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Causality between foreign direct investment and economic growth for Cambodia

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Abstract: The relationship between foreign direct investment (FDI) and economic growth in recipient economies remains one of the hottest debates. As confirmed in the literature, many studies support the growth impact of FDI, but some do not. Cambodia, a war-torn economy, also depends on FDI as a driver of economic growth. In addition, the causal relationship between FDI and growth in Cambodia is not fully known. Therefore, this paper is an attempt to examine the causal link between the two variables over the period 1980–2014, using Granger causality test based on the vector error correction model. The empirical results provide strong evidence on the causal impact of FDI on Cambodia's economic growth (GDP). However, the study does not confirm causality to run from GDP to FDI. This can be concluded that the growth impact of FDI is sufficiently supported in Cambodia.

Subjects: Economics and Development; Macroeconomics; Econometrics

Keywords: causality; Cambodia; economic growth; foreign direct investment

1. Introduction

Today is the era of globalization, which reflects the free movement of multinational companies (MNCs) from the developed to the developing world. A huge amount of foreign direct investment (FDI) is seen to flow into developing countries through MNCs. For many decades, FDI has been treated as a major source of capital accumulation, which in turn leads to economic growth in a recipient economy; therefore, these countries produce all possible policies to attract more inward FDI via removing restrictions of foreign investment, enhancing domestic economic policies and regulations, promoting the financial sector development, and producing encouraging environments for foreign investment.

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PUBLIC INTEREST STATEMENT

In developing countries, it is believed that foreign direct investment (FDI) positively contributes to economic growth. In addition, many empirical findings also confirm the positive link between FDI and growth in recipient countries. Therefore, each developing country produces various policies to attract inward FDI with a purpose to enhance their economic growth and development. However, in some countries, FDI does not seem to promote growth it might be due to a number of barriers, including political instability and low levels of human capital, trade openness, or financial sector development, etc. With focus on Cambodia, FDI is found to promote economic growth, meaning that FDI is an important vehicle of growth in this country as well.

As postulated in theory, FDI is one of the main drivers of economic growth. However, empirical evidence has lagged behind. For example, a number of findings support FDI to be an important catalyst for growth (e.g. Nair-Reichert & Weinhold, 2001; Pegkas, 2015; Vu, Gangnes, & Noy, 2008; Yao & Wei, 2007), some confirm the variable to have growth impact in a host economy only with a strong financial system (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Durham, 2004) and a high level of human capital (Borensztein, De Gregorio, & Lee, 1998; Li & Liu, 2005). Others indicate that the link between FDI and growth is unclear (Herzer, Klasen, & Nowak-Lehmann, 2008). In addition, some empirical findings do not support the view that FDI has positive impact on growth (e.g. Duasa, 2007; Kholdy, 1995; Mohamed, Singh, & Liew, 2013). Although the growth impact of FDI is debatable, it is still strongly believed and recommended that the variable has a vital role in boosting growth because its benefits are seen in many countries around the globe.

Turning to Cambodia, the country had gone through approximately three decades of political upheavals, especially civil wars, which destroyed nearly all types of infrastructure and human capital; therefore, it is quite challenging for the country to stand up and strive to develop this war-torn economy with empty hands. In the sense, foreign capital plays a very significant role in helping the country to generate growth. Although a huge amount of inward FDI is seen in many developing nations, FDI inflows into Cambodia were likely to be small before the 1990s. However, it starts to increase gradually thereafter although the size is still small compared to other ASEAN[1] member states. Internationally, there has been a large body of empirical literature on the growth impact of FDI in low and medium-income countries, but findings on the causal impact of FDI on Cambodian growth are not fully known. Therefore, the present paper is an attempt to examine the causality between FDI and growth in Cambodia, using time-series techniques of co-integration and Granger causality based on the vector error correction model (VECM).

The remainder of the paper proceeds as follows: Section 2 illustrates an overview of FDI and economic growth. Section 3 focuses on literature review. In Section 4, the data and methodology are discussed. Section 5 presents the empirical findings, and Section 6 provides the conclusion and policy implications of the study.

2. An overview of FDI and economic growth in Cambodia

FDI really plays an imperative role as a vehicle of growth in Cambodia because this country had passed through many tragic generations, particularly the Pol Pot regime,[2] which devastated almost all types of infrastructure, including human capital and approximately two millions of innocent lives. Due to lack of domestic capital for enhancing growth and development, foreign capital, chiefly FDI, is certainly beneficial to this goal. In order to attract inward FDI, Cambodia had to do a major economic reform, moving from a centrally planned economy to a market-oriented economy in the late 1980s; the country also improves the investment and business environments for foreign investors via establishing the Investment Law in 1994.

