Government expenditure and economic growth: does the role of corruption control matter?

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ABSTRACT

This study focuses on analyzing the role of corruption control in the impact of government expenditure on economic growth. The data were collected from 16 Emerging Markets and Developing Economies (EMDEs) in Asia over the period 2002–2019. Generalized method of moments (GMM) and threshold model were used to estimate research models. The estimation results show that government expenditure and corruption control have a negative impact on economic growth. Specifically, the interaction between government expenditure and corruption control can reduce the level of the negative impact of these two factors on economic growth, which is an interesting finding of this study. Moreover, unlike previous studies, the threshold model estimation results reveal that corruption control has two threshold values of -0.61 and 0.01, respectively. Accordingly, EMDEs in Asia can make the positive impact of government expenditure on economic growth if corruption control is above the threshold value of 0.01.

1. Introduction

The impact of government expenditure (GE) on economic growth (EG) is always of the top concern in many countries. In particular, corruption control (CC) can play a very important role in stimulating the impact of GE on EG (d’Agostino et al., 2016; Hodge et al., 2011). If this role is identified, countries will have a basis to make appropriate policies towards improving EG in a sustainable manner. In order to provide empirical evidence on this issue, we conducted this study with the objective of examining the role of CC in the impact of GE on EG.

The impact of GE on EG can be explained through the endogenous growth model (Bucci et al., 2021; Burkiewicz and Yanikkaya, 2011). Accordingly, GE plays an important role in allocating resources in the economy, thereby impacting EG significantly in the long run. Furthermore, GE impacts EG through the efficiency of the provision of public goods and services (Grossman, 1990). What is more, the impact of GE on EG is also a research topic that has received great attention in empirical studies. In particular, a number of studies have shown that GE can have a positive impact on EG through improving the quality of public services, encouraging consumption, and promoting private investment (for example: Arestis et al., 2021; Arvin et al., 2021; Attari and Javed, 2013; Bucci and Cozzi, 2021; Facchini and Melki, 2013; Ghose and Das, 2013; Grossman, 1990; Odhiambo, 2021; Ram, 1986; Wu et al., 2010).

However, others argue that GE can hinder EG if GE is used inefficiently (for instance, Afonso and Furceri, 2010; Barro, 1990; Butkiewicz and Yanikkaya, 2011; Grier and Tullock, 1989; Guseh, 1997; Hajamini and Falahi, 2018; Hanson and Henrekson, 1994; Landau, 1985; Romero-Ávila and Strauch, 2008; Schaltegger and Torgler, 2006). This indicates that the impact of GE on EG has been confirmed in a great deal of existing literature. Nonetheless, there are still conflicting views on the impact level of GE on EG.

The impact of CC on EG has also been confirmed in many empirical studies. However, there are still some conflicting views on the level of this impact. Indeed, CC can improve the efficiency of resource allocation in the economy, encouraging new investment, thereby stimulating EG (for example, Afdt et al., 2008; Al Qudah et al., 2020; Banerjee et al., 2022; Bardhan, 1997; Blackburn et al., 2006; Cieslik and Goczek, 2018; Gründler and Potrafke, 2019; Malanski and Póvoa, 2021; Mauro, 1995; Ménard and Sekkat, 2005; Pellegrini and Gerlagh, 2004; Rock and Bonnett, 2004; Saleh et al., 2016; Ugur, 2014). Nevertheless, CC can have a negative impact on EG because it can restrict resource allocation in the economy. Accordingly, corruption can be useful in ‘greasing of the wheels’, thereby promoting EG, which proves to be suitable for countries with weak institutional quality. This view is supported by the empirical studies of Colombatto (2003), Ménard and Weill (2010), Kato and Sato (2015), Huang (2016). In addition, some experimental studies have...
confirmed the nonlinear impact of CC on EG, which means there is a threshold value of CC in this impact. Accordingly, CC can stimulate EG significantly when CC exceeds the threshold value (Aidt, 2009; Alfada, 2019; Bose et al., 2008; Dzhumashev, 2014; Haque and Kneller, 2009).

From a different perspective, several empirical studies have assumed that corruption can reduce the efficiency of GE use (Dzhumashev, 2014; Keefer and Knack, 2007), thereby having a significant impact on EG. In other words, CC may play an important role in the impact of GE on EMDEs. Indeed, Hodge et al. (2011) stated that corruption can promote EG by reducing GE in 81 countries. It can be seen that Hodge et al. (2011) is one of the pioneering studies in exploring the role of CC in the impact of GE on EG. However, this study only made a statement about this role, and it has not analyzed the specific impact of GE on EG at different levels of CC. In another study, d'Agostino et al. (2016) noted that corruption is closely associated with GE in 106 countries. Accordingly, corruption and GE are two factors that have a negative impact on EG, but good CC can reduce the level of the negative impact of GE on EG. Recently, Nan (2022) suggested that countries should improve CC as well as allocate GE effectively to promote EG.

