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Exploring the Nexus between Foreign Aid, Corruption and Economic Growth in ASEAN Countries

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The prime objective of the research is to explore the nexus between foreign aid, corruption and economic growth in ASEAN countries. The present research begins by providing background information about corruption as well as its current situation in ASEAN. Afterwards, the previous models used in previous research will be explored, followed by the discussion of data and estimation techniques. Moreover, the next section involves a discussion about the theoretical foundation of corruption models, and present estimation equations, data sources and mathematical derivations. In addition, the current study may also facilitate in spreading awareness regarding corruption and possible policy options for the policy makers to combat corruption in ASEAN. The study has employed a robust statistical analysis on the data covering period from 1985 to 2018. The fixed effect and Granger causality test are used to examine the relationship between foreign aid, corruption and economic growth. Finally, this paper aims to present a summary of the obtained empirical findings, policy implications, concluding remarks and future research direction. The study aims to particularly emphasise corruption's indirect and direct effects on government expenditure, capital accumulation, economic growth and foreign aid.

Key words: *Corruption, economic growth, Foreign Aid.*

Introduction

Corruption is a strong constraint and a serious threat to a country's economic development. Corruption tends to decline the efficiency of private and public sectors, allowing people to presume power not through ability rather through patronage. Those productive resources which generally obtain greater returns are kept idle or used for less productive businesses. The literature of the impact of corruption lacks empirical and theoretical support, therefore, current literature tries to incorporate and investigate the potential effects of corruption on the national output, by influencing it's impact on economic growth and production function. Till now, several studies (Ali, Khan, Sohail, & Puah, 2019; Leung, 2018; Shan, Le, Chan, & Hu, 2020; Сучок, 2016) have analysed the hypothesised impact of corruption only separately, however, no research examined the potential impact of corruption at the aggregate level. Thus, a neo-classical economic growth model was developed in this study which tried to capture direct and indirect corruption and human capital accumulation effects on economic growth (Kodongo & Ojah, 2016). This model was empirically tested by employing time series data for analysing the corruptive behaviour in ASEAN.

During a preliminary analysis, it was found that corruption is a complex phenomenon, which is largely recognised as a consequence of various embedded issues arising from institutional incentives, governance, and policy distortion. According to the economics' literature, corruption is considered as a growth inhibitive. However, a view has been put forward in 1960 that corruption may improve the process of economic growth. For instance, Huang (2016) argued that political regimes and bureaucrats wish to be part of the political offices and they conceive politics with the same thinking and become economically inefficient. In another study, corruption is suggested as a modernisation consequence, asserting that corruption acts as a diversion from inefficient and unproductive policies. This pro-efficient corruption argument has been disproved by Mbaku (2019), suggesting that since bribery is illegal, bureaucrats try to regulate the bidding process only for the ones they trust. Trust does not serve as a proxy variable for efficiency; therefore, the highest bidder will not necessarily be the most efficient one. A similar conclusion was obtained by Lučić, Radišić, and Dobromirov (2016) who also suggested that corruption works under the theory of second best.

Contrarily, the existing theoretical and empirical research (Ali et al., 2019; Leung, 2018; Shan et al., 2020; Сучок, 2016) has shown that the problem of corruption has considerably grown in the past few years. The corruption became part of the economics literature under the microeconomic perspective. A study Auerbach and Azariadis (2015) attempted to analyse the effects of rent-seeking on the economic growth and demonstrated the potential of three equilibria in the economy. Ogun (2018) employed a three-sector approach to develop a production model indicating two-stable equilibria, where the first one is established under uncontrolled corruption and lack of honest agents. The other equilibrium is established when the economy achieves highest output without the involvement of any corrupt agents. Basu, Basu, and Cordella (2016) also reported two equilibria, where one is unstable and the other is a stable equilibrium in a corrupt economy. The researcher has fully recognised the importance of initial conditions and suggested that if the economy begins at average corruption levels then the economy will tend to move towards stable equilibrium with even higher levels of corruption, whereas, if there is low average levels of corruption, then it will return back to its honest economy. Thus, Leff's analysis only holds considering the perspective of Hall, Levendis, and Scarcioffolo (2019) who stated that corruption is a consequence of inefficient public policy. If the government's main priority is to achieve high levels of economic development then there will be uncontrolled corruption, and vice versa.

Figure 1. Corruption perception Index ASEAN (0 : least corrupt)

	Rank	Rank
	2016	2017
Singapore	7	6
Brunei	41	32
Malaysia	55	62
Indonesia	90	96
Thailand	101	96
Philippines	101	111
Vietnam	113	107
Laos	123	155
Myanmar	136	130
Cambodia	156	161

The tax and tariff context was also considered, to analyse the trends of corruption. Aidt (2016) suggested that rent seeking is particularly more costly as compared to the tariff. The findings of this study suggest that for a given level of import restriction, the rent-seekers have a Pareto-inferior competition against a tariff-equivalent restriction. The findings obtained by Aidt (2016) are consistent with the findings of Hall et al. (2019) study, which have found that there is a difference between taxes and bribes, where bribing is an illegal act. However, this rent-seeking model by Aidt (2016) can only be applicable for the case of developing economies, with income inequality prevailing among non-government and government workers. Besides corruption as one type of rent-seeking, various other forms of corruption also exist. Bertrand, Betschinger, and Laamanen (2019) also tried to analyse corruption within different firms' contexts; for this purpose the study used the principal-agent model to assess the corruption's impact on development. Another noticeable fact is that majority of microeconomic models use the corruption variable for predicting the economic development. However, these microeconomic models only consider corruption's effects without considering its larger aggregate effects on output (Iamsiraroj & Ulubaşoğlu, 2015). Thus, ignoring such potential effects may infuse priori bias in the model. Therefore, such microeconomic models could not quantify the trade-off among indirect and direct effects to prevent corruption.