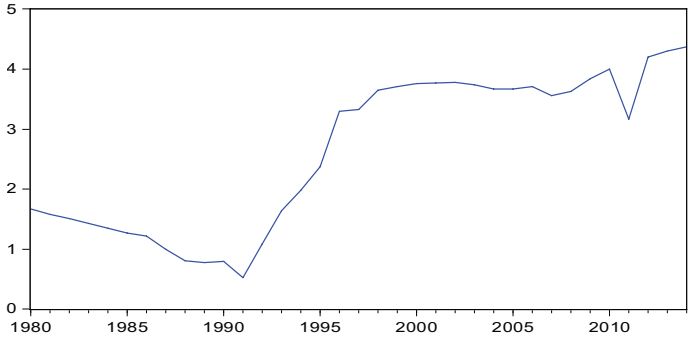


Figure 1. The ratio of FDI stock to GDP (in logarithm).

Source: UNCTAD (2015).

Before the 1990s, FDI stock as a percentage of GDP was relatively small. For example, for the period 1980 to 1989, FDI stock as a percentage of GDP was only 3.58% on average. Unfortunately, the amount was still small from 1990 to 1993 and it starts to increase gradually thereafter. To attract more inward FDI, the government of Cambodia enacted the Investment Law in 1994. As a result, FDI stock was likely to increase at a remarkable rate. From 1994 to 1998, FDI stock as a percentage of GDP was 18.8%. This amount continued to increase to 43.09% for the period 1999 to 2014 (see Figure 1). This growth occurs due to political stability, world and regional economic integration, investment law enforcements, and preferential economic policies, which produce good opportunities for foreign investors.

Looking at the growth trends of GDP, it is likely to fluctuate over time. For example, during the period 1980 to 1989, the average annual growth rate of real GDP was only 4.69 and 4.94% for the period 1990 to 1993. This growth slightly increased to 5.76% for the period 1994 to 1998. This slow growth occurs due to political instability because full peace in the country was not restored yet. In this period, civil wars still occurred in many parts of Cambodia, particularly along the borders with Thailand, producing difficulties for the government's development projects to enter the areas. Therefore, many parts of Cambodia are still in abject poverty. Fortunately, from 1999 to 2014, GDP growth rate was 8.1% on average (See Figure 3). This represents a noticeable economic success that Cambodia has gained. This high growth was due to full political stability and the expansion of the four pillars of growth, namely construction, textile and garment, tourism, and agriculture. However, for the whole period, the annual real GDP growth was 6.52% (see Appendix 1) lower than that of the last decade (8.1%). Although growth rate was relatively high during the last decade, it is also influenced by external shocks. For example, in 2009, real GDP growth was only 0.1% (See Figure 3). This economic slowdown was mainly due to the financial crisis that occurred in the United States in 2008 and spread to other parts of the world. Cambodia, a country that has a trade link with the US, is negatively affected. This indicates that Cambodian economy seems to be prone to external shocks, leading to decrease in the three main pillars of growth, namely textile and garment, construction, and tourism industries. The shrinkage in the three pillars dramatically affected growth in the country. Fortunately, due to recent world economic recovery, Cambodian economy also starts to regain its economic strength by achieving real growth rates of 7.3, 7.4, and 7% in 2012, 2013, and 2014, respectively (See Figure 3).

Figure 2. Real GDP per capita (in logarithm).

Source: UNCTAD (2015).

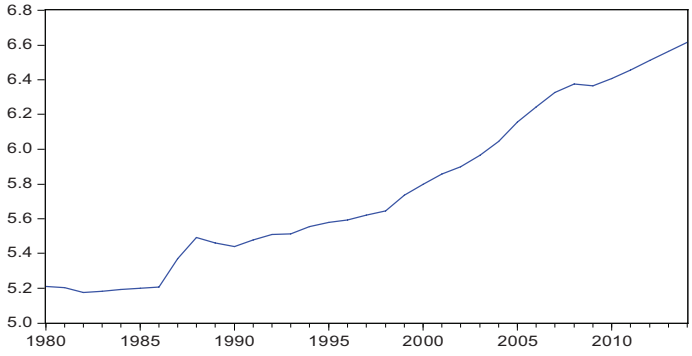
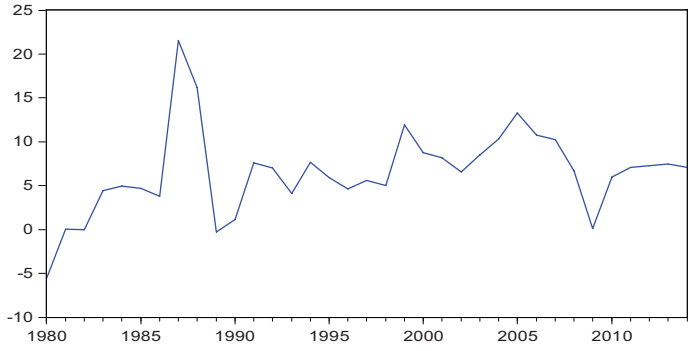


Figure 3. Real GDP growth (annual %).