It can be seen that the role of CC in the impact of GE on EG is a research topic that has not been paid enough attention in empirical studies. Specifically, d'Agostino et al. (2016) and Nan (2022) are two rare empirical proofs to be in favour of the original statement of Hodge et al. (2011). Notwithstanding, these experimental studies still have a great limitation when they only come to the conclusion that CC can interact with GE when these two factors affect EG. These studies have not analyzed the specific impact of GE on EG at different levels of CC. This is really a big gap that needs to be explored and analyzed more adequately.

In general, the impact of GE on EG depends on the size of GE (Hajamini and Falahi, 2018) and especially the level of CC (d’Agostino et al., 2016; Hodge et al., 2011). It can be said that the size of GE and the level of CC are two important factors for many countries when these countries desire to achieve sustainable EG (Alfada, 2019; d’Agostino et al., 2016). Corruption can stimulate GE (Haque and Kneller, 2009), because it enables bureaucrats to abuse their public positions for private gains (Dzhumashev, 2014). If GE is used effectively, it can boost EG, otherwise it can inhibit EG (d’Agostino et al., 2016; Montinola and Jackman, 2002). This shows that GE and CC can interact with each other and this interaction can have a significant impact on EG. This judgment was found in the studies conducted by Hodge et al. (2011), d’Agostino et al. (2016) and Nan (2022). It can be seen that these are ground-breaking studies which find a significant impact of the interaction variable between GE and CC on EG. However, this issue has rarely been examined in empirical studies. In addition, there is a lack of empirical studies examining the specific impact of GE on EG at different levels of CC. Or in other words, can good control of corruption have a positive impact, or just reduce the level of the negative impact of GE on EG? If yes, what value should the level of CC achieve? These questions have not been answered satisfactorily in the existing literature.

It can be seen that examining the role of CC in the impact of GE on EG is an interesting subject of research and there have been plenty of gaps to explore. Corruption is a very strong emerging phenomenon in EMDEs (d’Agostino et al., 2016). However, there is a lack of empirical studies examining the role of CC in the impact of GE on EG in EMDEs, especially EMDEs in Asia. Therefore, this research topic is not only scientifically valid through providing the existing literature with the role of CC in the impact of GE on EG, but also has important implications for EMDEs in Asia.

We conduct this study with the expectation that we might contribute to the existing literature in a number of ways. First, we provide empirical evidence on the impact of the interaction variable between GE and CC on EG in EMDEs in Asia. Although this impact was previously shown by Hodge et al. (2011), d’Agostino et al. (2016) and Nan (2022), this is still a very rare research topic in empirical studies. Almost no empirical studies have examined this issue with the data sample of EMDEs. Second, based on the views of Hodge et al. (2011) and d’Agostino et al. (2016), we examine the role of CC in the impact of GE on EG in EMDEs in Asia. Accordingly, we can determine the existence of threshold values of CC in this impact. Especially, the impact of GE on EG in the regions before and after these threshold values is examined, which has not been done in previous studies.

The findings in this paper are important because they are the first empirical evidence for the role of CC in the impact of GE on EG in EMDEs in Asia. Indeed, through the GMM estimation, we find the negative impact of GE and CC on EG; however, the interaction between GE and CC can reduce the level of the negative impact of these two factors on EG. This result is consistent with the previous findings of Hodge et al. (2011) and d’Agostino et al. (2016). Furthermore, through the threshold model, we determine the two threshold values of CC of -0.61 and 0.01, respectively. In combination with the use of the GMM estimation, we find that GE can make a positive impact on EG if CC is maintained above the threshold value of 0.01, which is our new finding compared with previous studies. Our findings shed more light on the role of CC in the impact of GE on EG, which is a major contribution to the existing literature on this topic. Additionally, our new findings have important implications for EMDEs in Asia in making appropriate policies to promote sustainable EG. Accordingly, the improvement in CC becomes very important for EMDEs in Asia in promoting sustainable EG. Furthermore, these countries need to allocate GE reasonably and efficiently. On top of that, the synchronous combination of many appropriate policies is also essential in promoting sustainable EG.

The rest of the study is organized as follows. The next section presents an overview of the relevant literature, followed by the methodology and data section. Section four reports the main empirical results, and section five of the article draws conclusions and proposes a number of policy implications for improving the effectiveness of GE on EG.