Literature Review

The literature of economics is full of microeconomic and principal-agent models, but there is no such richness in macroeconomic literature. To examine the effects of corruption on the macroeconomic variables of the economy, various economic growth models were being employed in previous research (Ali et al., 2019; Leung, 2018; Shan et al., 2020; Сучок, 2016). The author also stated that corruption acts as an obstacle in achieving economic growth and also diminishes the effectiveness of investment. Another study has reported that corruption minimises the level of human capital and the share of investment. In addition, a significant negative impact of corruption on the level of investment and insignificant impact on growth has been reported, with the Luas growth model (Crescenzi, Cataldo, & Rodríguez-Pose, 2016). On the contrary, it has been argued that the intention of gaining corruption benefits can easily restrict the access to key social services. Therefore, the study concluded that corruption poses negative impacts on human development. Furthermore, the government officials feel enticed by corruption and tend to allocate less public resources to social welfare to gain extorting bribe opportunities. Agostino, Dunne, and Pieroni (2016) suggested the potential effects of corruption and mentioned that it lowers the quality of public services and infrastructure projects, resulting in the reduction in investment, economic growth and negative effects on human development.

Mazllami (2019) designed and demonstrated a Keynesian model to exhibit the negative effects of corruption on the production, employment level, consumption, government spending, money market, domestic investment and net exports of a developing country. Another study revealed a negative relation among corruption and a balanced growth path, by employing an endogenous growth model (Ugwuanyi & Ugwunta, 2017). In a balanced growth model, the level of growth declines with an increase in bribe payments. Therefore, it is presumed that the magnitude of investment reduces with the increase in corruption, resulting in the reduction of economic growth level (Haque & Kneller, 2015). Contrarily, while considering an infinite horizon growth model, the researcher presumed that entrepreneurs tend to put in more human capital resources and time to deal with bureaucratic obstacles, particularly in the presence of bureaucracy. As the longer it takes to deal with bureaucracy issues, the greater will be the bribe payments. In the view of the scholar, requiring more time to handle government officials tends to increase the demand for higher bribe payments, thereby wasting potential human capital and time.

According to Agostino et al. (2016), corruption alters the government spending composition, discourages investment, and restricts the level of economic growth. He attempted to analyse corruption's effects on various public spending, and incorporated ethno-linguistic fractionalisation as an instrument variable (Cooray, Dzhumashev, & Schneider, 2017). A two-stage least square method was used in this study and the findings suggest that corruption reduces economic growth level by reducing the rate of investment. Although, Bertrand et al. (2019) suggested that those bureaucrats which are involved in corruption try to make investment in larger projects making bribery less easily identifiable. The empirical findings of Mauro has directed the attention towards another controversial topic. However, Mauro's work also has several shortcomings. On the other hand, Van den Berg (2016) used a neoclassical growth model and added corruption, assuming that economic growth is negatively affected by corruption. Their model suggests that government officials can decide whether they want to take bribe or not. However, the study used similar methodology as used for criminal activities in previous studies. However, the assumptions have failed to satisfy two points:

Firstly, Goedhuys, Mohnen, and Taha (2016) advocated corruption as a persistent phenomenon and the decision of whether to engage or not in corrupt activities does not solely depend on the chances of being caught. On the other hand, there is a second group which prevents individual behaviour. This suggests that the predecessor's reputation directly influenced the individual's behaviour of becoming corrupt or not. Although, all the aforementioned models must also consider the potential endogeneity bias. However, the endogeneity bias usually arises when the results of subjective surveys are used as a proxy variable for the level of corruption and which can be avoided by employing appropriate estimation techniques (Kim & Kang, 2014). The results obtained from these may seem to be less powerful because of higher sensitivity towards the corruption index and sample size employed in the data. This approach also offers some important implications that can be considered while conducting future studies by using those models which are less sensitive in terms of indexes, sample size and proxies. Furthermore, the aforementioned models separately test the effects of corruption, without considering its aggregate impact on production factors and on the long term growth implications (Webb & Martin, 2017). Thus, there is still no theoretical framework available in the existing literature which examines the corruption's potential effects on output by influencing the production function, economic growth and development. Therefore, a neoclassical economic growth model is developed in this study involving human capital accumulation and indirect and direct effects on economic growth by corruption. While developing a theoretical model for economic growth, the study also takes into account the possibility of economic growth in ASEAN to be influenced by corruption through affecting foreign aid, investment, and government spending (Hakimi & Hamdi, 2017).