Source: UNCTAD (2015).



3. Literature review

In developing countries, it is believed that FDI definitely contributes to economic growth. At the firm level, several studies provide evidence of technology spillovers and enhanced firm productivity (Zhou, Li, & Tse, 2002). At the macro level, FDI positively contributes to higher GDP per capita, industrial productivity (Zhao & Zhang, 2010), and higher positive productivity externalities (Wang, 2010). Furthermore, based on the neoclassical growth model, FDI promotes growth via expanding the quantity of total investment, and in the endogenous growth model, FDI stimulates growth by producing technological and knowledge spillovers from the developed world to the host economies, meaning that through FDI, a host economy gains new inputs, technology, skills/knowledge, organizational and managerial practices, enhanced R&D, and access to markets (Balasubramanyam, Salisu, & Sapsford, 1996; de Mello, 1997; Noorbakhsh, Paloni, & Youssef, 2001). In addition, FDI is also a main source of employment in a host economy (Lipsey, Sjöholm, & Sun, 2013; Waldkirch, Nunnenkamp, & Alatorre Bremont, 2009). Some researchers confirm FDI to have causal impact on exports as well (Vogiatzoglou & Thi, 2016; Zhang & Song, 2002). Other benefits of FDI are also seen in many recipient countries. For example, literature shows that FDI plays a protuberant role in complementing domestic investment (Lean & Tan, 2011; Tang, Selvanathan, & Selvanathan, 2008; Wu, Sun, & Li, 2012) and transferring technical and market externalities to accelerate modernization and outward orientation (Brooks, Roland-Holst, & Zhai, 2008).

Aside from positive effects, FDI has some negative effects in a host economy. For instance, it might place more pressure on domestic firms if it is not export-based. In addition, FDI might also cause natural resource depletion and pollution (Acharyya, 2009; Yang, Yang, & Xu, 2008) if a host government does not have sufficient capacities to manage their resources efficiently. Aside from these, voluminous literature on the impact of FDI reveals the crowding-out effects on domestic investment (Adams, 2009). This might be due to their superior technology, greater opportunities, and shrinkage in the market share of domestic firms. Another important cost of FDI is that it increases local wages (Figlio & Blonigen, 2000; Tomohara & Takii, 2011), which later may lead to increase in the prices of relevant domestically supplied inputs. Aside from these, FDI is also a contributor of inequality and reduces the share of agriculture to GDP in host economies (Basu & Guariglia, 2007). Although there are some costs of FDI, it is still strongly believed to have positive impact on growth in a vast majority of developing countries around the globe.

For example, Zhang (1999) investigates the causal impact of FDI on growth in 10 East Asian economies and finds that FDI appears to enhance growth in the long run for mainland China, Hong Kong, Indonesia, Japan, and Taiwan and in the short run for Singapore. In 2001, Nair-Reichert and Weinhold examine the relationship between FDI and growth in developing countries. They find a causal link between FDI and growth. Later, Hansen and Rand (2006) find bidirectional causality between FDI and GDP growth for a sample of 31 developing countries. Among ASEAN economies, Bhatt (2014) examines the impact of FDI on economic growth. The empirical results of the study confirm strong evidence on the causal impact of FDI on growth for the countries under consideration. In addition, the same empirical results are also confirmed by other studies (e.g. Tan & Tang, 2016; Vogiatzoglou & Thi, 2016). Another recent study also confirms the important role of FDI in stimulating economic growth in the Eurozone countries (Pegkas, 2015). Turning to country-specific studies, for example, Ramírez (2000) performed a study on the causal impact of FDI on growth for Mexico, using data for the period 1960–1995. The researcher finds FDI to Granger cause GDP both in the short run and the long run. Asheghian (2004) investigated the causal impact of FDI on growth in the United States based on Granger non-causality test. The causality is confirmed to run from FDI to GDP, indicating the importance of FDI in the US economy. In Ghana, Frimpong and Oteng-Abayie (2006) find FDI to have causal impact on growth. However, it occurs during the post-SAP period. Using annual data for the period 1960–2003, Fedderke and Romm (2006) find FDI and GDP to be cointegrated and the long-run causality runs from FDI to GDP for South Africa. In Asia, Tang et al. (2008) confirm the causal impact of FDI on economic growth in China. They also ascertain that FDI plays an imperative

role in complementing domestic investment in this country. Most recently, in Estonia, Kisswani, Kein, and Shetty (2015) examine the impact of FDI inflows on economic growth. Their empirical findings confirm causality to run from FDI to GDP.

