAN developing countries, public and private investment has the negative effect on economic growth in the short term (possibly it is due to poor capital absorption). This result contrasts with the result for non-ASEAN countries. However, in general, for all Asian developing countries, all public, private and public-private partnership investments, have a positive effect on economic growth in short-term. To see causal effects in the short, medium and long term, we can see the figure of impulse response function.
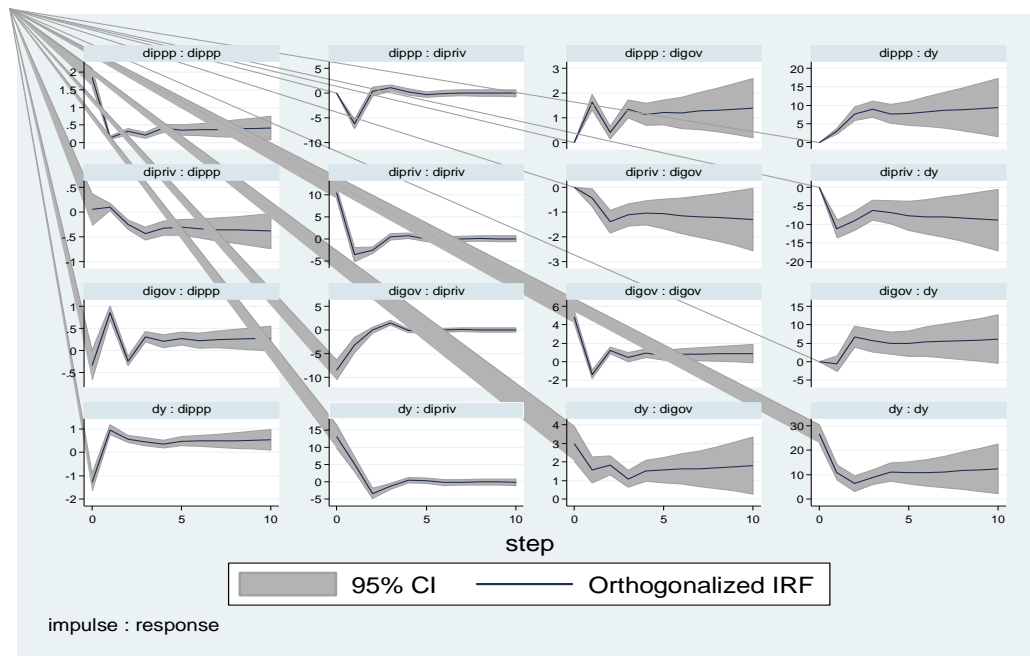

Figure 1. Impulse Response Functions (IRF) for ASEAN Developing Countries

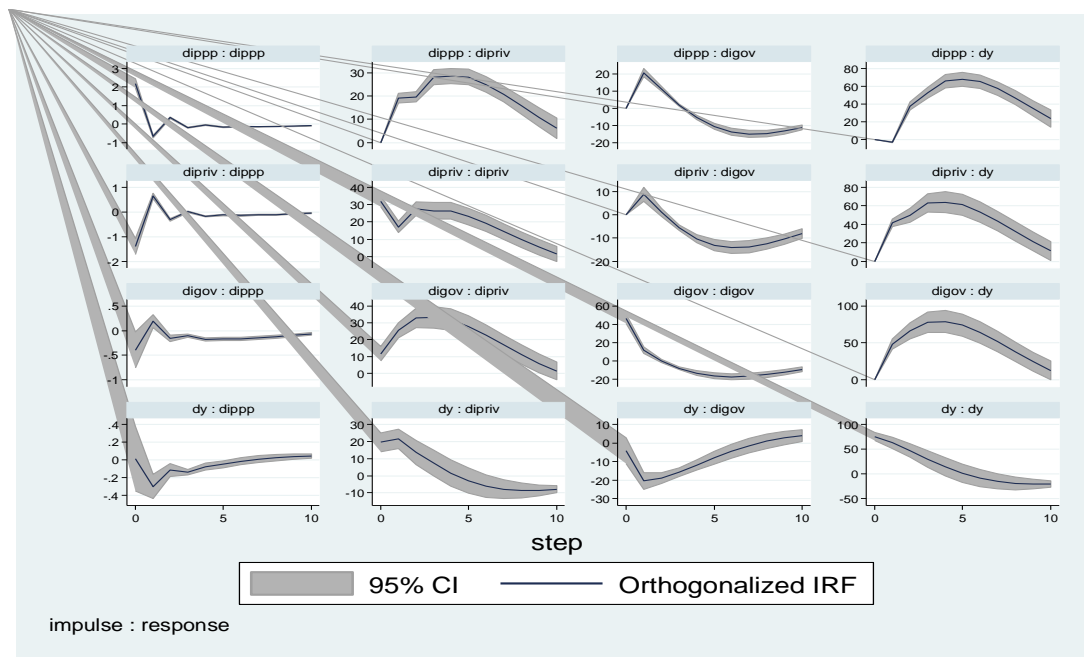*Source*: Author's calculations from Stata14.