The Theoretical Model

For developing a theoretical model, the present study used Mankiw, Romer, and Weil (1992) work. The findings suggest that adding human capital into the production function has significantly improved the explanatory power of the Solow growth model. This paper is the extension of the Solow model, aiming to incorporate corruption as a government spending determinant. Hence, this study defines corruption as 'using public office power to obtain private benefits'. In order to clarify, we assume that the economy under study is a good producing economy, where output is produced by incorporating well-behaved production function having strict and positive physical capital with diminishing marginal productivity (Matar, 2016). The Inada conditions assume that for both labour and capital, the marginal productivity will reach to infinity when its value reaches to zero, and when the value reaches to infinity, the marginal productivity will be equal to zero. Thus, the functional form of Cobb-Douglas production function is as follows:

$$\boldsymbol{Y_t} = PK_t^{\alpha} HK_t^{\beta} [Gov_t(\theta) Lab_t] \ldots \ldots \ldots (1)$$

Here Y_t represents an aggregate of real income level, PK_t^{α} represents the physical capital, HC_t^{β} represents the human capital level, Lab_t represents the total number of labour employed, Gt represents government spending, and ρ shows a country's level of corruption, where $Gov_t(\theta) <$. Suppose that $0 < \alpha < 1$, $0 < \beta < 1$ and $\alpha + \beta < 1$. Such conditions confirm that for each point, the production function displays constant or diminishing returns to scale. Time (t) is taken as a continuous variable. By omitting corruption, the standard neo-classical results will be obtained, i.e. for each worker, growth rate increases by increasing the physical capital investments and decreasing capital depreciation rate, decreasing output per worker at initial level and the population growth. Thus, the equations are stated as follows:

$$\frac{\boldsymbol{dPK}}{\boldsymbol{dt}} = S_{PK} Y_t - \partial_{PK} PK_t \ldots\ldots\ldots\ldots\ldots (2)$$

$$\frac{\boldsymbol{dHK}}{\boldsymbol{dt}} = S_{HK} Y_t - \partial_{HK} HK_t \ldots\ldots\ldots\ldots\ldots (3)$$

Here, $S_{PK}, S_{HK}, \partial_{PK}$ and ∂_{HK} shows the parameters for this model, representing income shares for capital and human investment, and physical and human capital's depreciation rate. Moreover, population growth is taken to be constant over time, which is defined and determined exogenously $Lab_t = Lab_0 e^{nt}$. Whereas, the full employment assumption suggests that 'n' also specifies the labour force growth rate($\frac{\frac{dLab}{dt}}{Lab_t} = n$). Thus, the steady state reduced equation is stated as follows:

$$\mathbf{ln}\left(\frac{\boldsymbol{Y_t}}{\boldsymbol{Lab_t}}\right) = \ln(Gov_0) + \emptyset t + [\alpha/(1-\alpha-\beta)]\ln\left[\frac{S_{PK}}{(n+\partial_{PK}+\emptyset)}\right] + [\beta/(1-\alpha-\beta]\ln\left[\frac{S_{HK}}{(n+\partial_{HK}+\emptyset)}\right] \ldots\ldots (4)$$

In the equation (4), it is revealed that this reduced equation for a steady state is an increasing function of human and physical capital savings, growth rate of initial government spending level, and government spending at output per worker. The output growth per worker can be expressed through making differentiation in terms of time, to obtain a steady state level:

$$\mathbf{ln}\boldsymbol{Y_t} - \mathbf{ln}\boldsymbol{Y_0} = (1-e^{\gamma t})\{\ln(Gov_0)\ln(Gov_0) + \emptyset t - [\frac{\alpha+\beta}{1-\alpha-\beta}](\ln[n+\partial_{PK}+\emptyset] + [\frac{\alpha}{1-\alpha-\beta}]\ln(S_{PK}) + Gov_t(\theta)\} - (1-e^{\gamma t})\mathbf{ln}\boldsymbol{Y_0} \ldots\ldots \mathbf{(5)}$$

The change in the effectiveness of government spending gives an inverse relationship of upward moving corruption with output growth per worker, although, standard neoclassical results are obtained by omitting the corruption term (see equation 5). This implies that output growth rate per worker increases by increasing the human and physical capital investments and decreasing the depreciation rate of capital, population growth and output per worker at the initial level. In an attempt of modelling corruption effects on the multifactor productivity, the present study assumed a structural form for that factor. The corruption has a non-linear effect on the economy and is bounded by a subsistent level and corrupt-free output. In an economy, all government agents will not depart from the production sector, therefore, some output is expected to be generated. Thus, to assess the relation of corruption in government spending function, we suppose that:

$$Gov_t(\theta) = \widehat{Gov_t e}^{\gamma\theta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where $0 \leq \theta \leq 1$, and

$$\widehat{Gov_t} = Gov_t e^{\emptyset t} \ldots\ldots\ldots\ldots\ldots\ldots.. (7)$$

