Fiscal Causal Hypotheses and Panel Cointegration Analysis for Sustainable Economic Growth in ASEAN*

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Abstract

This study aims to examine the causal links between the fiscal components, i.e., government expenditures (GE) and government revenues (GR), and their impact on the economic growth of the Association of Southeast Asian Nations (ASEAN) region. This analysis considered secondary panel data from 1990 to 2019 at an annual frequency. The data is obtained from the Asian Development Bank (ADB) and World Bank Database. A panel cointegration and panel DH causality (Dumitrescu and Hurlin) approach was employed on financial data at an annual frequency from 1990 to 2019. The findings from panel unit root and panel cointegration tests demonstrate that, at first, all the variables are stationary and cointegrated. The panel ARDL disclosed that GE has a long-run connection with GDP, is significantly and positively associated with economic growth in the long run, whereas GR is significant in the short run. The contribution of GE is high in sustaining economic growth as compared to GR. Also, cointegration regression disclosed that GE is more sensitive toward GDP, while GR is less elastic. Lastly, the findings reveal that bidirectional causality exists between GE and GR variables. These results have policy implications for sustainable economic growth in the ASEAN region.

Keywords: Government Revenues, Government Expenditures, Fiscal Policy, Economic Growth, Panel Causality Analysis

JEL Classification Code: E62, C13, C33

1. Introduction

Stable economic policies implemented and planned by authorities may have essential consequences on the economy, both in the short run and the long run. Though, some economic policies consider short-run and ignore long-run

consequences (Bongers & Díaz-Roldán, 2019). Sustainable economic growth is the key goal of economic policies. In the past two decades, there has been increasing research on economic stability (Bui, 2019; Rajan, Tan, & Tan, 2015), especially, after the economic shocks, such as the Asian financial crisis in 1996 and world financial crisis in 2007. Unexpected shocks from crises have proved that applying sound fiscal policy has stabilizing effects on the economy. The basic feature of a stable policy is to be strengthening the economy without disturbing its future developing abilities. Today, the economy is dealing with limited resources, and dependence on borrowing because of unfavorable fiscal policy, which in turn raises the government liabilities. Seeking stable policy on fiscal grounds has been getting much importance for economists and policymakers because it provides stability in the economy by maintaining fiscal deficit.

At the end of 1997, the economic crisis was at its peak in South East Asia. Most of the southeast countries lost their currency value. For instance, Indonesian currency value fell by 82%, Thailand currency value depreciated by 42%, likewise with Malaysia and Philippines currencies, which lost

their value, simultaneously stock markets had a downward trend in Malaysia, Thailand, Indonesia and the Philippines (Bello, 1999). The crisis almost paralyzed governments throughout the region. In the global financial crisis of 2007, the annual GDP growth in ASEAN-10 was on a downward trajectory, and the GDP growth in Singapore, a high-income country of ASEAN, fell below the worldwide average to 2 percent in 2016 (Lau & Yip, 2019). However, the ASEAN region is now considered the center of the most dynamic economic region of the world because of the emerging trends in their economies, attracting economists and policymakers all over the world (Nasir, Duc Huynh, & Xuan Tram, 2019).

This study is considering the causal relationship between fiscal components, i.e., government expenditures (GE) and government revenues (GR), and its impact on economic growth, and seeking a sustainable policy for the ASEAN region. ASEAN is selected for this study because it is an emerging economic market. In addition, the member countries of ASEAN have common economic characteristics, demographics, and mutual trade interests. The specific objectives are, first, to examine Fiscal Causal Hypotheses to suggest a sustainable policy for ASEAN-10 that would assist the economic policymakers in better formulation and implementation of fiscal policy in a sustainable way. Second, to identify the long-run connections between GE, GR, and GDP, which are essential for long-run planning to provide a sustainable economic policy. Third, the study aims to estimate the solvency (sustainability) ratio between fiscal components and economic growth in the long run. The solvency ratio can differentiate the weak from the strong stability of fiscal components toward GDP. Fourth, the study considers the sensitivity of fiscal components toward economic growth in the long run. Consequently, it would alert policymakers of the most sensitive fiscal components before taking any decision regarding expenditures and revenues. The subsequent sections describe the theoretical and empirical views, data, variables and methodology, results, discussion and conclusion, and policy implications.