Figure 2. Impulse Response Functions (IRF) for Non-ASEAN Developing Countries

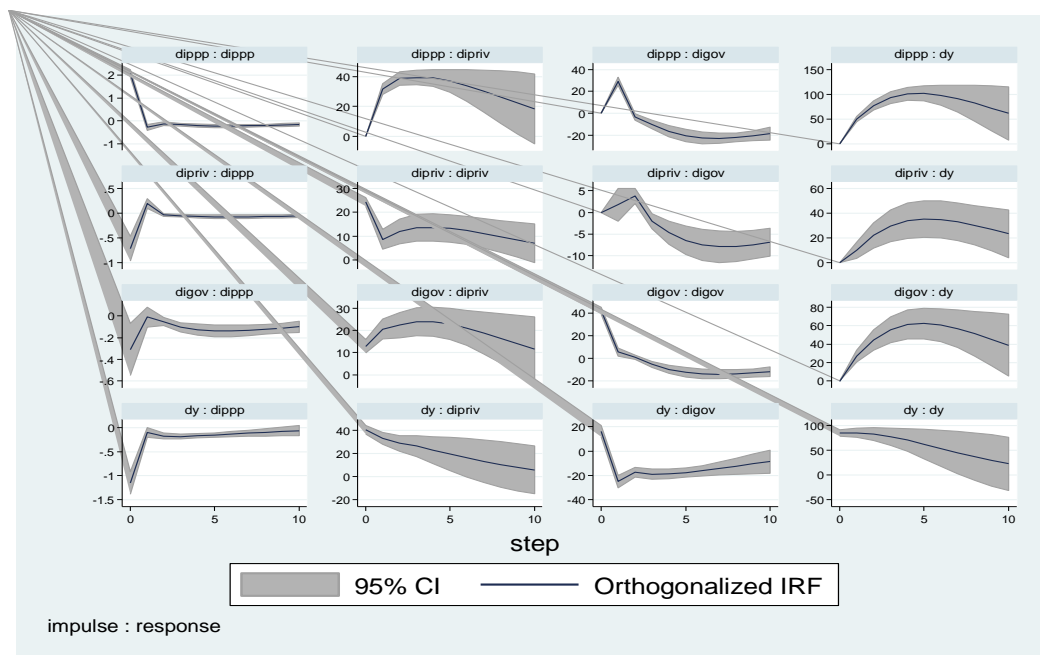*Source*: Author's calculations from Stata14.

Figure 3. Impulse Response Functions (IRF) for Whole Sample of Asian Developing Countries

Source: Author's calculations from Stata14.

The results from the impulse response function (Figure 1, Figure 2, Figure 3,) showing the effect of public investment on private investment and economic growth by group regions developing countries in Asia can be summarized in the following table (Table 7).