2. Review of relevant literature

2.1. Empirical studies on the impact of GE on EG

The neoclassical growth model and the endogenous growth model are two important models in the theory of EG (Bucci et al., 2021; Butkiewicz and Yanikkaya, 2011). In the neoclassical growth model, EG depends on the growth of resources (labor) and technology. This shows that EG is not impacted by the government’s policy selection. In the endogenous growth model, this model assumes that policies and other variables influence EG in the long run. In these policies, GE plays an important role in resource allocation in the economy, and therefore, it can have a significant impact on EG. Moreover, GE is also considered to be the main cause of EG in many countries (Loizides and Vamvoukas, 2005). GE not only responds to the needs of the public sector, but also helps regulate the private sector (Arestis et al., 2021). As a result, the role of GE in EG has been increasingly improved, especially in the case of the countries in the process of industrialization and urbanization. The economic theory asserts that government can influence EG through two ways: (1) Positive impact through the effective provision of public goods and services; (2) Negative impact through ineffective provision of public goods and services (Grossman, 1990). In empirical studies, although this is a topic that has been of great interest, there are still many contradictory views.

GE can boost EG through consumption stimulation and the incentive to promote private investment (Arestis et al., 2021). Indeed, increased and effectively used GE can improve the quality of public services, stimulating domestic consumption, as well as also facilitating and promoting private sector investment. Therefore, GE can have a positive impact on EG, which is what most countries desire to aim for. This result is also found in many empirical studies. For example, Ram (1986), when analyzing the data from 115 developing and developing countries, argued that GE has a positive impact on EG. Grossman (1990) found a positive impact of GE on EG in 48 countries. In another study, Wu et al. (2010) found that GE has a useful role in stimulating EG in 182 countries. Attari and Javed (2013) argued that GE can have a positive impact on EG in Pakistan. With the analysis of the data from 19 emerging market economies.
economies, Ghose and Das (2013) also found a positive impact of GE on EG. With the same viewpoint, Facchini and Melki (2013) also find a positive effect of GE on EG in France. Furthermore, this study also shows that the level of the impact of GE on EG depends much on the characteristics of each country. Recently, Arestis et al. (2021) found a positive impact of GE on EG in Turkey. Arvin et al. (2021) argued that the improvement in the effectiveness of GE has an important role in stimulating EG in the long run in low-income and lower middle-income countries. Bucci et al. (2021) demonstrated that health expenditure as well as health investment have a positive impact on EG in low-income and middle-income countries. In addition, Odhiambö (2021) found a significant impact of public health expenditure on EG in sub-Saharan African low-income countries, but this impact was insignificant in middle-income countries in this region.

GE can have a negative impact on EG. Accordingly, if GE is used ineffectively, it can reduce the quality of public services, limit consumption, and can overwhelm or inhibit private investment, thereby reducing EG. This impact has been found in many empirical studies. For instance, Landau (1985) argued that GE is correlated with the deceleration of EG in developed countries. In the same view, Grier and Tulloch (1989) also found a negative impact of GE on EG in 113 countries. Based on the theory of endogenous growth, Barro (1990) stated that ineffective GE can decrease EG, but the level of this impact depen the effectiveness of government management. Hansson and Henrekson (1994) analyzed the data from 14 OECD countries and argued that government consumer expenditure has a negative impact on EG. Meanwhile, EG is positively impacted by expenditure on education and not significantly impacted by expenditure on investment. Guseh (1997) argued that GE has a negative impact on EG in 59 middle-income developing countries. Sharing the same view, the studies found the negative impact of GE on EG in OECD countries. With a different approach, Schaltegger and Torgler (2006) conducted an analysis of data at the localities in Switzerland and showed that expenditure from the budget has a negative impact on EG at these localities. Romero-Avila and Strauch (2008) argued that government consumption spending has a negative impact on EG in 15 European countries, but public investment spending has a positive effect on EG. Afonso and Furrer (2010) also found the negative impact of GE on EG in OECD and EU countries. Butkiewicz and Yanikkaya (2011) stated that GE has a negative impact on EG in more than 100 developed and developing countries. This impact is found very clearly in developing countries with ineffective governments. This shows the importance of fiscal policies to EG, especially in developing countries. Moreover, the researchers also assumed that government effectiveness is an important determinant of the impact of GE on EG. Recently, Hajamini and Falahi (2018) have highlighted that a large increase in GE could lead to a negative impact on EG in 14 developed countries in Europe.

Overall, GE plays an important role in resource allocation in the economy (Butkiewicz and Yanikkaya, 2011). Therefore, EG is impacted positively or negatively by GE depending on the size of the expenditure (Hajamini and Falahi, 2018), especially the effectiveness of the government in allocating and spending management (Barro, 1990; Butkiewicz and Yanikkaya, 2011). In addition, the impact of GE on EG depends on the data and analytical methods (Aged et al., 1997). It can be said that the statistically significant impact of GE on EG has been found in quite a few empirical studies. However, there are still some empirical studies that have not found a statistically significant impact in terms of this issue, such as the studies conducted by Easterly and Rebelo (1995), Bose et al. (2007).