2. Literature Review

2.1. Theoretical Views

The main economic theories differ in their proposition on the role of fiscal policy. Classical economists believe fiscal policy has no effect on output growth in the long term, while Keynesian economists put forth the theory that the consequences of fiscal policy on the economy are both temporary and everlasting. Friedman (1978) argued that it is essential to consider the direction of fiscal variables, whether GE is regulating GR or GR is controlled by GE. So, it is essential to understand that government expenditures are directly related to economic growth, or it is regulating by

revenues. The advantage of knowing this is to target the specific fiscal variable in the right direction. In theory, there are four fiscal causal hypotheses, namely, revenue dominance hypothesis, expenditure dominance hypothesis, fiscal synchronization, and institutional separation hypothesis. The revenue dominance hypothesis suggested by Friedman (1978) states that the increase in taxes, raising the price of the resources accessible to the public sector to reduce the fiscal deficit, translates only to an increase in GE. In case the revenues have a constructive effect on expenses, then the revenues will lead to cost reductions. The expenditure dominance hypothesis posits that alterations in revenue and taxation policies are determined by expenditures decisions. Following the Ricardian equivalence model, the gain in public expenditures contributes to a rise in taxation. The fiscal synchronization claims that decisions on revenues and expenditures are formed at the same time or conjointly. The policymakers analyze the marginal benefits and expenses of government programs once identifying the proper degree of expenditure and revenue, suggested by Musgrave (1966) and Meltzer and Richard (1981). The institutional separation believes the expenditures and revenues are independent of each other, i.e., no causality, and revenues are somewhat autonomous in the case of expenditures.

2.2. Empirical Debate on ASEAN

Empirically, to test the validity of the fiscal synchronization, expenditure dominance and revenue dominance hypothesis, Karim, Asri, Abdullah, Antoni, & Yusoff (2006) have studied the long-term association in government expenditures, revenues, and ASEAN-5 economic growth using cointegration and variance decomposition analysis. The results showed a strong influence of the expenditure dominance hypothesis in Malaysia, Indonesia, and the Philippines, while, in contrast, Singapore and Thailand supported the revenue dominance hypothesis. Phiri (2016) investigated the fact that tax authorities should implement their policies continuously over the long term, i.e., tax authorities must improve fiscal imbalances through significant reinforcement between revenue collection and distribution of expenditures. Magazzino (2014) has inspected the connection in GE and GR in ASEAN-10 by employing panel Granger causality, which satisfies the tax-and-spend hypothesis in five out of ten countries. Saysombath and Kyophilavong (2013) explored the association between expenditures and revenue for South-East Asian country Lao PDR over the time of 1980 to 2010. Cointegration, autoregressive distributed lad (ARDL) joint with the Vector error correction model (VECM) based Granger causality has been used within their analysis. Results demonstrated a long-run connection between the government expenditure and revenue, and a unidirectional relationship from expenditure

and revenue, supporting the expenditure dominance hypothesis. Another study has focused on two-state governments, namely, Penang and Kelantan, done by Jalil and Harun (J2012). The study utilized the ARDL bounds test for cointegration relationships. The reported results in the state of Kelantan in line with tax and spend theory. In the state of Penang, the results did not show any causal association in its spending and revenue in the short run. Tang, Liu, and Cheung (2013) examined the usefulness of fiscal policy in the ASEAN-5 economies, these are Indonesia, Thailand, Malaysia, the Philippines, and Singapore. They concluded that government expenditures are having a highly insignificant impact on output, while taxes have an impact on output by using a vector autoregressive model and time-varying VAR model. Further evidence from results showed that in Thailand and Singapore, timely government expenditures could be beneficial for countercyclical fiscal policy. The association between revenues and expenditures by applying linear and non-linear cointegration techniques is reported by Jiranyakul (2018). The study is supporting the spend-tax hypothesis in Thailand by recommending that policymakers should be careful in expansionary fiscal policy as it can raise the fiscal deficit.

