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Impact of Public Spending on Private Investment in Malaysia: Crowding-In or Crowding-Out Effect

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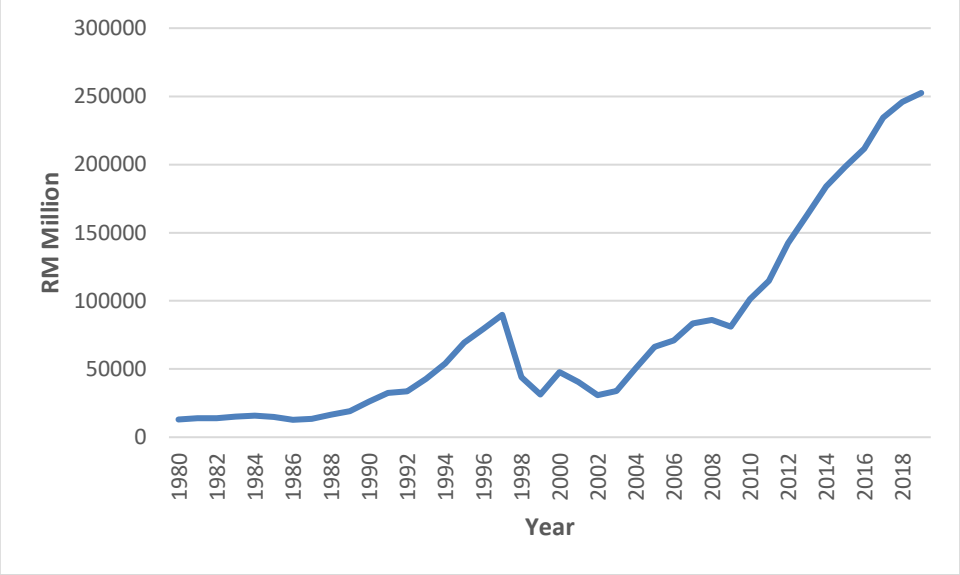
Abstract
This study intends to explore the crowding effect of disaggregated public expenditure on private investment in Malaysia from 1980 to 2016 via Vector Error Correction model. Empirical findings show that public spending has an enormous impact on long-term but marginal effect on short-term private investment. Specifically, private investment is significantly crowd-in education and defense of government expenditures while significantly crowd-out health and transportation expenditure in the long term. Nevertheless, there is insufficient evidence on short-run causality between public spending on private investment.

Keywords: Public spending, private investment, crowding-in, crowding-out

Introduction

Investment as part of the aggregate demand is viewed as an essential tool for economic expansion. According to the Department of Statistic, investments from the private sector remains unchanged as more than half of the total investment over sixteen (16) years. For instance, the private sector remains the driving force of the Malaysian total investment with a share of 65.4 percent, which grew steadily compared to the previous year (63.8 percent private investment in 2014). Both services and manufacturing activities mostly held private investment until the end of 2015. In 2015, the services component was the largest contributor to the private investment with a share about 51.8 percent meanwhile, the second largest component was held by manufacturing with 24.7 percent. The remaining 23.5 percent was derived from other activities of the private sector. On the other hand, the public sector's domestic investment was spearheaded mainly by Services and followed by Mining & Quarrying activities that contribute about 66.3 percent and 24.8 percent, respectively.

Figure 1 shows Gross fixed capital formation (formerly known as gross domestic fixed investment by World Bank) in Malaysia from 1980 to 2019. Overall, the trend of this particular private investment shows growing steadily except for 1997, in which the investment performance, especially in the private sector shows dropped sharply. Malaysia experienced a reduction in private sector investment before the 1997 Asian financial crisis from approximately RM89,671 in 1997 to RM31,375 million in 1999. The high volume of investment in the property sector has contributed to the boom and bust cycle of private investment over the last decade (Unteroberdoerster and Guimarães, 2006). During 1996-1998 period, the real growth rate of property in Malaysia was peaked at 30 percent per year. There were a few mega projects that underpinned the robust investment numbers. After the Asian Financial crisis in 1997, it turned negative and has remained substantially lower at about 5-10 percent per year since 2000.