2.2. Empirical studies on the impact of CC on EG

Corruption can be understood as the abuse of a public office for private gain, which can also be considered as the abuse of entrusted power for private gain (Banerjee et al., 2022; d’Agostino et al., 2016). Corruption is an emerging phenomenon in many countries (Cieśluk and Goczek, 2018). Corruption can also result in an increase in government resource allocation, which can stimulate EG if these resources are managed and allocated effectively. However, the allocation of these resources will be ineffective if public officials seek to maximize private gain, which can inhibit EG (d’Agostino et al., 2016; Montinola and Jackman, 2002). Therefore, CC will contribute to limiting corruption, which can have a significant impact on EG. Most empirical studies have considered EG as a function of CC and a set of control variables (Barro, 1991; Levine and Renelt, 1992). However, there have been many contradictory views about the impact of CC on EG.

CC can play an important role in stimulating EG because corruption is often considered an important obstacle to EG in many countries (d’Agostino et al., 2016). Indeed, corruption increases uncertainty in terms of return on investment (Blackburn et al., 2006; Guriev, 2004), reducing individuals’ investment motives and, in particular, decreasing the effectiveness of resource allocation in the economy (d’Agostino et al., 2016). In an environment of high corruption, the resources allocated in the economy will be wasted and ineffective (Cieśluk and Goczek, 2018). Consequently, corruption can lead to discouraging new investment, destabilizing the economy, impeding EG and becoming a burden on each country (Bardhan, 1997; Blackburn et al., 2006; Mauro, 1995; Meen and Sekkat, 2005; Pellegrini and Gerlagh, 2004; Rock and Bonnett, 2004). With an approach through the synthesis of the results of empirical studies, many researchers have declared that corruption can hinder EG. For example, Ugur (2014) synthesized the results of 29 empirical studies and found that although there are differences in the country scope, the analysis time and the estimation method, the main direction of the impact of corruption on EG is negative. With the synthesis of the results of 41 empirical studies, Saleh et al. (2016) found that most of the empirical studies have a common view on the negative impact of corruption on EG. With another point of view, Aidt et al. (2008) claimed that the impact of corruption on EG in countries depends on the institutions of these countries. Specifically, in the countries with high institutional quality, corruption can have a significant negative impact on EG. Meanwhile, in the countries with low institutional quality, the impact of corruption on EG is insignificant. Additionally, Cieśluk and Goczek (2018) also found that corruption can hinder investment and inhibit EG in 142 countries. This study also found that rich countries often have easier access to international financial resources and are less susceptible to corruption than emerging economies. Moreover, corruption also causes significant costs to the economy, the resources in the economy are allocated inefficiently, and policies are distorted. In another study, Gründler and Potrafke (2019) found a negative impact of corruption on EG in the long run in 175 countries, and this impact was evident in the countries with low institutional quality. Al Qudah et al. (2020) also found a negative impact of corruption on EG in the long run in Tunisia. Sharing the same view, Malanski and Povoa (2021) found a negative impact of corruption on EG in emerging countries in Latin America and Pacific Asia. Meanwhile, Goel and Nelson (2021) stated that the effectiveness of CC in countries depends on the size and structure of the government. Recently, Banerjee et al. (2022b) have asserted that CC plays an important role in developing countries, especially in the improvement in the ability to mobilize capital in these countries. CC can have a negative impact on EG because it can limit the allocation of government resources, thereby inhibiting EG. This impact is appropriate for countries with poor institutional quality. Indeed, Colombo (2003) presumed that in developing countries, corruption acts as ‘speed money’ under conditions of political instability and institutional inefficiency, thereby boosting EG. Therefore, CC can hinder EG in these countries. Sharing the same view, Aidt et al. (2008) have claimed that corruption does little to detract from economic growth in poor institutional quality. As another interpretation, Meen and Weill (2010) pinpointed that corruption can be useful in ‘greasing of the wheels’, meaning that corruption will stimulate EG in countries with ineffective institutional quality. This view is also supported by the study of Kato and Sato (2015) with the analysis of the Indian data. In addition, Huang (2016) found a positive impact of corruption on EG in South Korea. The author also argued that the fact that policy makers use anti-corruption policies to promote EG may not be effective.
With a different point of view, many studies have suggested that CC can have a nonlinear impact on EG. Accordingly, the impact of CC on EG may vary depending on the level of CC. Indeed, an appropriate increase in corruption (below the threshold of corruption, which means the high level of CC) can contribute to stimulating growth. Conversely, if the level of corruption is higher than the permitted threshold (the low level of CC), corruption can hinder EG. This result has been found in the studies of Bose et al. (2008), Aidt (2009), Haque and Kneller (2009), Dzhumashev (2014). Recently, Alfada (2019) has examined the nonlinear impact of a number of corruption cases on EG in the Indonesian provinces. The research results show that corruption can hamper EG in the provinces with the corruption level below the threshold of 1,765 points, and this negative impact becomes stronger for provinces with the level of corruption above the threshold. This shows that localities in Indonesia have to grapple with the problem of corruption even though they have succeeded in maintaining the corruption level below the threshold.