Concerning the connection between GE and economic growth, the reported judgments in previous studies are controversial in general, and specifically, lacking in-depth analysis in ASEAN. Few studies have reported an encouraging and significant association between the GE and economic growth as documented by Chang, Huang, and Yang (2011), Lee, Won, and Jei (2019), Wu, Tang, and Lin (2010), but few studies have found a negative association (Afonso & Furceri, 2010; Dudzevičiūtė, 2018). Furthermore, some of the studies have found no connection (Durevall & Henrekson, 2011). The discussion on GE and economic growth in five ASEAN economies by Tang et al. (2013) reported no immediate and significant influence on economic growth. Another recent study reported mixed results regarding the GE and economic growth in a few ASEAN economies (Tan, Mohamed, Habibullah, & Chin, 2020), i.e., a negative relationship in Malaysia and Singapore, and an encouraging relationship in Thailand. The findings of Samudram, Nair, and Vaithilingam (2009) on Malaysia suggested a long-run bidirectional causality for expenditures and gross national product, supporting Keynes's law and also Wagner's law. Nguyen and Anwar (2011) reported on Vietnam that investment expenses are positively linked with economic growth, and suggested that expenditure decentralization promotes economic growth. The conflicting findings in previous studies could be the result of the inconsistency of definitions and dissimilarities in the investigated economies (Bergh & Henrekson, 2011).

In summary, disagreements exist in the findings of previous studies concerning causality and impact on economic growth. Particularly, there has been very little empirical work reported in the whole ASEAN region concerning policy implications of macroeconomic perspective. Thus, there is a need to clarify the causal association between fiscal variables to implement a stable policy in ASEAN-10. Using the causality approach to enlighten the policymaking process is the key concern of this study. Understanding the long-run and short-run relationship between GE/GR and growth would assist the economic policymakers in formulating an efficient policy. After defining the key objectives in the previous section, this study also addresses a few research questions, i.e., what type of causality exists between GE and GR? What is the impact of these fiscal components (GE and GR) on economic growth? Furthermore, how can policymakers implement a stable policy on fiscal grounds in ASEAN?

3. Research Methods and Materials

3.1. Data and Variables

This analysis considered secondary panel data from 1990 to 2019 with annual frequency. The data is obtained from the Asian Development Bank (ADB) and World Bank Database. Three variables are under consideration, i.e., Government expenditures (GE), Government revenues (GR), and Gross Domestic Product (GDP). The variables GE and GR are well-known components of fiscal policy, and the variable GDP is considered as a substitution indicator for economic growth. The econometric techniques used in this analysis are recently reported by recent related studies (Basuki, Purwaningsih, Soesilo, & Mulyanto, 2020; Nguyen, 2019; Yoong, Latip, Sanusi, & Kusairi, 2020). The analysis is carried out in three stages. First, the Panel unit root and cointegration tests are adopted. In the second stage, cointegration analysis is explored by panel ARDL based on Pool-Mean Group (PMG) and Cointegration regression (Fully Modified Ordinary Least Squares – FMOLS, and Dynamic Ordinary Least Squares – DOLS). The reason for the second stage is to deeply analyze long-run relations by examining the sensitivities of cointegrated variables and sustainable ratios (Quintos, 1995). The third stage includes panel DH causality to identify the causal association between the fiscal components (GE and GR) for economic policy implications.

3.2. Panel Unit Root Test

Panel unit root tests possess high power in the panel data structure than the unit root tests based on time series. In empirical studies, unit root for time-series analysis could not perform well for short-run periods (Baltagi, 2008; Banerjee, Marcellino, & Osbat, 2004). Baltagi (2008) stated

that the two most efficient tests reported by Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin or IPS (2003) for stationarity in panel data setup.

3.3. Panel Cointegration Test

The identification of long-run connections among the variables is essential before estimating the econometric model. It can be drifting to determine any strong association among the variables after estimating the econometric model when there are no long-run associations among the variables. Hence, for this purpose, the test had proposed by Pedroni (1999, 2004) underlying Johansen methodology is adapted to find out the long-run associations among the variables.