θ is the parameter which shows the corruption index to be used and γ represents the magnitude of corruption effects on government spending. The traditional government spending expands at the rate '$\emptyset$' and is exogenous. Therefore, Equation (6) explains the state when there is no corruption in the economy. It also holds for $\widehat{Gov_t}=Gov_t$. Corruption influences every production function in a different way; the effects of corruption increases when γ exhibits a higher value. Ceteris paribus, when γ=0, the corruption function equals the point of unity and maximises total output. Thus, the equations 1, 2, 3 can also be stated in an intensive form:

$$\ddot{y}_t = e^{-\emptyset t} P\ddot{K}_t^{\alpha} H\ddot{K}_t^{\beta} \ldots\ldots (8)$$

$$\frac{\boldsymbol{dP\ddot{K}}}{\boldsymbol{dt}} = S_{PK}\ddot{y}_t - (n + \partial_{PK} + \emptyset)P\ddot{K}_t \ldots\ldots\ldots\ldots\ldots (9)$$

$$\frac{\boldsymbol{dH\ddot{K}}}{\boldsymbol{dt}} = S_{HK}\ddot{y}_t - (n + \partial_{PK} + \emptyset)H\ddot{K}_t \ldots\ldots\ldots\ldots\ldots (10)$$

Here, $\ddot{y}_t$=Y/L, $P\ddot{K}_t^{\alpha}$=PK/Lab, $H\ddot{K}_t^{\beta}$=HK/Lab, $\ddot{y}_t = y/y_t Gov_t$ represents each worker's output per government spending, $P\ddot{K}_t^{\alpha}$=PK/Gov_t shows human capital for each worker per government spending and $H\ddot{K}_t^{\beta}$=HK/Gov_t shows physical capital per worker per government spending. Thus, at the steady state, equation 9 and equation 10 equals to 0. Setting these equations to zero offers a three equation system with three unknowns. Thus, following are the state levels of human and physical capital:

$$P\ddot{K}_t = \left[\left(\frac{s_{PK}}{(n+\partial_{PK}+\emptyset)}\right)^{\left(\frac{1-\beta}{1-\alpha-\beta}\right)}\right] * \left[\left(\frac{s_{HK}}{(n+\partial_{HK}+\emptyset)}\right)^{\left(\frac{\beta}{1-\alpha-\beta}\right)}\right] * e^{-\emptyset t} \ldots\ldots\ldots (11)$$

$$P\ddot{K}_t = \left[\left(\frac{s_{PK}}{(n+\partial_{PK}+\emptyset)}\right)^{\left(\frac{\alpha}{1-\alpha-\beta}\right)}\right] * \left[\left(\frac{s_{HK}}{(n+\partial_{HK}+\emptyset)}\right)^{\left(\frac{1-\alpha}{1-\alpha-\beta}\right)}\right] * e^{-\emptyset t} \ldots\ldots\ldots (12)$$

Replacing Equations 11 and 12 to the equation 8 results, we obtain:

$$\ddot{y}_t = \left[\left(\frac{s_{PK}}{(n+\partial_{PK}+\emptyset)}\right)^{\left(\frac{\alpha}{1-\alpha-\beta}\right)}\right] * \left[\left(\frac{s_{HK}}{(n+\partial_{HK}+\emptyset)}\right)^{\left(\frac{\beta}{1-\alpha-\beta}\right)}\right] * e^{-\emptyset t} \ldots\ldots\ldots (13)$$

Since $y\ \ddot{y}_t = Y_t/(\ddot{G}_t L_t)$ Thus, substituting it into the obtained (13), and then multiplying it with $\ddot{G}_t$, followed by taking the natural log, we obtain:

$$\mathbf{ln}\left(\frac{\boldsymbol{Y_t}}{\boldsymbol{Lab_t}}\right) = \ln(Gov_0) + \emptyset t + [\alpha/(1-\alpha-\beta)]\ln\left[\frac{s_{PK}}{(n+\partial_{PK}+\emptyset)}\right] + \left[\frac{\beta}{1-\alpha-\beta}\right]\ln\left[\frac{s_{HK}}{(n+\partial_{HK}+\emptyset)}\right] - \emptyset t \ldots\ldots (14)$$

In order to clarify, assume that the depreciation rate for physical and human capital is the same. Therefore, we obtain:

$$\mathbf{ln}\left(\frac{Y_t}{Lab_t}\right) = \ln(Gov_0) + \emptyset t - [\alpha + \beta/(1-\alpha-\beta)]\ln[n + \partial_{PK} + \emptyset] + [\frac{1-\alpha}{1-\alpha-\beta}]\ln[S_{PK}] + [\frac{\beta}{1-\alpha-\beta}]\ln[S_{HK}] - \emptyset t \ldots\ldots (15)$$

Now, the equation (15) explains that the output per worker in a steady state is increasing at an initial multifactor productivity level, capital and physical rates of investment and growth rate Bonga, Sithole, and Shenje (2015) of initial multifactor productivity. For each worker, the steady state output increases with higher multifactor productivity levels, and the greater the multifactor growth rate the higher will be the steady output per worker. The investment rate automatically works through Equations (11) and (12). Obtaining higher rates of investment tends to increase per worker's human and physical capital, which in turn increases the level of output for each worker, using equation (8). However, output per worker may decrease by depreciation $[n + \partial_{PK} + \emptyset]$ in capital and corruption. The value for γ determines the effects of corruption. If the value for γ is positive, it indicates that corruption is weakening the level of output, while, if the value for γ is negative, it indicates that corruption is enhancing the output and if γ=0, then the equation for a steady state output level equals to MRW. It shows the corruption effects on the economic growth and steady state level of a country. Capital productivity reduces with the increase in corruption by shifting the production function to right (Borja, 2017). Thus, at point A, it is impossible to maintain the initial capital stock per worker (k0), and moving the economy towards lower per capita stock per worker (k1). Thus, moving from k0-k1, negative economic growth will be witnessed along with reduction in output per worker.