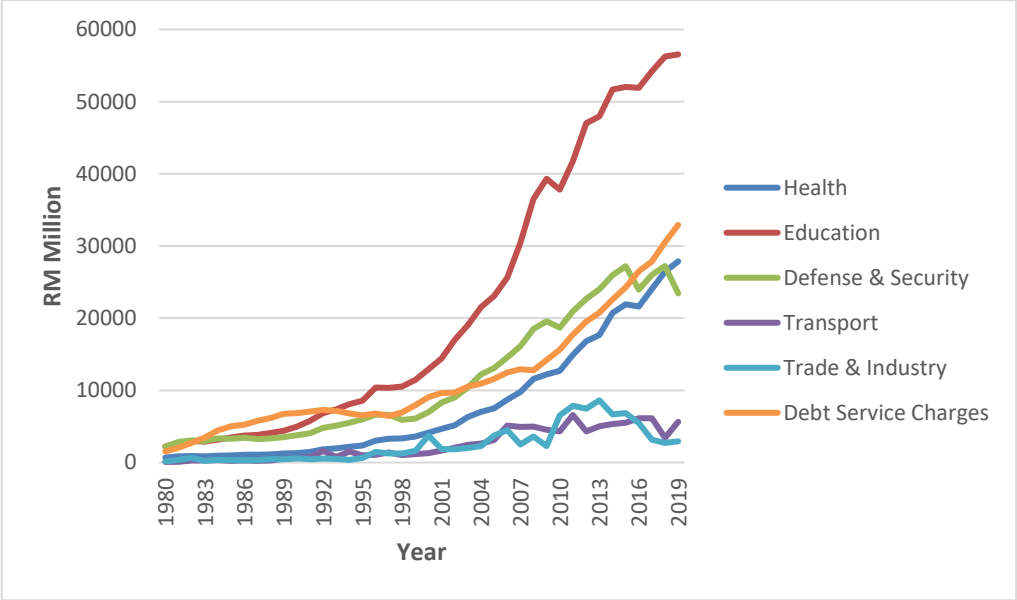
(Source: CEIC database, 2020)

Figure 1: Gross Fixed Capital Formation in Malaysia

There was a slight decrease in the private investment's Gross fixed capital formation with a drop of about 6 percent from a gradual growth over the past few years (drop RM5086 million from 2008 to 2009). However, Menon (2012) claims that the global financial crisis's onset pushed investment below 15 percent of GDP in 2009, which is the lowest level in recent history. The Gross fixed capital formation by the private sector in Malaysia did not affect much from the global financial crisis in 2008. This was mainly due the contingency plan as proposed by Malaysia's government's contingency plan to control and respond to the crisis. Malaysia introduced the stimulus packages intending to mend the economy as to encounter the recession (Goh and Lim, 2010). One of the projects is to allocate about RM1.5 billion to set up an investment fund to attract private sector investment in the country. The Gross fixed capital formation of the private sector recorded a tremendous growth until the present and this expansion has exceeded the value of Gross fixed capital formation during pre-crisis period. According to Ministry of International Trade and Industry (MITI) Malaysia Report (2015), new projects were the main contributors to domestic private investment. For instance, the projects were mainly in petroleum products that contribute about RM25.1 billion or 47.6 percent from total domestic investment approved in 2015. Apart from that, more than half of the total private investment were contributed by the services sector in 2015.

The above graph shows the major components of current public expenditure in Malaysia from 1980 until 2019. The highest expense of public contribution is in the education sector. On the other hand, the relatively low expenditures were channeled to trade and industry, agriculture and rural development, as well as the transport sector. From the observation of the graph above, the expenditures show gradual increase with a few movements of up and down except for expenses on general administration and trade and industry. At 2010, the expense for general administration shows sharp decreases from RM 27,123 million to RM 15,342 million which drop about 43 percent from previous year. Malaysian public expenses contribute about RM 10 million to RM 495 million roughly for all the components at year 1976. The overall average increases were from RM 567 million to RM 2,177 million for all these expenditure components, which shows about three times increases in this 10 years' period. In this period, all the components expenses were steadily increasing. Expense on debt service charges shows

gradually decreases until 1997 with about 13 percent from RM 7,304 million to RM 6,426 million with started decrease point at year 1992. However, the total debt began to decline for the first time in 1992 and this continued until 1996 when total debt stood at RM 89.68 billion. This was due to the rapid growth Malaysia enjoyed in that period and as the public drew surpluses, total debt reduced. The rapid rise of public expense on debt service charges recently was RM 26,479.42 million with approximately increase with 9 percent compared to previous year. The purpose of increasing the expenditure was to cover the increase in public debt which more than RM 627.5 billion.



(Source: CEIC database, 2020)

Figure 2: Major Components of Central Public Current Expenditure in Malaysia from 1980 to 2019

Education expenditure was about RM 10,398 million in 1996 and increased by approximately 399 percent (equivalent to 4 times increased) to RM 51,886 million in 2016. Moreover, the expenditure allocated to defence and security in Malaysia shows steadily increased until 2015, which recorded the highest expenditure by itself at RM 27,182.8 million. The growth rate of this expense was about 4.7 percent annually until 2015. This drop in expenditure was probably due to the sluggish of economic growth in this recent year in Malaysia, which resulted from falling in commodity price and leads to a weakened ringgit.