3.4. Panel ARDL

The panel ARDL is employed to re-analyze long-term and short-term significance, and also to cover the limitations of the cointegration test (Pedroni, 2004). The pooled-mean group (PMG) in the panel ARDL frame was reported by Pesaran, Shin, and Smith (1999). According to them, the homogeneity in long-run relationships can occur due to many factors, like conventional technologies or mutual institutional development. In this study, homogeneity will be seeking in the panel members of ASEAN on the grounds of sustainable policy. The ARDL approach avoids deficiencies arises due to the classification of tested variables according to integration order I(0) and I(1). The ARDL model performs better as compared with traditional panel cointegration tests; for instance, ARDL is appropriate even with the endogeneity issue of independent variables (Marques, Fuinhas, & Pais, 2018). Moreover, it is helpful to explore long-run and short-run dynamics. Representation of the general panel ARDL model is given below:

$$\Delta GDP_{it} = \alpha_i + \sum_{K=1}^{K} \beta_1 GE_{it} + \sum_{K=1}^{K} \beta_2 GR_{it} + \sum_{K=1}^{K} \delta_{1i} \Delta GE_{i,t-k}$$
$$+ \sum_{K=1}^{K} \delta_{2i} \Delta GR_{i,t-k} + \sum_{K=1}^{K} \delta_{3i} \Delta GDP_{i,t-k} + \varepsilon_t \quad (1)$$

GDP is a gross domestic product, GE and GR presenting 'government expenditures' and 'government revenues', respectively. α_i denotes the country's specific intercept. k and t denote lags and time, respectively. The null hypothesis of ARDL is 'no cointegration'.

The long-run relationship for the ARDL model described below:

$$\Delta GDP_{it} = \mu_i + \sum_{K=0}^{K} \delta_{1i} \Delta GE_{i,t-k} + \sum_{i=0}^{n} \delta_{2i} \Delta GR_{i,t-k} + \varepsilon_t \quad (2)$$

Here PMG approach has imposed an assumption that long-run coefficients are similar for every country. When a long-run association is concluded through the panel ARDL approach and the null hypothesis of 'no (zero) cointegration' is rejected. Coefficient δ_{1i} and δ_{2i} expressing the sustainability ratio between GE-GDP and GR-GDP. This ratio can distinguish weak and strong fiscal sustainable growth as explained by (Quintos, 1995). If δ_{1i} and δ_{2i} approaches to unity refer to high sustainable growth. While and if diverges from unity shows a low level of sustainable growth.

Error correction terms can be derived from this relationship, short-run fluctuation presented by error correction model described below:

$$\Delta GDP_{it} = \alpha_i + \sum_{K=0}^{K} \delta_{1i} \Delta GE_{i,t-k} + \sum_{k=0}^{k} \delta_{2i} \Delta GR_{i,t-k}$$
$$+ \sum_{k=0}^{k} \delta_{3i} \Delta GDP_{i,t-k} + \alpha ECT_{t-1} + \varepsilon_{i,t} \quad (3)$$

Residual $\varepsilon_{i,t}$ is independently and normally scattered with zero mean and constant variance, and the ECT term is the error correction term which is extracted from the long-run equilibrium. The coefficient of the ECT term is the speed of adjustment to the equilibrium level. The estimators of parameters are acquired through the PMG method; PMG estimators are usually consistent and normally distributed as explained by Pesaran et al. (1999).

3.5. Cointegration Regression Analysis

This study is adapting cointegration regression analysis by using Fully Modified Ordinary Least Squares (FMOLS) and Dynamic-Ordinary Least Squares (DOLS). These techniques are employed to evaluate long-run sensitivities in the cointegrated relationship. FMOLS is helpful to address endogeneity and autocorrelation issues (Hansen & Phillips, 1990). DOLS, introduced by Kao and Liu (2000), concluded that DOLS performs better than OLS and FMOLS in terms of unbiased estimation.