Convergence to a Steady State

Keeping with MRW, the speed of convergence can be derived by reaching closer to the steady output level. We represented the speed of convergence using first order linear differential equation:

$$\frac{dlny_t}{dt} = \vartheta(lny^{ss} - lny_t) \ldots\ldots (16)$$

Here, $\vartheta = [n + \partial_{PK} + \emptyset] * 1 - \alpha - \beta$, This can be rewritten as $\mathrm{e}^{-\vartheta t}\left[\frac{\mathrm{dy_t}}{\mathrm{dt}}\right] + \vartheta lny_t = \mathrm{e}^{-\vartheta t}(\mathrm{lny^{ss}})$ *to get the solution for Equation 16, thus we obtain:*

$$lny_t = (1 - \mathrm{e}^{-\vartheta t})(\mathrm{lny^{ss}}) - (1 - \mathrm{e}^{-\vartheta t})\mathrm{lny_0} \ldots\ldots (17)$$

Here, y0 shows the economy's output at initial level. The right and left sides of Equation (17) is subtracted by ln yss with (15), we obtain the convergence equation:

$$\boldsymbol{lnY_t} - \boldsymbol{lnLab_t} = (1 - \mathrm{e}^{-\vartheta t}) * \{\ln(Gov_0) + \emptyset t - \left[\frac{\alpha + \beta}{(1 - \alpha - \beta)}\right](\ln[n + \partial_{PK} + \emptyset]) + \left[\frac{1 - \alpha}{1 - \alpha - \beta}\right]\ln[S_{PK}] + \left[\frac{\beta}{1 - \alpha - \beta}\right]\ln[S_{HK}] - \emptyset\gamma\Big\} - (1 - \mathrm{e}^{-\vartheta t})\ln y_0 \ldots..(18)$$

Given a constant speed of convergence (ϑ), equation (18) is an economic growth function of initial multifactor productivity level and its growth rate, human and physical capital investment rates, population growth rate, initial output level and corruption level. Previously, the trivial factors indicate positive associations among initial levels of technology and time trends. Furthermore, this model also presents the traditional Solow neoclassical results. Exogenous parameters, e.g. depreciation rate and population growth, cause negative effects on the economy. However, the conditional convergence for this model is determined through the negative association among the economic growth level and initial output level.

Corruption minimises human and physical capital effectiveness which in turn affects the level of output per worker. Moreover, lower output per worker involves lower investments, therefore, keeping investment rates fixed. This would give rise to lower investment levels which further brings reduction in the level of output. Thus, it will result in negative impact on the rate of output growth per worker. Considering equation (15), it is the positive or negative sign of gamma which determines the direction of corruption, i.e. whether it is output debilitating or output enhancing. If the value of gamma is positive then it indicates that multifactor productivity has negative effects, on the other hand, if the value of gamma is negative, then it indicates results that are output-enhancing. To maintain uniformity, it must be noted that if gamma is zero then the equation (18) is reduced to the MRW. Equations (15) and (18) inherently contribute in a way that these equations can be tested directly by using ordinary least square (OLS). Therefore, the study must assume assumptions such as normality and other about the data.

Model Extensions

The above model is formulated to analyse the corruption effects on the economic growth through integrating a multifactor productivity and corruption in a Cobb-Douglas production function. This model will help to assess the government officials' corruptive behaviour in government resource allocation. Although, these government officials may have no control on the government spending, but they try to obstruct the resource allocation process, which comes from external sources like the United Nations, World Bank, and International Monetary Fund, non-government organisations, and foreign governments. Therefore, modification can be made in the above-mentioned model to analyse the slowing down of economic growth through the corruption level, which occurs by affecting the level of foreign aid and government spending. Thus, we can reproduce equation (1) as:

$$Y_t = PK_t^{\alpha} HK_t^{\beta} [F_t(\theta) Lab_t]^{1-\alpha-\beta} \ldots\ldots (19)$$

Reconsidering and replacing G (government spending) in the equation (6) with F (foreign aid), we obtain:

$$F_t(\theta) = \ddot{F}_t e^{-\gamma\theta\vartheta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

Here, γf represents the magnitude of the corruption's effect on the foreign aid. Thus, assuming conventional foreign aid (Ft) to be exogenous, it grows with rate $\ddot{F}_t e^{-\gamma\theta\vartheta}$keeping *dFt* =0. Thus, the data for the foreign aid will be used to estimate the following equation, by employing the same mathematical arrangement as used in the developing equation (15).

$$\mathbf{ln}\left(\frac{Y_t}{Lab_t}\right) = \ln(F_0) + ft - [\alpha + \beta/(1-\alpha-\beta)]\ln[n + \partial_{PK} + \emptyset] + [\frac{1-\alpha}{1-\alpha-\beta}]\ln[S_{PK}] + [\frac{\beta}{1-\alpha-\beta}]\ln[S_{HK}] - \gamma f\vartheta \ldots\ldots (21)$$