However some empirical studies do not support the growth impact of FDI. For instance, Kholdy (1995) carries out Granger causality tests, using data from 10 East Asian economies to examine the growth impact of FDI. Findings do not confirm the causation between FDI and productivity. The explanation offered is that FDI may generate only limited efficiency spillovers and may be a less important vehicle for technology transfer than was previously thought. Based on a panel cointegration framework, Basu, Chakraborty, and Reagle (2003) explore the two-way link between FDI and growth for a panel of 23 developing countries. In addition, they also investigate the impact of liberalization on the dynamics of the FDI and GDP relationship. They find that the cointegrating vectors reveal bi-directional causality between GDP and FDI for more open economies. For relatively closed economies, long-run causality appears unidirectional and runs from GDP to FDI. Using error-correction model to explore the causal relationship between growth, total investment, and inward FDI in 47 countries, Hsiao and Hsiao (2006) confirm FDI's effect is uncertain in developing countries. They conclude FDI to enhance growth only under some conditions. Most recently, Herzer et al. (2008) investigated the impact of FDI on economic growth in 28 developing countries, using co-integration techniques on a country-by-country basis. They find that there exists neither a long-run nor a short-run effect of FDI on economic growth in the vast majority of countries. Their findings provide no clear association between the growth impact of FDI and the level of per capita income in the developing countries in their sample of study. Turning to country-specific studies, Chakraborty and Basu (2002) utilize the technique of co-integration and error-correction modeling to examine the link between FDI and growth in India. The results suggest that GDP in India is not Granger caused by FDI, and the causality runs more from GDP to FDI. Later, Duasa (2007) and Kakar and Khilji (2011) examined the causal link between FDI and economic growth in Malaysia. They do not find strong evidence on the growth impact of FDI in this country, confirming that FDI does not cause economic growth and vice versa. With the analysis of vector autoregressive type (VAR), Ludosean (2012) does not find FDI to have causal impact on growth in Romania, but causality runs from economic growth to FDI. This finding is also in line with a number of studies that confirm FDI to have no impact on growth (Akinlo, 2004; Mutafoglu, 2012). In 2014, Belloumi employed the Bound Testing (ARDL) approach to examine the impact of FDI on growth in Tunisia for the period 1970 to 2008. The author finds FDI to have no causal impact on economic growth for this country.

The above discussions show that a common conclusion on the growth impact of FDI cannot be reached. This means that findings on the impact of FDI on growth are still debatable.

4. Data and methodology

4.1. Data

To get a better view, the study not only includes FDI, but also manufacturing and investment as the engines of growth. In this paper, foreign direct investment is measured as the ratio of FDI stock to GDP (Mehic, Silajdzic, & Babic-Hodovic, 2013; Pegkas, 2015). Manufacturing (MAN) is included in the study because the variable is also considered as an engine of growth (Abbas, Azeem, Bakhsh, Fatima, & Samie, 2014; Szirmai & Verspagen, 2015). Manufacturing here denotes the share of manufacturing output to GDP (Abbas et al., 2014; Elhiraika, Aboubakar, & Muhammad, 2014). TI denotes investment, which is measured as the ratio of gross fixed capital formation to GDP (Barro, 1989, 2003). Economic growth, the dependent variable in this study, is proxied by real GDP per capita. All the series employed cover the period 1980–2014 and are gathered from the United Nations Conference on Trade and Development [UNCTAD] (2015) who publishes many annual economic data. The data from UNCTAD can be reliable because many studies have employed the data published by this institution.

4.2. Unit root test

To study the stationarity properties of time series, the Augmented Dickey–Fuller test (ADF) (Dickey & Fuller, 1981) is conducted in this paper. The test involves estimating the regression

$$\Delta X_t = \alpha + \rho t + \beta X_{t-1} + \sum_{i=1}^{k-1} \gamma_i \Delta X_{t-i} + \varepsilon_t \quad (1)$$

In the above equation, α is the constant and ρ is the coefficient of time trend. X is the variable under consideration. In our case, the variables include log(FDI), log(MAN), log(TI), and log(GDP). Δ is the first-difference operator; t is a time trend; and ε is a stationary random error. The test for a unit root is conducted on the coefficient of X_{t-1} in the above regression. If the coefficient, β, is found to be significantly different from zero ($\beta \neq 0$), the null hypothesis that the variable X contains a unit root problem is rejected, implying that the variable does not have a unit root. The optimal lag length is also determined in the ADF regression and is selected using Akaike information criterion (AIC).