3.6. Dumitrescu and Hurlin (DH) Panel Causality Test

The panel causality test, introduced by Dumitrescu and Hurlin (2012), is called the DH Granger causality test. This test is applicable for heterogeneous panel data with static parameter values. It considers two measurements under consideration, first is the heterogeneousness of the regression model which is used to test the Granger causality, and the second is the heterogeneousness of the causal relationship. Inspect the following given model:

$$y_{i,t} = \alpha_i + \sum_{K=1}^{K} \gamma_i^k y_{i,t-k} + \sum_{K=1}^{K} \beta_i^k x_{i,t-k} + \varepsilon_{i,t} \quad (4)$$

$$i = 1, 2, ..., N : t = 1, 2, ..., T$$

x and y are stationary variables which are observed for N individuals in T periods, β_i and α_i are presumed to be static in the time dimension. Further lag orders of K are supposed to be identical for all individuals of the panel. β_i^k and γ_i^k can change across groups.

Null hypothesis supposed that there is no (zero) causal relationship and no heterogeneity, that is why this is called Homogenous Non-Causality (HNC).

According to Dumitrescu and Hurlin (DH), β_i can be changed across groups under the alternative hypothesis, heterogeneity can be allowed but not for all cross-sections.

Granger Causality Model (Dumitrescu & Hurlin, 2012)

$$GE_{i,t} = \alpha_i + \sum_{K=1}^{K} \gamma_i^k GE_{i,t-k} + \sum_{K=1}^{K} \alpha_i^k GDP_{i,t-k} + \varepsilon_{i,t} \quad (5)$$

$$GR_{i,t} = \alpha_i + \sum_{K=1}^{K} \gamma_i^k GR_{i,t-k} + \sum_{K=1}^{K} \beta_i^k GE_{i,t-k}$$
$$+ \sum_{K-1}^{K} \alpha_i^k GDP_{i,t-k} + \varepsilon_{i,t} \quad (6)$$

$$i = 1, 2, ..., N : t = 1, 2, ..., T, \text{k=lag}$$

3.7. The Panel Data Regression Model

The Panel Data Regression Model for the "fiscal policy impact over economic growth" can be represented as follows:

$$GDP_{it} = \alpha_i + \beta GEXP_{it} + \gamma GREV_{it} + \varepsilon_{it} \quad (7)$$

$$i = 1, 2, ..., N : t = 1, 2, ..., T,$$

$$v_{it} = a_i + \varepsilon_{it} \quad (8)$$

Here, i is the individual dimension, and GDP_{it} is the time dimension. Hence, GDP_{it} represents the dependence of individual i at time t, a_i are the unobserved individual effect, time-invariant intercepts, $GEXP_{it}$ and $GREV_{it}$ denotes the explanatory variable of individual i at time t, β shows a vector of regression coefficients, and ε_{it} represents the error term of individual i at time t. In panel data models, the individual intercept a_i is meant to control for the influence of an unobservable regressor that is specific to individual i. In the panel data models approach, is known as a random effect, for each cross-section observation when it is considered as a parameter to be estimated. The estimation of individual effect can differentiate the difference between the random effect and fixed effect.

4. Empirical Results and Discussion

4.1. Examining the Presence of Unit Root

Two types of panel unit root tests are employed, one LLC for collective Panel unit root, and the second ADF Chi-square and PP-Fisher for the individual (cross-section) unit root. To identify the number of lags, the AIC criterion is used which is helpful to evade high order autoregression. Results of LLC identified the non-stationarity of GDP, GR, and GE at the level I(1). ADF-Fisher and PP-Fisher also showed that tested variables are non-stationary at the first level I(1). After taking the first difference, the tested variables got stationarity and integrated at level I(1). Therefore, both types of Panel unit root tests have an agreement in their results. The results are shown in Table 1.