Data and Estimation

To perform a thorough statistical analysis, obtaining quality data is a prerequisite for a broad sample, such as in the case of emerging markets. The theoretical models involve certain parameters for physical capital investment rate, corruption, human capital saving rate, depreciation rate, multifactor productivity (such as, foreign aid, government spending) and population growth. Several sources were used for these variables. The economic data was obtained primarily from IMF, World Penn Tables, World Bank, Lebanese Ministry of Finance, and Bank of ASEAN. Whereas, for the corruption index, several information sources were used having merits and demerits for each one. Since there is no perfect corruption index, the one with longest time series was chosen for ASEAN. This corruption index is obtained from International Country Risk Guide (ICRG) of Political Risk Services International. The ICRR index involves enough information, as compared to the ones of their competitors, based on its correlation along with other corruption indices (Knack, 2001). Thus, the current data base was extensively utilised to carry out corruption related research, as appeared in the recent works (Tanzi & Davoodi, 2000; Knack & Keefer, 1995; Everhart & Sumlinski, 2001; Rajkumar & Swaroop, 2002; Abdiweli & Hodan, 2003; Seldadyo & Haan, 2006). As with other corruption indices, ICRG also suffers from expert's biasness risk i.e. biased opinions of experts. ICRG tries to determine the level of corruption through analysing special payments that the government officials demand and whether such payments are also demanded by lower level government officials. Such payments are generally made as bribes and are associated with exchange controls, police protection, import-export licenses, loan, or tax assessment. A numeric measure is provided by ICRG which ranges from 0-6, where 0 represents most corrupt and vice versa. This data base issue ratings every month for more than 100 countries, starting from 1984. In Equation (1) the corruption index was represented by ρ. Thus, the raw data for corruption (ςt) will be converted into an index having a range between 0-1, i.e. the closer the value to 1 the higher will be the average level of corruption. This function is used because *CRPT* ()ςt turns output into a negative corruption function. For testing corruption's linearity, the corruption function would then be added both non-linearly and linearly into the production function. Accepting various limitations of corruption measures is often difficult. The operational definition presented in this study for corruption states that corruption is 'using public official power to obtain private benefits'. It is evident that varying degrees of abuse are available and separating low-cost and annoying corruption from the Mobutu-style or grand corruption is clearly not possible. Even if it is possible to measure the corruption's immediate impact, how can we still capture its subsequent impact, since investors often tend to avoid situations of out of control corruption?

The base model of the study without corruption used to estimate the impact of human and physical capital by static panel is as follows :

$$RGDP_{it} = \alpha_0 + \alpha_1 Gov_{it} + \alpha_2(\delta + PopG_{it}) + \alpha_3 Inv_{it} + \alpha_4 Edu_{it} + \varepsilon_{it} \ldots \ldots (22)$$

Adding the element of corruption in equation 22

$$RGDP_{it} = \alpha_0 + \alpha_1 Gov_{it} + \alpha_2(\delta + PopG_{it}) + \alpha_3 Inv_{it} + \alpha_4 Edu_{it} + \alpha_5 Corup_{it} + \varepsilon_{it} \ldots \ldots (23)$$

Adding the element of foreign aid in equation 23

$$RGDP_{it} = \alpha_0 + \alpha_1 Gov_{it} + \alpha_2(\delta + PopG_{it}) + \alpha_3 Inv - GDP_{it} + \alpha_4 Edu_{it} + \alpha_5 Corup_{it} + \alpha_6 FAid_{it} + \varepsilon_{it} \ldots \ldots (24)$$

Thus, this model has following limitations:

1) It only takes into account the government corruption;
2) The corruption index (ICRG) employed in this study is a poll of polls which is presumed to assist in cleansing surveyor-specific bias involved in the analysis. ICRG like other corruption indices tries to capture the perceptions of business people, risk analysts and academics about the degree of corruption. One of the major drawbacks of using this database is that it involves a short time series, is developed on the basis of subjective surveys and does not involve any methodology changing trouble from time to time.

The data inconsistency with respect to time gives rise to another unknown bias. Thus, in order to appropriately utilise and affect the shape of this database, it is important to acknowledge the limitations of corruption data. Some basic qualities also exist which make the corruption indicator most useful. Generally, for good measure, it must be trustworthy to capture the level of corruption. The credibility of an indicator declines when it is developed on the basis of one or few person's personal opinions, and thus becomes less useful. In addition, there must also be a valid measurement. Such as, if one aims to only capture the studying aspects of corruption, then measuring corruption convictions may only reflect the judiciary institutions' effectiveness. Other key factors include precision and accuracy. The greater susceptibility of the index to make measurement errors turns it into a less useful index. However, a standard deviation must be used to assess the level of accuracy. Contrarily, a quantity exhibits precision when there is general agreement on what it measures, whereas, it is ambiguous or imprecise when different opinions exist regarding a particular number. Survey precision can be achieved by inquiring those questions which are unrelated to individual standards. Moreover, government spending is used as a multifactor productivity measure in this model, without considering other factors, such as technology's impact on the growth (Sakamoto, 2018).