2.3. Empirical studies on the role of CC over the impact of GE on EG

In addition to the studies that analyze the direct impact of CC on EG, there are a number of studies that have examined the indirect impact of CC on EG through GE. In fact, government officials with corruption often allocate expenditure on projects where they can collect bribes and to keep them hidden. This means that corruption can lead to inefficient GE (Dzhumashev, 2014; Keefer and Knack, 2007). Hence, the indirect impact of CC on EG through GE is understandable. This impact is also found in a number of empirical studies. For example, Hodge et al. (2011) argued that corruption can promote EG in 81 countries by reducing government consumer expenditure. Furthermore, corruption can hamper EG in these countries by reducing investment in physical capital and human capital. In a different study, Ugur (2014) synthesized the results of 29 previous studies and found that corruption can harm EG through public finance. What is more, corruption can distort the budget revenue and affect the government's expenditure structure. With more detailed remarks, d’Agostino et al. (2016) noted that corruption is closely related to GE in 106 countries. Although these two factors have negative impacts on EG, good control of corruption can reduce the level of the negative impact of GE on EG. In addition to the above factors, CC can play a very important role in Eq. (1). Indeed, CC can act as a control variable, and at the same time can act as an independent variable in this equation (Alfada, 2019; d’Agostino et al., 2016). Moreover, GE can be significantly dependent on CC (Cieslik and Goczek, 2018).

3. Econometric methodology and data

3.1. Econometric methodology

3.1.1. GMM estimation

We analyze the impact of GE on EG through the following equation:

\[ \text{EG}_t = \alpha + \beta \text{GE}_t + \gamma_1 \text{CC}_t + \gamma_2 \text{INF}_t + \epsilon_t \]  

(1)

Where:

- \( \text{EG} \) is measured via GDP per capita growth (annual %), which is in accordance with the previous views of Attari and Javed (2013), Ghose and Das (2013).
- \( \text{GE} \) is measured through general government final consumption expenditure (% of GDP), which is based on the studies of Guseh (1997), Attari and Javed (2013), Ghose and Das (2013), Cieslik and Goczek (2018), Hajamini and Falahi (2018).

\( \text{X} \) is a set of control variables, including: Gross capital formation (CAP) and inflation (INF). These control variables are also used in the study of Attari and Javed (2013), Ghose and Das (2013), Cieslik and Goczek (2018). By including these two control variables in our model, we desire to further examine the impact of inflation and domestic investment on EG. In addition to the above factors, CC can play a very important role in Eq. (1). Indeed, CC can act as a control variable, and at the same time can act as an independent variable in this equation (Alfada, 2019; d’Agostino et al., 2016). Moreover, CC can be significantly dependent on CC (Cieslik and Goczek, 2018).

\[ \epsilon_t \] is the error in the model.

Based on the idea of Cieslik and Goczek (2018), we use a linear interaction model by forming the term of the interaction between GE and CC. Through this approach, we can examine the impact of the combination of GE and CC on EG. In other words, we can evaluate the dependency of GE on CC through Eq. (2). In particular, CC is identified based on the Worldwide Governance Indicator (WGI) data published by the World Bank (Table 1).

Assuming GE is dependent on CC, we have:

\[ \delta = \gamma_1 + \gamma_2 \text{CC}_t \]

(2)

Accordingly, the research model of the impact of GE on EG has the following equation:

\[ \text{EG}_t = \alpha + \gamma_1 \text{GE}_t \times \text{CC}_t + \gamma_2 \text{INF}_t + \beta \text{X}_t + \epsilon_t \]

(3)

To test the impact of GE on EG, we use the GMM proposed by Arellano and Bond (1991) to estimate the research model according to Eq. (3). The GMM estimation was also used in the study of d’Agostino et al. (2016), Cieslik and Goczek (2018), Hajamini and Falahi (2018). This estimation method allows us to control the endogeneity issues in the research model, and simultaneously, to ensure the robustness of the research model. The latent endogeneity in the model can arise when the explanatory variables are correlated with the errors, and these explanatory variables are called endogenous variables. The GMM estimation will be done through the use of a matrix of instrumental variables that are correlated with endogenous variables, but not correlated with the model errors (Hajamini and Falahi, 2018). Thereby, the latent endogeneity in the model will be controlled, ensuring the reliability of the estimation results.

| Table 1. Variables and definition. |
|-----------------------------------|
| Variables       | Definition                                           |
| Economic growth  | \( \text{EG} \) GDP per capita growth (annual %)      |
| Government expenditure | \( \text{GE} \) General government final consumption expenditure (% of GDP), GE includes all government current expenditures to buy goods and services. GE also covers most national defense and security expenditures |
| Corruption control | \( \text{CC} \) stands for Corruption Control Index. CC estimates the government effectiveness of corruption control. CC ranges from -2.5 (weak) to 2.5 (strong) |
| Gross capital formation | \( \text{CAP} \) Gross capital formation (% of GDP). CAP consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories |
| Inflation        | \( \text{INF} \) Consumer prices (annual %)            |
3.1.2. Threshold model