Table 1: Results of Panel Unit Root Testing

Levin, Lin, and Chu Test	Level	First Difference
GDP	[2.40] (0.99)	[6.34] (0.00)**
GR	[1.49] (093)	[7.86] (0.00)**
GE	3.16 (0.99)	[6.40] (0.00)**
ADF-Fisher Chi-square		
GDP	5.56 (0.99)	73.71 (0.00)
GR	15.78 (0.72)	95.88 (0.00)
GE	2.35 (0.99)	76.88 (0.00)
PP-Fisher Chi-square		
GDP	0.70 (0.99)	102.67 (0.00)
GR	10.83 (0.93)	422.541 (0.00)
GE	0.85 (0.99)	114.92 (0.00)

Note: Asymptotic normality is used in probabilities calculation of all the tests except the Fisher test calculation where asymptotic Chi-square distribution is applied. LLC assumes a collective unit root process; while ADF-Fisher and PP-Fisher undertake the cross-sectional unit root process. The number of total observations and cross-sections is 270, and 10, respectively.

Table 2: Results of Panel Cointegration Testing

Pedroni Test	Statistic	Probability	Johansen Fisher Panel Test		
			Hypotheses	Fisher Statistics (Trace Test)	Probability
Panel v-Statistic	234.06	0.000*	None	89.46	0.000*
Panel rho-statistic	-20.39	0.000*	At most 1	44.86	0.000*
Panel PP-statistic	-3.06	0.000*	At most 2	22.48	0.310
Panel ADF-statistic	-6.066	0.000*	Hypotheses	Fisher stat (Max-Eigen)	Probability
Group rho-statistic	-3.08	0.000*	None	66.96	0.000*
Group PP-statistic	-4.01	0.000*	At most 1	41.54	0.000*
Group ADF-statistic	-5.72	0.000*	At most 2	22.48	0.311

Note: The asterisk (*) refers to statistical significance. The lag length is 1 in both Pedroni and Johansen tests.

4.2. Cointegration Results

To determine the cointegration, the panel cointegration test is applied to the panel data and explored the long-run relationship among GDP, GE, and GR variables. In Table 2, the outcomes of the Pedroni test and the Johansen Fisher Panel test for panel cointegration are provided. All the Pedroni statistics, including group and Panel, meet the statistical significance at level 1% and reject the null hypothesis of having 'no cointegration' for the panel data. Similarly, in the Johansen Fisher Panel test, the Fisher statistic from the Trace test and Max-Eigen test meet the statistical significance at level 1% and reject the null-hypotheses of 'no cointegration' except for 'at most 2'. Thus, interpreting the results of panel cointegration tests, the tested variables change together in the long-run, and the presence of a long-run connection between the tested variables is determined. The reliability of using Panel ADF and group ADF test statistics are reported by Pedroni (2004).

4.3. Results of Panel ARDL

4.3.1. PMG Long-Run

In the model, the GDP is used as a dependent variable, and the GE and GR are used as independent variables; here control variable is not included because the objective of interest is not the impact of independent variables. Panel ARDL test for cointegration is performed to re-analyze the long-run association between fiscal components and GDP. The Akaike information criterion (AIC) is used to accomplish the model selection. ARDL model covered automatic lag selection (four lags). In a long-run estimate, government expenditures (GE) hold a long-run connection with GDP, and government revenues (GE) have a positive and significant effect on GDP. have a long-term relationship with GDP, and GE has a positive and significant impact on GDP. At the same time, GR is negatively related to GDP, as maximizing revenue will not necessarily maximize growth in the long run. So, government revenue is not impactful in the long run.

4.3.2. Sustainable Growth Estimation

The long-run analyses help in estimating the long-run sensitivity, which can differentiate weak and robust sustainable growth, as suggested by Quintos (1995). Coefficient δ_{1i} and δ_{2i} representing long-run elasticity/sensitivity. δ_{1i} value is 0.8997, which is closed to unity, expressing strong enough sustainable growth from the expenditures side. However, δ_{2i} value is -0.0048, which is quite low and shows weak sustainable growth from the revenues side, see Table 3. Previously, it had reported that a stable situation is suitable and weak is also satisfied but government authorities can face difficult times to maintain sustainability if expenditures sensitivity is continuously increasing as compared to revenues (Cipollini, 2001).