4.3. Johansen cointegration test

Due to lack of the empirical findings on the causal impact of FDI on economic growth in Cambodia, the present paper attempts to use the Johansen maximum likelihood cointegration test (Johansen, 1988) to determine long-run relationships among the variables being investigated. In examining causality, the Granger causality analysis is also performed. In order to obtain good results from the test, selecting the optimal lag length is so important. The Johansen cointegration framework takes its starting point in the vector autoregressive (VAR) model of order p given by:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B x_t + \varepsilon_t, \quad (2)$$

where y_t is a vector of endogenous variables and A represents the autoregressive matrices. x_t is the deterministic vector and B represents the parameter matrices. ε_t is a vector of innovations and p is the lag length. The VAR can be re-written as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + B x_t + \varepsilon_t, \quad (3)$$

where $\Pi = \sum_{i=1}^{p} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$. The matrix Π contains the information regarding the long-run coefficients of the y_t variables in the vector. If all the endogenous variables in y_t are cointegrated at order one, the cointegrating rank, r, is given by the rank of $\Pi = \alpha\beta'$, where the elements of α are known as the corresponding adjustment of coefficient in the VEC model and β represents the matrix of parameters of the cointegrating vector. To indicate the number of cointegrating rank, two likelihood ratio (LR) test statistics, namely the trace and the maximum Eigen value tests (Johansen, 1988), are used to determine the number of cointegrating vectors. The two tests are defined as: $\lambda_{\text{trace}} = -T \sum_{i=r+1}^{k} \log(1-\lambda_i)$ and $\lambda_{\max} = -T\log(1-\lambda_{i+1})$, where λ_i denotes the estimated values of the characteristic roots obtained from the estimated Π, and T is the number of observations. The first statistic test tests H_0 that the number of cointegrating vector is less than or equal to r against the alternative hypothesis of k cointegrating relations, where k is the number of endogenous variables, for $r = 0, 1, \ldots, k-1$. The alternative of k cointegrating relations corresponds to the case where none of the series has a unit root. The second test tests the null that the number of cointegrating vectors is r, against the alternative hypothesis of $1 + r$ cointegrating vectors.

4.4. Granger causality based on the vector error correction model

In order to identify the long-run relationship among the series under study, the Johansen co-integration test must be done. However, the test does not indicate anything about the direction of causality among the variables in the system; therefore, the Granger causality analysis must be done. If the series are co-integrated, the VECM-based Granger causality analysis is an appropriate technique

used to determine the long-run and the short-run relationships (Engle & Granger, 1987) based on the following forms:

Model 1: Y = [log(GDP), log(FDI)]

$$\Delta\log(GDP)_t = \beta_{1,t} + \sum_{j=1}^{n-1} \beta_{11,j}\Delta\log(GDP)_{t-j} + \sum_{j=1}^{n-1} \beta_{12,j}\Delta\log(FDI)_{t-j} + \delta_1 EC_{t-1} + \mu_{1t} \quad (4)$$

$$\Delta\log(FDI)_t = \beta_{2,t} + \sum_{j=1}^{n-1} \beta_{21,j}\Delta\log(FDI)_{t-j} + \sum_{j=1}^{n-1} \beta_{22,j}\Delta\log(GDP)_{t-j} + \delta_2 EC_{t-1} + \mu_{2t} \quad (5)$$

Model 2: Y = [log(GDP), log(MAN)]

$$\Delta\log(GDP)_t = \gamma_{1,t} + \sum_{j=1}^{n-1} \gamma_{11,j}\Delta\log(GDP)_{t-j} + \sum_{j=1}^{n-1} \gamma_{12,j}\Delta\log(MAN)_{t-j} + \theta_1 EC_{t-1} + \varepsilon_{1t} \quad (6)$$

$$\Delta\log(MAN)_t = \gamma_{2,t} + \sum_{j=1}^{n-1} \gamma_{21,j}\Delta\log(MAN)_{t-j} + \sum_{j=1}^{n-1} \gamma_{22,j}\Delta\log(GDP)_{t-j} + \theta_2 EC_{t-1} + \varepsilon_{2t} \quad (7)$$