The estimation of the regression pair is entailed by Granger causality test.

$$\boldsymbol{RGDP_{it}} = \sum_{t=1}^{n} \beta_i Gov_{it-1} + \sum_{t=1}^{n} \beta_j RGDP_{it-1} + \varepsilon_{1it} \ldots\ldots\ldots\ldots \quad (25)$$

$$\boldsymbol{Gov_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j Gov_{it-1} + \varepsilon_{2it} \ldots\ldots\ldots\ldots \quad (26)$$

$$\boldsymbol{PopG_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j PopG_{it-1} + \varepsilon_{3it} \ldots\ldots\ldots\ldots \quad (27)$$

$$\boldsymbol{Edu_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j Edu_{it-1} + \varepsilon_{4it} \ldots\ldots\ldots\ldots \quad (28)$$

$$\boldsymbol{Corup_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j Corup_{it-1} + \varepsilon_{5it} \ldots\ldots\ldots \quad (29)$$

$$\boldsymbol{FAid_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j FAid_{it-1} + \varepsilon_{6it} \ldots\ldots\ldots\ldots \quad (30)$$

$$\boldsymbol{Inv_{it}} = \sum_{t=1}^{n} \beta_i RGDP_{it-1} + \sum_{t=1}^{n} \beta_j Inv_{it-1} + \varepsilon_{6it} \ldots\ldots\ldots\ldots \quad (31)$$

Results

Correlation analysis is used to determine the direction and strength of the relationship between latent variables. As illustrated in Table 1, the results show that all variables, have a positive relationship with ECN.

Table 1: Correlation Analysis

	1	2	3	4	5	6	7
RGDP	1.00						
	--						
Gov	0.15	1.00					
	(0.41)	--					
Pop	0.20	0.13	1.00				
	(0.27)	(0.48)	--				
Inv	0.26	-0.13	0.41	1.00			
	(0.15)	(0.46)	(0.02)	--			
Edu	0.03	-0.12	0.43	0.03	1.00		
	(0.87)	(0.52)	(0.01)	(0.88)	--		
Corup	0.311	0.03	-0.23	0.31	0.13	1.00	
	(0.01)	(0.87)	(0.52)	(0.01)	(0.88)	--	
Faid	0.411	0.543	-0.762	0.052	0.362	0.234	1.00
	(0.01)	(0.627)	(0.52)	(0.01)	(0.88)	(0.62)	--

Econometric theory requires that all variables must be stationary conditions. If non-stationary variables are used in the regression, the results will be misleading because of spurious regression. Therefore, it is a preliminary condition to test for the unit root before proceeding to other econometric analysis. In this study, the LLC test was employed to perform the panel unit root test.

Table 2: LLC test

Test	Constant	Constant+Trend
Panel v-Statistics	-1.926	-2.8731
Panel ρ -Statistics	0.07231	0.7632
Panel t -Statistics (non-parametric)	-6.6752***	-8.843***
Panel t -Statistics (parametric)	-4.327***	-6.674***
Group ρ -Statistics	2.732	2.923
Group t -Statistics (non-parametric)	-7.762***	-10.253***
Group t -Statistics (parametric)	-3.877***	-4.324***

The null hypothesis is rejected at 5 percent significance level by the ADF, and in the panel and group t statistics, even the conditions are constant or constant plus trend. Therefore, the null hypothesis rejection is supported by most of the statistics, which reflects that there exists a long-term association between the variables with reference to the ASEAN countries. In the conditions of constant or constant plus trend, the parametric (ADF-statistics) and non-parametric (t-statistics) are considered reliable (Pedroni, 1999). In this regard, Table 3 shows the results, which lead to the conclusion that there is a long term association between the variables.

During the estimation exercise, we conducted a number of tests that included the Redundant Fixed Effects test and Hausman test. For instance, the Redundant Fixed Effects test was conducted to test the hypothesis that time-specific effects are present in the time series and cross section data. This test enables us to determine if the pooled Ordinary Least Squares (OLS) estimation is appropriate or not and whether one should use the FE/RE estimation. Similarly, the Hausman test was performed to determine if the RE estimates are correct and preferred to the FE and GMM estimates. The data of ASEAN countries over the period of 32 years from 1982 to 2017 is gathered from the official forums The fixed effect regression results of the model 2-8 are explained in the table 2 and table 3. The findings of the study are showing consistency with the prior finds. The government expenses and inflation appeared in a negative but significant relationship with the saving of ASEAN countries.

Table 3: Regression results of fixed effect estimates (equation 22-24)

Dependent Variable: $\boldsymbol{GDP}$	**Model 22**	**Model 23**	**Model 24**
Gov	0.177***	0.135**	0.089**
Pop	0.198**	0.154**	0.170**
Inv	0.254**	0.0238**	0.243*
Edu	0.222	0.313*	0.284*
Corup		-0.231**	-0.239**
FAid			-0.234*
$\boldsymbol{R}$**^2**	**0.740**	**0.518**	**0.616**

Table 4 represents the results of causality direction between the variables of interest examined through Granger causality test. This study performed the Granger causality test to assess the causal relation between economic growth and corruption. For this test, same data set for real per capita GDP and corruption was used and was obtained from IMF and ICRG, respectively. The question that whether x variable Granger causes y variable, i.e. how much of the past y values explain the current y value, and if there is any improvement in explanation by adding variable x lagged values. It is said that x Granger caused y, if x contributes to predict y, or similarly when lagged x coefficients turned out to be statistically significant. A case which frequently occurs is a two-way causation i.e. x Granger causes y and y Granger causes x. However, it must be noted that the Granger cause statement does not indicate that y is the result of x. The Granger causality test measures information content and precedence, however it does not measure causality as the term says. The statistical findings give F-statistics obtained by performing Wald test to analyse the joint hypothesis. In the first hypothesis, it is tested that there is no causal relationship running from x to y, and the other null hypothesis states that a causal relationship runs from y to x. The value of F-statistic was found to be statistically significant which rejects the null hypothesis.