Motivation of study

The linkage between public spending and private investment has been intensively discussed in the literature, particularly the issue of crowding-in and crowding-out of private investment. It is essential to separate the public expenditure into component to study the disaggregated effect towards private investment (Aschauer, 1989). The private investment crowding-out happens when an increase in public spending decreases private investment. This is the argument made by neoclassical economists, that assumes full employment. Apart from that, this reduces the private sector due to the rise of interest rate when the public capital expenditure is financed by borrowing. Thus, if the interest rate is high, private investment will decrease. The crowding-out effect of high public spending on private investment would lead to a fall in Malaysia's local

investment. This situation would force Malaysia to rely substantially on foreign investment. Significant ownership by foreign companies, especially in strategically important industries, will lower Malaysia's comparative advantage. Apart from that, foreign investments are risky because the political and economic situation positively influences them in both home and host countries. Unexpected events in their home country or host country would lead to the withdrawal of investments by foreign investors from Malaysia.

On the other hand, crowding in effect reacts in the opposite direction to the crowding out effect, as the surge in public spending would increase the private investment. This is because an increase in public spending would stimulate the domestic economy, which will increase private investment. An increase in local investment in Malaysia indicates a high return on investment for the domestic economy. Heavy reliance on foreign investment over domestic investment would squeeze up domestic capital stock growth. Therefore, promoting domestic investment is worthwhile to ensure sustainable growth.

Literature Review

Several studies are examining on the occurrence of public spending, either crown-our or crowd-in private investment. For example, Narayan (2004) used Autoregressive distributed lag (ARDL) to analyze public spending and private investment in Fiji from 1950 to 2000. Findings showed that public investment over the period 1950–1975 had an effectual crowding on private investment. Hussain, Mohammad, Akram and Lal (2009) investigated the linkage between private investment and public spending in Pakistan from 1975 to 2008. The empirical findings indicated that defense expenditure and debt financing crowd-out private investment. Mahmoudzadeh, Sadeghi, and Sadeghi (2013) investigated the impact of disaggregated public spending on advanced and developing countries' private investment from 2000 to 2009. Their empirical panel findings showed that there is a crowd-in effect of public spending on investment. Xu and Yan (2014) investigated whether public spending has the effect of crowding out or crowding in private investment in China on an annual basis between 1980 and 2011. The findings showed that public spending on public goods is significantly crowded in private investment while public spending on commercial goods, industry and trade is significantly crowded out private investment.

Rahman et al. (2015) analyzed the impact of disaggregated public expenditure on private investment in Pakistan from 1974 to 2010. Empirical results suggested that the effect of public spending on agriculture, communication, safety, and transportation on private investment is crowding. In addition, there is the crowding-out impact on private investment for spending on debt financing. Meanwhile, Sinevičienė (2015) has conducted a panel test on the association between public expenditure and private investment in Bulgaria, Estonia, Latvia, Lithuania and Slovenia from 1996 to 2012. The findings showed weak evidence on either crowding-out or crowding-in between public expenditure on private investment. Choong, Law, and Pek (2015) investigated the linkages amongst private investment, government investments, foreign direct investment (FDI) and economic growth in the case of Malaysia annually from 1970 to 2011. Their result shows that in long run relationship, the private investment is positively correlated to both FDI inflows and government spending and negatively related to interest rate (cost of borrowing).

On the other hand, in short run relationship, all explanatory variables are significant to Granger cause private investment where it also appears bidirectional causality between FDI and private investment, and economic growth and private investment. Furthermore, the study conducted by Teklay (2016) is entitling with the impact of government expenditure on growth of private sector investment the case of Ethiopia. The study used secondary time series data annual from 1981 to 2014. The result from the analysis indicates that capital expenditure in the long run

model output has a significant and positive effect on private investment. The positive value shows that capital expenditure has crowed in private investment.

Methodology

Data adopted are obtained from CEIC database and Department of Statistic Malaysia from1980 until 2016. Specifically, the variables used in this study includes private investment, disaggregate level of public expenditures, Gross Domestic Product (GDP), and Foreign Direct Investment (FDI). Gross Fixed Capital Formation of private sector is selected as the proxy of private investment because there are a number of previous related studies that used gross fixed capital formation as the indicator for private investment. From the previous study, the rise in public expenditures will either increase or decrease the private investment and the results may differ in terms of short-sun and long-run.