Model 3: Y = [log(GDP), log(TI)]

$$\Delta\log(GDP)_t = \rho_{1,t} + \sum_{j=1}^{n-1} \rho_{11,j}\Delta\log(GDP)_{t-j} + \sum_{j=1}^{n-1} \rho_{12,j}\Delta\log(TI)_{t-j} + \varphi_1 EC_{t-1} + \eta_{1t} \quad (8)$$

$$\Delta\log(TI)_t = \rho_{2,t} + \sum_{j=1}^{n-1} \delta_{21,j}\Delta\log(TI)_{t-j} + \sum_{j=1}^{n-1} \rho_{22,j}\Delta\log(GDP)_{t-j} + \varphi_2 EC_{t-1} + \eta_{2t} \quad (9)$$

log(GDP), log(FDI), log(MAN), and log(TI) Denote the natural logarithms of real GDP per capita, FDI, manufacturing, and investment, respectively. Our main focus is on Model 1. The coefficients of the EC_{t-1} term indicate causality in the long run and the joint F test of the coefficients of the first-differenced independent variables confirms short-run causality. Δ denotes first-difference operator. μ_{1t} and μ_{2t} are the stationary disturbance terms for Equations (4) and (5), respectively. n is the order of the VAR, which is translated into lag of n−1 in the error correction mechanism. δ_1 and δ_2 denote the coefficients of long-run Granger causality for Equations (5) and (6), respectively. In Equation (4), the coefficients of lagged value $\beta_{12,j}$ for j = 1, … n−1 represent short-run effects of FDI stock on GDP. In Equation (5), the coefficients of lagged value $\beta_{22,j}$ for j = 1, … n-1 represent short-run effects of GDP on FDI. In Model 2, θ_1 and θ_2 denote the coefficients of long-run Granger causality for Equations (6) and (7), respectively. In Equation (6), the coefficients of lagged value $\gamma_{12,j}$ for j = 1, … n−1 represent short-run effects of manufacturing on GDP. In Equation (7), the coefficients of lagged value $\gamma_{22,j}$ for j = 1, … n−1 represent short-run effects of GDP on manufacturing. φ_1 and φ_2 denote the coefficients of long-run Granger causality for Equations (8) and (9). In Equation (8), the coefficients of lagged value $\rho_{12,j}$ for j = 1, … n−1 represent short-run effects of investment on GDP. In Equation (9), the coefficients of lagged value $\rho_{22,j}$ for j = 1, … n−1 represent short-run effects of GDP on investment. In this paper, the short-run causality is determined through the Wald test of the joint significance of lags of the independent variables, which is known as Granger causality test based on vector error correction model.

5. Empirical results and discussions

In this section, the empirical findings for the stationarity test, the Johansen cointegration test, and the Granger causality test based on the vector error correction mechanism are presented. Many economic series are found to be non-stationary, but few are stationary. Therefore, to avoid spurious results for policy analysis, testing stationarity of the variables is important. The results of standard Augmented Dickey-Fuller (ADF) test are presented in Table 1. The test results show that all the data

Table 1. Augmented Dickey–Fuller test

Series	Level	First difference
log(GDP)	1.032	−3.776*
log(FDI)	−0.312	−5.732*
log(MAN)	−0.855	−6.049*
log(TI)	−0.593	−12.007*

*Denotes rejection of the null hypothesis at the 1 percent levels of significance.

Table 2 Johansen's Cointegration test for long-run equilibrium relationship between log(FDI), log(MAN), log(TI), and Cambodian economic growth, 1980–2014

Null (H_0)	Alternative (H_1)	λ_{trace}	95% CV	λ_{max}	95% CV
Model 1: Y = [log(GDP), log(FDI)]					
$r = 0$	$r \geq 1$	34.2699*	15.4947	32.90325*	14.2646
$r \leq 1$	$r \geq 2$	1.3667	3.8414	1.366721	3.8414
Model 2: Y = [log(GDP), log(MAN)]					
$r = 0$	$r \geq 1$	46.9492*	15.4947	46.2110*	14.2646
$r \leq 1$	$r \geq 2$	0.7381	3.8414	0.7381	3.8414
Model 3: Y = [log(GDP), log(TI)]					
$r = 0$	$r \geq 1$	54.7639*	15.4947	52.6910*	14.2646
$r \leq 1$	$r \geq 2$	2.0728	3.8414	2.0728	3.8414

*Denotes the significance at the 1% level. The number of lags chosen is based on maximum AIC for the three models.

are found to be nonstationary at level, $I(0)$. After first differencing, the null hypothesis (H_0) for the existence of a unit root in the three variables is rejected, implying that the three variables used in the study are integrated at order one, $I(1)$. The findings confirm that the Johansen cointegration mechanism is an appropriate technique used to check whether the variables are cointegrated.

To implement the Johansen cointegration test, the first thing to do is to decide the optimal lag structure for the VEC mechanism. In this paper, the AIC statistics are employed to select the appropriate lag structure for the VEC mechanism. In this paper, the number of lag chosen is based on the maximum value of AIC. Results of the bivariate Johansen co-integration tests are presented in Table 2. For the three models, the empirical results confirm that the values of the trace tests and those of the maximum eigenvalue tests are statistically significant ($p < 0.01$) and greater than the critical values. This confirms that the null hypothesis of no co-integration ($r = 0$) is rejected by both the maximum eigenvalue and trace statistics in the three models. This indicates the existence of a long-run equilibrium relationship between FDI and GDP, manufacturing and GDP, and investment and GDP for the period being investigated.