Table 4: Granger causality test

Equation 25			
Excluded	**Chi-sq**	**df**	**Prob.**
RGDP	34.651	2	0.000
L-RGDP	20.219	2	0.000
Gov	78.236	2	0.000
All	**133.106**	**6**	**0.000**
Equation 26			
RGDP	31.721	2	0.000
L-Gov	17.182	2	0.000
Gov	53.236	2	0.000
All	**102.39**	6	**0.000**
Equation 27			
RGDP	14.613	2	0.000
Pop	10.222	2	0.000
L-Pop	21.236	2	0.000
All	**46.071**	**6**	**0.000**
Equation 28			
RGDP	32.231	2	0.000
Edu	12.762	2	0.000
L-Edu	28.236	2	0.000
All	**73.229**	**6**	**0.000**
Equation 29			
RGDP	21.651	2	0.000
Corup	17.219	2	0.000
L-Corup	21.236	2	0.000
All	**60.521**	6	**0.000**
Equation 30			
RGDP	21.023	2	0.000
FAid	2.321	2	0.000
L-FAid	8.091	2	0.000
All	**31.435**	6	**0.000**
Equation 31			
RGDP	34.231	2	0.000
Inv	20.219	2	0.000
L-Inv	11.226	2	0.000

All	**65.676**	**6**	**0.000**

Thus, another causality test was performed to check the causal relation among corruption and economic growth. In the first hypothesis, it is proposed a causal relation runs from corruption to economic growth, and in the second null hypothesis, it is proposed that no causality exists from economic growth to corruption. Table 3 shows that due to insignificant F-statistic, the first null-hypothesis cannot be rejected, which implies that it confirms that corruption does not cause economic growth. This finding is inconsistent with the literature. Contrarily, the F-statistics for the second hypothesis turned out to be significant at 5% significance level, which indicates the rejection of the second hypothesis. The rejection of the second hypothesis implies that a causal relation exists between economic growth and corruption. A few countries while experiencing economic growth tend to make necessary structural adjustments, through replacing corrupt practices, policies, and institutions, with the good strategies to make it look less crucial, which may empower the elite class and encourage corrupt activities (Franko, 2018). Such as, after the Second World War, the rapid growth period of the former Soviet Union has aggravated the corruption level without improving institutions and introducing new policies. In late 1990s, the Asian crisis has shown that experiencing rapid economic growth in the absence of proper institutional structures may encourage corruption and is more exposed to crises (Chang & Grabel, 2014).

Conclusion

It has been argued that foreign aid encourages corruption (Belgibayeva & Plekhanov, 2019). In an effort to improve foreign aid accountability, although costly, it has become a common practice, since spending on corrupt governments has abandoned those institutions which are critical for the country's economic growth and that establish corrupt elites. Thus, a causality test was performed to test the causal relationship between corruption and foreign aid (Abu, Karim, & Zaini, 2015). In the first hypothesis, it is proposed that there is no causal relation running from corruption to foreign aid, whereas, in the second hypothesis, it is proposed that there is no causal relation running from foreign aid to corruption. This has shown that we cannot reject both the first and second null hypotheses, as F-statistics obtained for both hypotheses are insignificant. It implies that corruption does not cause foreign aid and foreign aid also does not cause corruption. A noteworthy fact highlighted by Heywood (2015) is that during 1960-2005, a foreign aid of above US$450 billion has been received by Africa, despite the worsening condition of corruption in Africa during the past few years.

Furthermore, the findings suggest that the effects of government spending on output is reduced by corruption. Putting it differently, corruption infuses inefficiency in the factors of production, such as, the corrupt officials tend to approve higher cost public projects to obtain personal benefits (Chayes, 2015). Incompetent and inefficient firms offer bribe payments to capture government licenses and contracts to obtain benefits through the corrupt officials, by creating additional cost and risk to the government. The findings obtained in this study are found to be consistent with the findings from Kobayashi (2017), who suggested that public investment increases and it's effectiveness decreases with corruption, and the findings from Tanzi and Davoodi (2015), which indicated that public investment increases, and infrastructure quality and operation maintenance decreases with the increase in political corruption. Moreover, results also explained that the education expenditure effects on output also reduces with corruption. Agostino et al. (2016) reported that negative association exists among corruption and, because it offers limited rent-seeking opportunities compared to what other items offer. In our study, the variable of education spending shows human capital. Thus, it is concluded that human capital productivity declines with corruption. Another study found empirical evidence that human capital productivity is negatively affected by corruption. Moreover, Agostino et al. (2016) suggested that corrupt officials put in substantial efforts and time to accumulate political capital, which consequently may reduce the productivity of democracies and governments.

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