Empirical Model

The empirical model for this study is followed by the model used by Şen and Kaya (2014). This model emphasized the study of each separate effect of public expenditure on private investment. The empirical model of the study is expressed follows:

$$LGFCF_t = \beta_0 + \beta_1 LHEA_t + \beta_2 LEDU_t + \beta_3 LDEF_t + \beta_4 LTRA_t + \beta_5 LRGDP_t + \beta_6 LFDI_t + \varepsilon_t \quad (1)$$

where,

LGFCF = logarithm of Gross Fixed Capital Formation;
LHEA = logarithm of Malaysia public current Health expenditure;
LEDU = logarithm of Malaysia public current Education expenditure;
LDEF = logarithm of Malaysia public current Defense and Security expenditure;
LTRAN = logarithm of Malaysia public current Transport expenditure;
LRGDP = logarithm of Real Gross Domestic Product;
LFDI = logarithm of Foreign Direct Investment Inflow;
β_0 = Constant;
β_1 = Coefficient of public health expenditure;
β_2 = Coefficient of public education expenditure;
β_3 = Coefficient of public defense and security expenditure;
β_4 = Coefficient of public transport expenditure;
β_5 = Coefficient of Real Gross Domestic Product;
β_6 = Coefficient of Foreign Direct Investment Inflow;
ε_t = Residual terms.

Private investment

Many indicators measure private investment. Indicator such as gross domestic investment, private sector gross fixed capital formation, fixed asset investment index is used to measure as the proxy of private investment. In previous related studies, Rahman et al. (2015); Mahmoudzadeh et al. (2013); Şen and Kaya (2014); Kuismanen and Kämppi (2010); Narayan (2004); used the fixed private investment to measure the private investment to obtain the result. However, Hussain et al. (2009); Malizard (2014); Furceri and Sousa (2011); Gbenga et al. (2015); Forgha and Mbella (2013) used the private gross fixed capital formation to measure the private investment.

Public expenditure

There are three possibilities of the relationship between them: positive relationship (crowding-in), negative relationship (crowding-out), and no significant relationship between variables. Many researchers are using single total public expenditure to measure the effect of private investment in their literature, such as the study of Furceri and Sousa (2011); Hassan and Salim (2011); Kuismanen and Kämppi (2010); Narayan (2004). Hussain et al. (2009); Nurudeen and Usman (2010); Gbenga et al. (2015) studies disaggregated level of public expenditure into components by objects spending such as health expenditure, education expenditure, debt service charges, transport and communication expenditure, defense and security expenditure and etc. These explanatory variables have explained every subcomponents effect on private investment. Examining the disaggregate public expenditure will provide more insight into the respective type of expenditure effect on domestic investment.

Gross domestic product

The sign of β_5 is anticipated to have positive relationship to the private investment. This is because of the accelerator model which means that the economic growth-investment relationship is positive. Therefore, the GDP is the potential significant of the variable that affects private investment. Apart from that, Gross Domestic Product (GDP) is closely affecting the private investment. This factor variable has been used in the study of Kustepeli (2005); Şen and Kaya (2014); Hussain et al. (2009); Wu and Zhang (2009); Furceri and Sousa (2011); Hassan and Salim (2011); Kuismanen and Kämppi (2010); Ifeakachukwu et al. (2013); Gbenga et al. (2015); Etkisi and Analizi (2011); Forgha and Mbella (2013).

Foreign direct investment

The sign of β_6 is anticipated to have positive effect to private investment via capital and technological accumulation. However, FDI remains controversy in term of whether FDI inflow can increase the local private investment in Malaysia. Choong et al. (2015) suggest positive effect of FDI inflows towards local private investment as the FDI inflows can bring in newer technologies and capital into the country. However, this also depends on the ability of private investment to absorb the efficiencies. Foreign direct investment (FDI) and private investment are closely related. Some authors adopt FDI as one of the explanatory variables for explaining private investment, such as the Choong et al. (2015) and Wu and Zhang (2009).

Augmented Dickey-Fuller (ADF) test

ADF test involved fitting into the following regression model:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \lambda_t + \sum_{i=1}^{p} a_i \Delta Y_{t-i} + \varepsilon_t \qquad (2)$$

where α refers to a constant, while β and λ are the coefficients, t is the time series trend, p is the optimal lag order of the autoregressive process, and ε is the disturbance term. When rejecting the null hypothesis, it means the variable is stationary. Meanwhile, when the null hypothesis is not rejected the variable is said to be non-stationary.

Philips and Perron (PP) test

The PP test is used to verify data stationarity for each element. Compared with ADF unit root test there are two advantages. First, the PP test does not need to specify a lag duration for the regression of the test, and this may prevent any problems with error specification. Secondly, unlike the ADF test, which implicitly assumes heteroscedastic error terms, PP unit root test is robust to general type of heteroscedasticity.