590

Table 7. The Results from the Impulse Response Functions by Group Regions Developing Countries in Asia

Effects	ASEAN developing countries	Non-ASEAN developing countries	Whole Asian Developing countries
Public Investment➔ Economic Growth	Public investment has a positive impact on economic growth in the medium-term, but it has negative effect in the short term and has no effect in long-term	The impact of public investment on economic growth with the inverted U-shaped pattern (which stimulates growth in the short and medium term, but in the long-term effects of stimulation growth tend to decrease)	The impact of public investment on economic growth with the inverted U-shaped pattern (which stimulates growth in the short and medium term, but in the long-term effects of stimulation growth tend to decrease)
Public-Private Partnership Investment➔ Economic Growth	Public Private Partnership investment has the effect of stimulating growth in the short and long term	Public Private Partnership investment in the short term does not have the effect on growth, but in the medium and long term it effects on growth with the inverted U-shaped pattern (which stimulates growth in the medium term, but in the long-term effects of stimulation growth tend to decrease)	The relationship between public-private partnership investment and growth in the inverted U-shaped effect (which stimulates growth in the short and medium term, but in the long-run, effects on growth tend to decrease)
Private Investment➔ Economic Growth	Private investment in the short term has no effect or negative effect on economic growth but in the medium and long term it has a positive effect on economic growth	Private investment stimulates growth in all terms with the inverted U-shaped pattern (which stimulates growth in the short and medium term, but in the long-term effects of stimulation growth tend to decrease)	Private investment has the inverted U-shaped effect on economic growth- stimulates growth in the short to medium term, but in the long-run effects on growth tend to decrease
Public Investment➔ Private Investment and Public-Private Partnership (PPP) Investment	Public investment has a stimulating effect on private investment in the medium and long term but it crowds out private investment in the short term; Public investment has the effect of public-private partnership investmentin the short term but it crouds out PPP investment in the medium term and has no effect in the long term	Public investment stimulates private investment in both the short run and the long run, but in the long term, the effects tend to decrease, the best effect in the medium term. While public investment stimulates Private-Public Partnership investment in the short term but it has no effect on PPP investment in the medium and in the long term	Public investment stimulates private investment in the short and medium term but in the long run the effect is reduced. Public investment only has the effect of stimulating PPP investment in the short term, but it has no effect in the medium-term and in the long-term

5. Conclusions and Policy Implications for Public Investment

The study used a quantitative method to assess the impact of public investment on private investment and economic growth based on data from two groups of developing countries over a 21-year period (1995-2015) by applying PVAR model combined with GMM. The findings show that all public

591

investment and public-private partnership investments affect private investment as well as affect economic growth but the effects vary cyclically, by time period, and by group of countries.

For the ASEAN developing countries, public investment crowds in private investment in the medium and long term but it crowds out private investment in the short term, it also crowds out public-private partnership investment in the medium term.

The findings for non-ASEAN developing countries in Asia are better, public investment has the positive effect on economic growth with U-shaped pattern (which reduces growth in the short and medium term but has the growth effect in the long-term). It also stimulates private investment in both the short run and the long run.

When we consider two groups in the whole sample of Asian developing countries, most of the results are in the in the inverted U-shaped effect (which stimulates growth in the short and medium term, but in the long-term effects of growth stimulation tends to decrease) and some of the effects are similar to those of non-ASEAN developing countries in Asia.

This can be explained by the fact that, when we combine two groups of countries in one which has a different size of economy and investment, different economic growth rate, these characteristics also affects the impact level and the trend of impact of public investment. For example, there are some developing countries in Asia has a large size of economy and high growth rates such as China, India while there are some small economy in ASEAN developing countries like Cambodia and Laos.

The results of this study provide some policy implications for ASEAN developing countries, including Vietnam as following:

First, ASEAN developing countries need to promote actively and effectively forms of PPP investment. Government should create the legal framework and favorable conditions for this type of investment to develop; help to increase investment efficiency, to reduce pressure on state budget spending. However, it should be noted that public-private partnership investment must be transferred to the private sector, and the government is only creating a good legal corridor to attract private investors to invest jointly with government in infrastructure development.

Second, public investment policy needs to be open and transparent. The lack of information in public investment leads to inefficient investment attraction.

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593

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Appendix A

List of ASEAN and Non-ASEAN Developing Countries in Asia

ASEAN developing countries			
Cambodia	Indonesia	Lao P.D.R.	
Malaysia	Philippines	Thailand	Vietnam

Non-ASEAN developing countries in Asia			
Bangladesh	China	Egypt	India
Iran	Iraq	Mongolia	Nepal
Pakistan	Sri Lanka	Yemen	