The direction of causality cannot be told through the Johansen co-integration test; therefore, the Granger causality test based on the vector error correction model is applied. The study focuses on the bivariate Granger causality analysis to examine the causal impact of FDI on Cambodia's economic growth. The study not only includes FDI, but also manufacturing and investment as important engines of growth. For the empirical analysis, there are three models to be estimated via using bivariate Granger causality test. The findings on the Granger causality analysis are presented in Table 3. Since the variables are cointegrated at the same order, $I(1)$, causality can be divided into two important parts, namely the long run and the short run. The significance of the coefficient of $EC_{(t-1)}$ confirms long-run Granger causality based on the t-statistics. The short-run Granger causality is indicated by joint significance of the LR test, which is derived from the Wald Test. In addition, this paper also conducted the diagnostic tests to examine the robustness of the three models. The results in Table 4 show that there are no problems of serial correlation and Heteroskedasticity ($p > 0.05$). Findings also confirm the residuals of the three models to be normally distributed,

Table 3. Causality analysis on the causal links between log(FDI), log(MAN), log(TI), and log(GDP) for the period 1980–2014

Dependent variables	Short run		Long run
Model 1: *Y* = [log(GDP), log(FDI)]	**Δlog(GDP)**	**Δlog(FDI)**	**EC(*t*−1)**
Δlog(GDP)	–	2.988	−2.109*
Δlog(FDI)	6.397	–	3.496*
Model 2: *Y* = [log(GDP), log(MAN)]	Δlog(GDP)	Δlog(MAN)	EC(*t*−1)
Δlog(GDP)	–	5.833	−2.912*
Δlog(MAN)	5.951	–	1.950
Model 3: *Y* = [log(GDP), log(TI)]	Δlog(GDP)	Δlog(TI)	EC(*t*−1)
Δlog(GDP)		71.082*	−8.493*
Δlog(TI)	8.033	–	−0.985

*Denotes the significance at the 1% level.

Table 4. Diagnostic test

	Model 1	Model 2	Model 3
R^2	0.818	0.892	0.908
Adj. R^2	0.649	0.791	0.822
DW	1.717	2.287	2.245
SE	0.025	0.019	0.018
Jarque–Bera normality test	0.078 (0.962)	1.643 (0.438)	0.220 (0.895)
Breusch–Godfrey serial correlation LM test:			
AR/MA (2)	0.208 (0.815)	0.455 (0.645)	0.689 (0.431)
AR/MA (1)	0.348 (0.566)	0.564 (0.466)	0.529 (0.351)
Heteroskedasticity Test: Breusch–Pagan–Godfrey	0.699 (0.743)	0.649 (0.783)	0.748 (0.701)

Note: Values in the parenthesis are the *p* values.

meaning that the three models are well defined. Accordingly, we can proceed to the Granger causality test. Based on the empirical results illustrated in Table 3, Model 1 shows that the long-run coefficient, $EC_{(t-1)}$, of the GDP equation is negative and statistically significant at the 1 per cent level ($p < 0.01$), but the reverse is true for the FDI equation. In the short run, the causal link between FDI and GDP is not found. This implies only unidirectional causality to run from FDI to GDP in the long run. The findings suggest the important role of FDI in stimulating Cambodia's long-run economic growth. As confirmed in other countries, the findings of this paper are consistent with a number of empirical studies of Ramírez (2000), Fedderke and Romm (2006), Vogiatzoglou and Thi (2016), and Tan and Tang (2016) who provide strong evidence on the causal impact of FDI on growth in the countries under their investigation. However, some empirical findings are inconsistent with this paper (e.g. Belloumi, 2014; Chakraborty & Basu, 2002; Kakar & Khilji, 2011; Ludosean, 2012). This can be concluded that the findings on the causal impact of FDI on growth are still controversial.

Many theoretical and empirical studies focus on the growth impact of FDI, but very few focus on using manufacturing as an engine of growth. Manufacturing itself is directly related to the production in an economy; therefore, the present paper chooses to use the variable as one of the determinants of growth. The idea is to know whether or not the manufacturing sector plays an important role in determining Cambodia's economic growth. Based on findings of the bivariate Granger causality analysis in Table 3, Model 2 suggests that only the error correction term, $EC_{(t-1)}$, of the GDP equation is negative and statistically significant at the 1% level ($p < 0.01$), implying that manufacturing has causal impact on growth. However, the study does not confirm causality to run from GDP to manufacturing. This confirms only unidirectional causality to run from the manufacturing sector to

GDP. The empirical results strongly endorse the vital role of manufacturing in Cambodian economy. This finding is corroborated by Atesoglu (1993) who suggests the important role of the manufacturing sector in the US economic growth. Other studies also support this view (e.g. Abbas et al., 2014; Elhiraika et al., 2014; Güçlü, 2013; Szirmai & Verspagen, 2015).