We will use the threshold model proposed by Hansen (1999) to test the existence of the threshold value of CC in the research model. If there is a threshold value of CC, we can analyze the impact of GE on EG at different levels of CC, namely in the regions before and after the threshold value of CC. This approach enables us to take a more detailed examination of the impact of GE on EG at different levels of CC, which is the limitation of the GMM estimation. Furthermore, estimating the threshold value of CC on panel data can lead to more reliable results than estimating on time series or cross sectional data (Hajamini and Falahi, 2018). Therefore, the combination of the GMM estimation and the threshold model has been used in a number of empirical studies, including the case of the data sample where the number of countries (N) is smaller than the time (T) as in the study by Hajamini and Falahi (2018).

In the case where a threshold (λ) exists, the model will have the following equation:

$$ EG_t = \alpha + \delta_1 GE_t I( CC_t \leq \lambda_1 ) + \delta_2 GE_t I( CC_t > \lambda_1 ) + \beta X_t + \epsilon_t \quad (4) $$

In Eq. (4), λ is the threshold value of CC. I(·) is an indicator function of CC.

In the case where the model has two thresholds (λ₁ and λ₂), the model will have the following equation:

$$ EG_t = \alpha + \delta_1 GE_t I( CC_t \leq \lambda_1 ) + \delta_2 GE_t I( \lambda_1 < CC_t \leq \lambda_2 ) + \delta_3 GE_t I( CC_t > \lambda_2 ) + \beta X_t + \epsilon_t \quad (5) $$

In Eq. (5), λ₁ and λ₂ are the two threshold values of CC. I(·) is an indicator function of CC.

In the case that the model has multiple-thresholds (j thresholds), the model will have the following equation:

$$ EG_t = \alpha + \delta_1 GE_t I( CC_t \leq \lambda_1 ) + \sum_{j=2}^{J-1} \delta_j GE_t I( \lambda_{j-1} < CC_t \leq \lambda_j ) + \delta_J GE_t I( CC_t > \lambda_J ) + \beta X_t + \epsilon_t \quad (6) $$

In Eq. (6), λ₁ (j thresholds) are the threshold values of CC. I(·) is an indicator function of CC.

3.2. Data

In this paper, we use the data from 16 EMDEs in Asia for analysis. EMDEs is a term used by the International Monetary Fund (IMF) to refer to the countries whose economies are in the development stage and in the transition period from developing countries to developed countries (Mody, 2004). These countries have similar characteristics of low or middle income levels, but they all achieve rapid growth (Hoskisson et al., 2004). These countries have similar characteristics of low or middle income levels, but they all achieve rapid growth (Hoskisson et al., 2004). These countries have similar characteristics of low or middle income levels, but they all achieve rapid growth (Hoskisson et al., 2004). These countries have similar characteristics of low or middle income levels, but they all achieve rapid growth (Hoskisson et al., 2004).

The data on CC, GE and control variables (CAP and INF) are collected from the official websites of World Bank Database. In terms of the data on CC, we collect this data from the WGI published by the World Bank. Based on a standard normal distribution, WGI scores a country in regard to the comprehensive index of corruption. CC ranges from -2.5 to 2.5, with lower value reflecting higher corruption. The annual data on CC are published from 2002 onwards; therefore, we can only collect the data on CC during this period.

4. Empirical analysis

4.1. Basic statistics

Table 2 shows the preliminary statistics on EG, GE, CC, CAP, and INF of 16 EMDEs in Asia over the period 2002-2019. In particular, EG reached the lowest value in Timor-Leste in 2002 and the highest value in Bhutan in 2007. GE reached the lowest value in Cambodia in 2006 and the highest value in Timor-Leste in 2002. CC reached the lowest value in Bangladesh in 2004 and the highest value in Bhutan in 2018.

Table 3 shows that multicollinearity in the research model is not an issue, because the correlation between the independent variables and the control variable is relatively low. Moreover, EG is negatively correlated with CC. Regarding the control variables CAP and INF, these variables are positively correlated with EG.

4.2. GMM estimation results

We use the GMM estimation to analyze the research model in terms of the impact of GE on EG according to Eq. (3), and the results are presented in Table 4.