The regression for the PP test can be expressed as follows:

$$\Delta PI_t = \alpha + \beta PI_{t-1} + \varepsilon_t \quad (3)$$

where α is a constant, βPI_{t-1} is correction factor, and t refers to the number of observation. Furthermore, the advantage of using PP test is that it does not require researcher to specify form of the serial correlation of ΔY_t under the null hypothesis. This help to avoid the wrongly specified p when using the ADF test.

Johansen and Juselius Multivariate Cointegration test

The Johansen and Juselius (1990) multivariate approach is used to quantify the number of cointegrating vectors in the system. The Johansen-Juselius Cointegration test can be referred to as regression as followed:

$$\Delta X_t = \Pi X_1 + \sum_{i=1}^{k-1} \Pi_i \Delta X_{t-i} + \mu_t + \epsilon_t \quad (4)$$

where Δ = the difference operator

X_t= (n x 1) vector of I(1) variables (Private investment and Public expenditure);

Π and Π_i = (n x n) coefficient matrixes where i = 1, 2, 3,…, k-1;

k = the lag length;

μ_t = (n x 1) constant vector

ϵ_t = independent and normally distributed (mean = 0 and covariance matrix Ω.)

If Π is equal to zero, this means that the linear stationary combination does not exist. In other words, X_t does not cointegrated. On the other hand, if Π is greater than zero, there is a possibility for linear stationary combination exists and brings ahead in the division of Π into two matrices, for instance α and β, such that:

$\Pi = \alpha\beta'$

where α = necessary adjustment coefficient matrix

B = coefficient vectors of r cointegration relationship.

Vector Error-Correlation Model (VECM)

Once the variables are found to be co-integrated in the estimated scheme, VECM is adopted for estimating the short-run dynamic causality relationship.

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{n} \beta_1 \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_2 \Delta X_{t-i} + \gamma_1 ECT_{t-i} + \varepsilon_t \quad (5)$$

$$\Delta X_t = \varphi_0 + \sum_{i=1}^{n} \varphi_1 \Delta X_{t-i} + \sum_{i=1}^{n} \varphi_2 \Delta Y_{t-i} + \gamma_2 ECT_{t-i} + \mu_t \quad (6)$$

where Δ is the lag operator, $\alpha_0, \varphi_0, \beta_1, \beta_2, \varphi_1, and\ \varphi_2$ are the estimated coefficients, meanwhile n represent the optimal lags length, $\varepsilon_t\ and\ \mu_t$ are the serially uncorrelated disturbance, $\gamma_1 and\ \gamma_2$ measure as a single period response of the shock towards back to equilibrium.

Granger Causality Test

This test is used to analyze whether the independent variable (health expenditure, education expenditure, defense and security expenditure, transport expenditure, real GDP, FDI) are exogenous in a bivariate relationship with dependent variable (private investment), It is a simple form of Granger-causal modelling proposed by Granger (1969) is the suitable test to use. The equations are show as below:

$$\Delta LGFCF_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LPI_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LHEA_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LEDU_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LDEF_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LTRAN_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LRGDP_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta LHEA_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LHEA_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LGFCF_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LEDU_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LDEF_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LTRAN_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LRGDP_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (8)$$

$$\Delta LEDU_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LEDU_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LHEA_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LGFCF_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LDEF_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LTRAN_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LRGDP_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (9)$$

$$\Delta LDEF_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LDEF_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LGFCF_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LHEA_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LEDU_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LTRAN_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LRGDP_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (10)$$

$$\Delta LTRAN_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LTRAN_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LGFCF_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LHEA_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LEDU_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LDEF_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LRGDP_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (11)$$

$$\Delta LRGDP_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LRGDP_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LGFCF_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LHEA_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LEDU_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LDEF_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LTRAN_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LFDI_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (12)$$

$$\Delta LFDI_t = \delta_0 + \sum_{i=1}^{p} \alpha_{1i}\Delta LFDI_{t-i} + \sum_{j=0}^{p} \alpha_{2j}\Delta LGFCF_{t-j} + \sum_{k=0}^{p} \alpha_{3k}\Delta LHEA_{t-k} + \sum_{l=0}^{p} \alpha_{4l}\Delta LEDU_{t-l} + \sum_{m=0}^{p} \alpha_{5m}\Delta LDEF_{t-m} + \sum_{n=0}^{p} \alpha_{5n}\Delta LTRAN_{t-n} + \sum_{q=0}^{p} \alpha_{5q}\Delta LRGDP_{t-q} + \lambda ECT_{t-1} + \varepsilon_t \quad (13)$$

where δ is intercept, ε_t is disturbance, and *i, j, k, l, m, n* and *q* is the optimal lags for variables, ECT represent convergence rate to reverse to its long-run equilibrium. There are two ways to find the causality for VECM framework which is *F* statistic or Wald test of explanatory variable refers to the short run causal effect, while *t*-test of ECT indicate the long run relationship.