Based on the Keynesian model, investment is a key component of aggregate demand and a leading source of economic growth. Changes in investment not only affect aggregate demand but also the productive capacity of a country. The variable is an essential contribution to the expansion of the productive capacity of the economy and promoting long-run economic growth. According to the neoclassical growth model, a higher level of investment generates faster economic growth. The empirical findings in Table 3 show that only the error correction term, $EC_{(t-1)}$, of the GDP equation in Model 3 is negative and statistically significant at the 1% level ($p < 0.01$). In the short run, investment is also found to have causal impact on growth. However, the study does not provide evidence on the causality to run from GDP to investment. This implies unidirectional causality to run from investment to economic growth in both the long run and the short run. Based on the findings, investment significantly contributes to growth in this country as postulated in the conventional growth model of Solow (Solow, 1956). This finding is also corroborated by other empirical studies (e.g. Barro, 1989; Mankiw, Romer, & Weil, 1992; Yan & Yudong, 2003).

6. Conclusion and policy implications

Cambodia, an ASEAN member state, had passed through many tragic political generations, causing almost complete destruction of infrastructure, human capital, and approximately two million innocent lives. In reconstructing the economy, foreign capital, chiefly FDI is highly needed as part of capital accumulation because domestic capital alone is not adequate for growth enhancing in this country. Therefore, in the late 1980s, Cambodia moved from the centrally planned economy to the market-oriented economic system. More inward FDI starts to flow into this war-torn economy. However, the amount was still small due to remaining political instability. After the UN-supervised election in 1993 and the Investment Law enacted in 1994, it is seen that FDI gradually increases. Policy-makers believe the variable to be a noteworthy contributor of Cambodian economic growth as postulated in theory.

Both theoretically and empirically, there is voluminous literature on the impact of FDI on growth across countries. Although most theoretical studies confirm a positive relationship between FDI and economic growth, some empirical studies do not support this relationship between the two variables. Additionally, findings on the growth impact of FDI are not fully known in Cambodia. Therefore, this study is carried out with an attempt to examine the causality between FDI and Cambodian economic growth. Manufacturing, one of the important variables used in the growth analysis, is also included into the study. Based on the findings of this paper, FDI helps boost Cambodia's economic growth by augmenting physical capital, which is needed in the country. However, growth itself is not found to play a crucial role in attracting more inward FDI. This might be due to small production base in the country. In addition, the paper also confirms manufacturing and gross fixed capital formation (investment) to be important determinants of Cambodia's long-run growth.

Hence, the findings do have some crucial policy implications. The present paper is done in order to provide some views on the growth impact of FDI in Cambodia. Based on findings, Cambodian policy-makers should focus more on the policies that are friendly and attractive to inward FDI. Most importantly, to attract more inward FDI, the government should produce sound macroeconomic policies, develop physical infrastructure, remove restrictions against inward FDI, enhance the financial sector development, and promote encouraging environments for trade and investment. In addition, policy-makers should not forget the development of human capital because the variable represents the absorption capacity of the economy. It must inevitably be developed in order to take full advantages of FDI. Another important determinant of FDI and growth is political stability. Political stability must be maintained because it might be the most crucial contributor of FDI and growth in this country. If political stability does not exist, it might negatively affect the economy as a whole.

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Notes
1. ASEAN stands for the Association of Southeast Asian Nations.
2. The Pol Pot regime is also known as the genocidal regime, which occurred from 1975 to early 1979 in Cambodia. Almost all types of infrastructure and approximately two million innocent lives had been destroyed in the regime.

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Appendix 1

Descriptive data on each variable, 1980–2014

	Real GDP	Manufacturing	Gross fixed capital formation	FDI stock
Mean	6.527942	12.58303	13.93110	25.96484
Median	6.691602	12.13447	13.41960	26.85757
Maximum	21.53152	19.91324	20.94545	79.30991
Minimum	−5.668406	7.187175	7.873631	1.678952
Std. dev.	4.959216	4.606079	4.285651	23.02470
Skewness	0.436314	0.194515	0.108344	0.547979
Kurtosis	4.684572	1.382571	1.445659	2.283215
Jarque-Bera	5.248925	4.035824	3.591773	2.500902
Probability	0.072479	0.132933	0.165980	0.286376
Sum	228.4780	440.4061	487.5885	908.7693
Sum sq. dev.	836.1900	721.3426	624.4713	18024.65
Observations	35	35	35	35

Source: UNCTAD (2015).

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