Table 4 shows that the estimation results of the research model according to the GMM method are statistically significant at the 1% level. At the same time, the tests like the Arellano-Bond test and the Hansen test are satisfactory. Therefore, the estimation results of the research model are appropriate and usable. Accordingly, EG is negatively impacted (−0.038) by GE at the 1% significance level. Our findings suggest that inefficient use of GE can hamper EG, which is quite relevant for EMDEs in Asia - where the government efficiency in the management of GE is still limited. These results are also consistent with previous studies by Landau (1985), Grier and Tullock (1989), Barro (1990), Hansson and Henrekson (1999), Guseh (1997), Fölster and Henrekson (1999, 2001), Dar and Amirkhakhali (2002), Schaltegger and Torgler (2006), Romero-Avila and Strauch (2008), Afonso and Furceri (2010), Butkiewicz and Yanikkaya (2011), Hajamini and Falahi (2018). Despite the same view as previous studies, our results are of great significance for EMDEs in Asia. This is because most previous studies only found the negative impact of GE on EG in developed countries such as OECD and EU countries, there is a lack of empirical studies examining this issue in EMDEs in Asia. In particular, based on these results, we can confirm that the endogenous growth model theory is completely consistent with the EMDEs in Asia, which means that the policy of Government (specifically, GE) plays an important role in resource allocation in the economy.

In terms of CC, we find the negative impact (−1.141) of CC on EG at the 1% significance level. This finding shows that CC can limit the allocation of government resources, which in turn can inhibit EG. This is completely relevant for EMDEs in Asia, where there are many countries with poor institutional quality. In these countries, corruption can be useful in ‘greasing of the wheels’, which leads to boosting EG. These results are also consistent with the earlier statements made by Colombo (2003), Afonso et al. (2008) when analyzing the data for developing countries. Additionally, our results are similar to some

Table 2. Descriptive statistics.

| Variable | Obs | Mean | Standard Deviation | Min | Max |
|----------|-----|------|--------------------|-----|-----|
| EG       | 288 | 4.222| 3.359              | -8.873 | 17.032 |
| GE       | 288 | 16.545| 18.879             | 3.460 | 147.733 |
| CC       | 288 | -0.339| 0.580              | -1.500 | 1.650 |
| CAP      | 288 | 30.679| 11.262             | 10.437 | 69.527 |
| INF      | 288 | 4.863 | 4.381              | -18.109 | 27.956 |

Table 3. Simple correlation matrix.

|       | EG   | GE   | CC   | CAP  | INF  |
|-------|------|------|------|------|------|
| EG    | 1.000|      |      |      |      |
| GE    | -0.228| 1.000|      |      |      |
| CC    | -0.190| 0.117| 1.000|      |      |
| CAP   | 0.353| -0.074| 0.243| 1.000|      |
| INF   | 0.220| -0.300| 0.168| 1.000|      |
previous studies on analyzing the data on countries with better development level, such as Kato and Sato (2015) and Huang (2016). However, we do not deny the important role of CC in EG, which is proven in the studies by Aidt et al. (2008), Uğur (2014), Saleh et al. (2016), Cieslik and Goczek (2018). In our opinion, if CC is implemented in conjunction with improving government effectiveness (especially improving the effectiveness of GE management), it is possible that CC can stimulate EG.

In Table 4, we found a negative impact (−0.021) of the interaction variable GE × CC on EG at the 1% significance level. This impact level is lower than the individual impact level of GE (−0.038) or CC (−1.141) on EG. This shows that the combination of GE and CC will reduce the negative impact of these two factors on EG. These results are consistent with the previous judgment of d’Agostino et al. (2016). However, our results are the first empirical evidence found in EMDEs in Asia; hence, these findings are of great significance for EMDEs in Asia. This GMM estimation result raises the following questions: Can good control of corruption have a positive impact, or only reduce the level of the negative impact of GE on EG? If yes, what value should the level of CC achieve? These questions are interesting but they have not been answered adequately in previous studies. To answer these questions, we will conduct the estimation of the research model proposed by Hansen (1999). This method is also used in the study of Alfada (2019). Accordingly, we expect to find the positive impact (0.108) of GE on EG at the 1% significance level. In the case that CC is greater than the second threshold value (λ2 = 0.01), we find a positive impact (0.108) of GE on EG at the 10% significance level. Therefore, with CC > -0.61, CC can indirectly impact EG through GE. Although this finding is quite similar to the study of Hodge et al. (2011), in this paper, we have identified two threshold values of CC (λ1 and λ2), Furthermore, we have determined the specific impact of GE on EG in the regions before and after these two threshold values, which is our new finding compared to previous studies. Accordingly, with CC ≤ 0.01, CC has not brought about a positive impact of GE on EG. However, with CC > 0.01, CC can bring about a significant positive impact of GE on EG. This finding has greatly supported our earlier judgment in the GMM estimation. Overall, CC does not always make a positive impact of GE on EG. If corruption is controlled at an appropriate level (above the threshold of λ2), it can completely stimulate EG. In this section, we also find a positive impact of the control variable CAP on EG, which is consistent with the GMM estimation results.

Overall, based on the ideas of Hodge et al. (2011) and d’Agostino et al. (2016), we found a negative impact of GE and CC on EG in EMDEs in Asia. However, the combination of GE and CC as an interaction variable can reduce the level of the negative impact. Moreover, we conducted more in-depth analysis to find the threshold values of CC, as well as the impact level of GE on EG in the regions before and after these threshold values. Our research results show that GE can completely create a positive impact on EG if CC is above the threshold value of 0.01. This is our new finding compared to previous studies. Furthermore, this finding has important implications for EMDEs in Asia in making appropriate policies towards improving EG in a sustainable manner.