Empirical Result

Unit Root Test

Table 1 shows the result of unit root test of Augmented Dicky Fuller (ADF) test and Philip-Perron (PP) test. Both of the tests show that the variables are non-stationary at level which denoted to *I*(0) except for the series Foreign Direct Investment (LFDI) which stationary at level for trend and intercept in PP test. However, all the variables are stationary at first differencing for both unit root tests. Furthermore, both tests usually have the same results despite their variations where the PP test lacks any serial association while ADF test uses a parametric autoregression to estimate the error structures (Shi, Li, and Alexiadis, 2012). From the overall result, we focus on the ADF test result which all variables stationary at first differencing. The study, therefore, performs a long-term analysis of cointegration between the variables.

Table 1: Results on Unit Root Test of ADF and PP Test

	Test Statistics			
	ADF		PP	
	Level			
Variables	**Trend and Intercept**	**Intercept**	**Trend and Intercept**	**Intercept**
LGFCF	-2.6904 (1)	-0.3724 (0)	-2.2072 (2)	-0.3724 (0)
LHEA	-2.1052 (1)	0.1529 (0)	-2.1052 (0)	0.1501 (1)
LEDU	-0.3677 (0)	-1.5266 (0)	-0.6860 (1)	-1.5266 (0)
LDEF	-1.1376 (0)	-1.2513 (0)	-1.6067 (3)	-1.1797 (3)
LTRAN	-2.2851 (1)	-2.4274 (1)	-3.5280 (3)	-2.3459 (3)
LRGDP	-1.2580 (0)	-1.2311 (0)	-1.3973 (2)	-1.1713 (1)
LFDI	-3.1967 (2)	-1.5336 (2)	-5.2547 (1)**	-3.0313 (3)**
	First Differences			
ΔLGFCF	-4.679 (0)**	-4.7353 (0)**	-4.5961 (2)**	-4.6574 (0)**
ΔLHEA	-5.5375 (1)**	-5.4637 (0)**	-6.1389 (1)**	-6.1079 (1)**
ΔLEDU	-4.9533 (0)**	-4.9289 (0)**	-4.9792 (1)**	-4.9500 (1)**
ΔLDEF	-4.9410 (0)**	-4.9921 (0)**	-4.9552 (2)**	-5.0007 (0)**
ΔLTRAN	-9.5390 (0)**	-9.0720 (0)**	-9.5390 (0)**	-9.1446 (0)**
ΔLRGDP	-5.0932 (0)**	-5.0386 (0)**	-5.0932 (0)**	-5.0528 (1)**
ΔLFDI	-6.7926 (1)**	-6.8947 (1)**	-20.954 (18)**	-21.172 (18)**

Notes: Asterisks (**) indicate statistically significant at 5 percent level. Figure in parentheses are lag length. The optimal lag length for ADF test is selected using the SIC (Schwarz Info Criterion) while the bandwidth for PP tests are selected using the Newey-West Bartlett kernel. Δ denotes first difference operator.
LGFCF = logarithm of Gross Fixed Capital Formation, LHEA = logarithm of Malaysia public current Health expenditure, LEDU = logarithm of Malaysia public current Education expenditure, LDEF = logarithm of Malaysia public current Defense and Security expenditure, LTRAN = logarithm of Malaysia public current Transport expenditure, LRGDP = logarithm of Real Gross Domestic Product, LFDI = logarithm of Foreign Direct Investment Inflow.

Cointegration Test

Table 2 represents the results of Johansen and Juselius Cointegration test. Trace statistic has statistical evidence to reject the null hypothesis of r=1, r=2 and r=3 because the test statistics of 163.2081, 111.4343 and 74.0391 are greater than critical value of 125.6154, 95.7536 and 69.8188, respectively at 5% level of significance. In terms of Maximum Eigenvalue test, there is statistical evidence to reject null hypothesis because the test statistics 51.7737 of null hypothesis r=1 is larger than critical value 46.2314 at 5% level of significance. Maximum Eigenvalue result is preferred compared to Trace test due to its ability to capture the number of cointegrating vector. Therefore, there is evidence of long-run equilibrium among the variables.