4.3. Threshold model results

First, we will test the existence of the threshold value of CC in the research model, and the results are presented in Table 5.

Table 5: CC threshold summary.

|                   | Threshold | Lower   | Upper   |
|-------------------|-----------|---------|---------|
| First threshold   | -0.61     | -0.640  | -0.485  |
| Second threshold  | 0.010     | -0.060  | 0.030   |

Prob Single 0.003***
Prob Double 0.060*

Note: ***significant at 1% and *significant at 10%.

reached the first threshold value of λ1 = -0.61 and the second threshold value of λ2 = 0.01. Therefore, the research model of the impact of GE on EG can be presented according to Eq. (5). It can be said that the discovery of two thresholds of CC (λ1 and λ2) in this paper is our great success, which has not been done in previous studies.

Next, we will proceed to estimate the impact of GE on EG in the regions before and after two threshold values of CC λ1 and λ2, and the results are presented in Table 6.

Table 6: The estimation results of the threshold model.

| Dependent variable: EG |
|------------------------|
| EG                     |
| GE (CC ≤ -0.61)        |
| GE (CC > -0.61)        |
| CC (CC ≤ -0.01)        |
| CC (CC > -0.01)        |

Prob Single 0.000***
Prob Double 0.062*

Note: ***significant at 1%, **significant at 5%, and *significant at 10%.

In this paper, we focus on the role of CC in the impact of GE on EG in EMDEs in Asia during the period 2002–2019. To achieve this objective, we used a combination of GMM estimation and threshold model. This approach has helped us overcome the limitations of previous studies and discovered many interesting things. Indeed, thanks to the GMM estimation, we found the negative impact of GE and CC on EG. In particular, if the combination of GE and CC via an interactive variable will reduce the negative impact of these two factors on EG, and it can be said that this is the first empirical evidence of this issue in EMDEs in Asia. With the threshold
model, we identified two threshold values of CC, namely $\lambda_1 = -0.61$ and $\lambda_2 = 0.01$. CC only brings about the positive impact of GE on EG when reaching the appropriate level (CC > 0.01). In contrast, with CC ≤ 0.01, CC has not really brought about the positive impact of GE on EG. In addition, we found a positive impact of the control variable CAP on EG. Overall, the threshold model has greatly supported the GMM estimation to provide more reliable and adequate research results. This has enabled us to make very interesting and significant findings, especially for EMDEs in Asia.

Based on our findings, EMDEs in Asia will have the basis to come up with appropriate policies to improve EG in a sustainable way. Below are some policy implications for improving the effectiveness of GE on EG in EMDEs in Asia:

- First, these countries have to improve the quality of their institutions, especially the level of CC, which is also the most important issue. Accordingly, CC needs to be improved above the threshold value of 0.01. This task is not easy but very necessary, because many EMDEs in Asia have CC below this threshold value. To do this, EMDEs should strengthen their anti-corruption work, including the enactment of regulations and monitoring mechanisms to improve CC, and can expand the channels for the public to express their views as well as denounce corruption cases. As a result, the government’s resources will be allocated more efficiently, and also contribute significantly to stimulating private investment, which is an important prerequisite for improving EG.

- Next, the management of GE needs to be allocated appropriately and effectively. It is necessary to focus allocating on necessary national issues, towards ensuring social security, promoting economic growth as well as avoiding corruption and waste. In particular, the information about the allocation of GE should be publicized and transparent; simultaneously, the public are allowed to monitor the allocation.

- Finally, EMDEs need to use a synchronous combination of many practical policies to promote EG in a sustainable way. These policies should aim to improve CC above the threshold value of 0.01, make efficient use of GE, and promote investment and consumption in the economy. In addition, EMDEs should improve the capacity to forecast the demand for GE as well as future economic developments in order to make plans to adjust policies in accordance with each period of time.

In conclusion, this study has achieved the research objective, which is to analyze the role of CC in the impact of GE on EG in EMDEs in Asia. Moreover, this study has determined the threshold value of CC through the threshold model. However, this study still has certain limitations. For example, the data sample used for the analysis in this study is limited in size, especially in terms of the number of countries. In addition, this study has not compared the role of CC in the impact of GE on EG between developed economies and EMDEs. Furthermore, some control variables may have an impact on EG but have not been considered in this study, such as: human capital, financial development or trade openness. These limitations may suggest new research directions in the future.

Declarations

**Author contribution statement**

My-Linh Thi Nguyen: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Ngoc Toan Bui: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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**Data availability statement**

Data will be made available on request.

**Declaration of interest’s statement**

The authors declare no conflict of interest.

**Additional information**

No additional information is available for this paper.

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