Table 2: Results on Johansen and Juselius Cointegration Test

Null	Alternative	k=2			
		λmax	95% CV	Trace	95% CV
r=0	r=1	51.7737**	46.2314	163.2081**	125.615
$r\leq1$	r=2	37.3951	40.0775	111.4343**	95.7536
$r\leq2$	r=3	31.4950	33.8768	74.0391**	69.8188
$r\leq3$	r=4	17.7224	27.5843	42.5440	47.8561
$r\leq4$	r=5	13.3930	21.1316	24.8216	29.7970
$r\leq5$	r=6	10.0893	14.2646	11.4286	15.4947
$r\leq6$	r=7	1.3393	3.8414	1.3393	3.8414

Notes: Asterisks (**) denote statistically significant at 5% level. The k is the lag length.

Normalized Cointegrating Equation

Table 3 shows the normalized estimated result of the regression in long run.

Table 3: Normalized Cointegrating Equation

Variables	Coefficient	Standard errors	*t* values
LEDU	5.6839*	2.7697	2.0522
LDEF	3.4129	2.9117	1.1720
LHEA	-8.9262*	3.3005	-2.7045
LTRAN	-1.6450*	0.9786	-1.6812
LRGDP	6.5141*	2.8562	2.2807
LFDI	0.8594*	0.2252	3.8169

Notes: Asterisks (**) indicate statistically significant at 5% level and (*) indicate statistically significant at 10% level.

LHEA = logarithm of Malaysia public current Health expenditure, LEDU = logarithm of Malaysia public current Education expenditure, LDEF = logarithm of Malaysia public current Defense and Security expenditure, LTRAN = logarithm of Malaysia public current Transport expenditure, LRGDP = logarithm of Real Gross Domestic Product, LFDI = logarithm of Foreign Direct Investment Inflow.

$$LGFCF_t = -80.435 + 5.684LEDU_t - 3.413LDEF_t - 8.926LHEA_t - 1.645LTRAN_t + 6.514LRGDP_t + 0.859LFDI_t$$

The findings show that education and defense expenditures crowd in private investment but the coefficient for defense expenditure is insignificant. This means that increase 1 percent of expenses in education, it will cause the rise in the private investment about 5.68 percent in Malaysia. The positive and significant coefficients consistent with Keynesian theory, whereas public expenditure stimulates private investment in long run. High performance in education level is believed to contribute to the vital human capital that leads to efficiency and productivity of human resources, which can benefit the investment made today to have a high return.

Additionally, results also show the crowd-out effect of public spending (health and transport) on private investment. The coefficient of health and transport expenditures was -8.92 and -1.65, representing that every 1 percent increase in these expense items will lead to the drop of private investment about 1.86 percent and 0.77 percent, respectively in Malaysia. This is in line with the study by Rahman et al. (2015), where public transport and health expenditure are highly significant with crowd-out effect in the long run. In addition, there was also crowd-in effect from real GDP and FDI toward private investment, which shows positive relation significantly.

Short-run Causality Model (Vector Error Correction Model –VECM)

Granger causality test based on VECM is adopted to explore the short run dynamics between the variables. Table 4 shows the Granger causality results based on VECM.

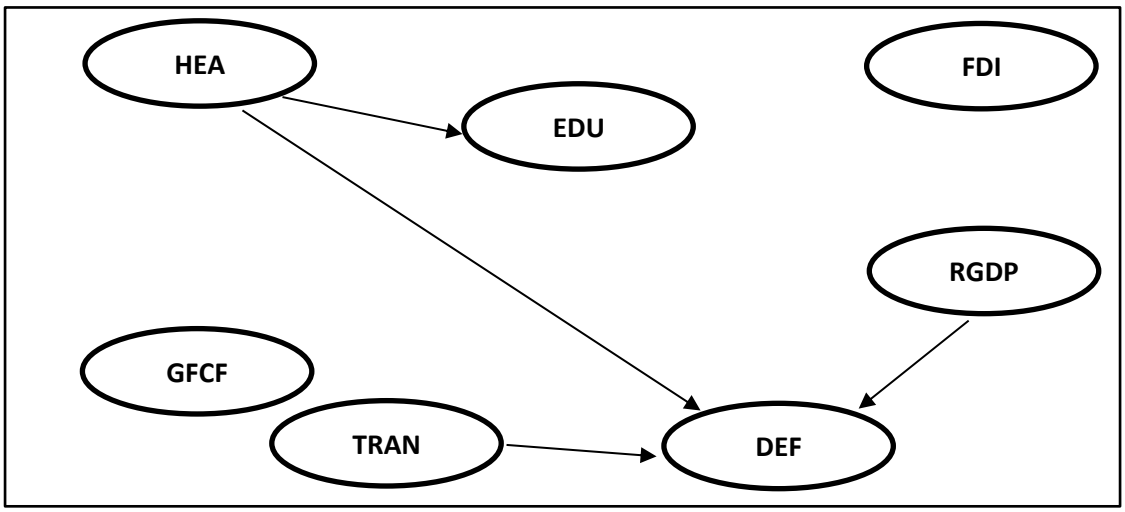
In Table 4, there are 3 coefficients of ECT that are statistically significant at 3.5%, 7.2% and 6.4%, which represents convergence rate towards equilibrium per year. This means Malaysia needs about 13.88 years to 28.57 years to bring back to equilibrium. Figure 3 illustrates the causality relationship of the variables where only uni-directional causality from public spending on transport, public spending on health and real GDP to public spending defense and also uni-directional causality from public spending on health to public spending on education.

Table 4: Granger causality results based on vector error correction model

	ΔLGFCF	ΔLEDU	ΔLDEF	ΔLHEA	ΔLTRAN	ΔLRGDP	ΔLFDI	ECT
				x^2-statistic(*p*-value)				[*t*-ratio]
ΔLGFCF	-	0.265	0.888	0.778	0.032	4.434	2.051	-0.015
		(0.875)	(0.641)	(0.677)	(0.983)	(0.108)	(0.358)	[-0.243]
ΔLEDU	0.738	-	3.180	8.710**	3.430	0.637	0.874	-0.035**
	(0.691)		(0.203)	(0.012)	(0.179)	(0.727)	(0.645)	[-2.425]
ΔLDEF	4.116	5.884	-	14.315**	7.260**	6.922**	0.460	-0.072**
	(0.127)	(0.052)		(0.000)	(0.026)	(0.031)	(0.794)	[-4.454]
ΔLHEA	0.885	2.119	0.121	-	1.222	0.694	0.975	-0.064**
	(0.642)	(0.346)	(0.941)		(0.542)	(0.706)	(0.614)	[-4.489]
ΔLTRAN	0.110	1.346	2.803	4.208	-	0.301	1.278	-0.019
	(0.946)	(0.510)	(0.246)	(0.121)		(0.860)	(0.527)	[-0.214]
ΔLRGDP	1.690	0.447	0.203	0.425	0.470	-	0.761	-0.004
	(0.429)	(0.799)	(0.903)	(0.808)	(0.790)		(0.683)	[-0.376]
ΔLFDI	3.031	0.963	0.815	1.028	0.998	5.026	-	0.140 [
	(0.219)	(0.617)	(0.665)	(0.597)	(0.607)	(0.081)		0.421]

Notes: The x^2-statistic tests the joint significance of the lagged values of the independent variables, and the significance of the error correction term (s). The figures in parentheses are the *p*-values. Asterisks (*) indicate statistically significant at 5 percent level.

LGFCF = logarithm of Gross Fixed Capital Formation, LHEA = logarithm of Malaysia public current Health expenditure, LEDU = logarithm of Malaysia public current Education expenditure, LDEF = logarithm of Malaysia public current Defense and Security expenditure, LTRAN = logarithm of Malaysia public current Transport expenditure, LRGDP = logarithm of Real Gross Domestic Product, LFDI = logarithm of Foreign Direct Investment Inflow.



LGFCF = logarithm of Gross Fixed Capital Formation, LHEA = logarithm of Malaysia public current Health expenditure, LEDU = logarithm of Malaysia public current Education expenditure, LDEF = logarithm of Malaysia public current Defense and Security expenditure, LTRAN = logarithm of Malaysia public current Transport expenditure, LRGDP = logarithm of Real Gross Domestic Product, LFDI = logarithm of Foreign Direct Investment Inflow.

Figure 3: Short run causality

Conclusion

This research aims to examine the evidence of crowd-in or crowd-out effect between public spending and private investment from 1980 to 2019 at a disaggregated level. Empirical findings show that private investment is strongly associated (crowd in) with education public spending, real GDP and FDI. However, private investment also significantly crowds out to both health and transportation expenditure in the long run. Meanwhile Granger causality results show that there is insufficient evidence to conclude that there is any short run causality relationship between the concerned variables: the short run relationship of private investment and disaggregate level of public expenditures. However, public spending on transport, public spending on health and real GDP have uni-directional causality to public spending defense and also uni-directional causality from public spending on health to public spending on education in the short run. In terms of policy perspective, public expenditure in education is essential for capital development and may induce private investment. Policymakers should continue to ensure the optimal level of spending on education in the long term.

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