4.3.3. PMG Short-run Fluctuations

ARDL short-run analysis shows short-run fluctuations and defines the error correction model (ECM) consistent with long-run equilibrium. Error correction term (ECT) at equilibrium is zero, and values below zero or non-zero

Table 3: PMG Long-run estimation

Independent Variables	GDP (dependent variable)			
		Coefficient	t-statistic (std. error)	Probability
	GE	0.8997	43.4911 (0.0206)	0.0001*
	GR	-0.0048	-0.7059 (0.0069)	0.4811

Notes: Values with * denotes 'significance'.

Table 4: Short-run Analysis

	Coefficients	Std. Error	t-statistic	Probability
COINTEQ01	-0.136240	0.105210	-1.294942	0.1969
ΔGDP(-1)	0.183062	0.125135	1.462910	0.1452
ΔGR	0.250989	0.140664	1.784312	0.0760*
ΔGR(-1)	0.033224	0.110811	0.299831	0.7646
ΔGR(-2)	-0.009437	0.159650	-0.059113	0.9529
ΔGR(-3)	0.293191	0.119064	2.462465	0.0147*
ΔGE	0.570826	0.153877	3.709619	0.0003*
ΔGE(-1)	-0.093141	0.102207	-0.911294	0.3633
ΔGE(-2)	-0.140489	0.081444	-1.724970	0.0862*
ΔGE(-3)	-0.048984	0.070556	-0.694254	0.4884
C	1.71E+09	6.07E+08	2.816826	0.0054*

Notes: C is constant/intercept, COINTEQ01 presents ECT, and * denotes significance.

suggesting a deviation from long-run equilibrium. So, ECT defines the adjustment and restoration of a cointegration relationship. Negative ECT with a range from zero-to-one is a requirement to show the stability of an error correction mechanism (Asongu, 2014). In Table 4, the error correction term (representing as COINTEQ01 in Table 4) is -0.13, which shows that 13 percent of convergence is possible to long-run equilibrium annually. Short-run fluctuations in ARDL covered automatic lag selection (four lags). Government revenues ΔGR and ΔGR (-3) are significant and positively related to GDP. In short-run, GR is impact-full. Government expenditures ΔGE and ΔGE (-2) are also significant in the short run. The lagged variables are significant and contribute to adjusting imbalance to cointegration relationships.

4.4. Results of Cointegration Regression

After analyzing panel cointegration (Pedroni, and Johansen Fisher panel Cointegration), the existence of a long-run association between GR, GE, and GDP is confirmed. However, this investigation was not enough to conclude the results. Thus, for further investigations, panel ARDL is used to explore the long-run and short-run fluctuations. Accordingly, the model is re-estimated by using cointegration

regression, including FMOLS and DOLS techniques. The use of these econometric techniques helped to identify the sensitivity of long-run parameters. As shown in Table 3, GR is having a negative and insignificant relationship; while GE is significant and positively related to GDP. In Table 4, it is shown that the short-run and significant relationship between GR and GDP. After getting all this information, now the sensitivity between GR-GDP and GE-GDP needs to analyze. According to FMOLS, the GR coefficient value is negative, less than unity, and approaching zero. This means sensitivity or elasticity between GR and GDP is less-elastic (less-sensitive). If the authorities change the revenue level, it would not much affect GDP. A negative sign shows that an increase in revenues can reduce economic growth because a high rate of taxes makes public goods expensive.

GE coefficient value is 0.99, which approaching unity, and it has a significant influence on GDP and shows a positive relationship between GE and GDP. DOLS presents both variables as significant while indicating the same sensitivity level on GDP. Moreover, the R^2 values are 0.9469 and 0.9982 for FMOLS and DOLS, respectively. Here some disagreement occurred in the results of FMOLS and DOLS regarding GR. In FMOLS, GR is not significant, while in DOLS, it is significant. FMOLS results may get

differ because of its semi-parametric nature. In DOLS, the R2 value is relatively better, and GE, GR coefficient values are also improved. So DOLS can be a good fit for the model, see Table 5.

4.5. Results of Panel DH Causality

Once the Panel unit root and Cointegration between the variables are confirmed, then the causality issue arises. For this purpose, the DH panel causality test is used. Causality is revealed between GE, GR, and GDP with lag length two, see Table 6. GDP is included in the causality analysis as a third variable because GE and GR are related to the overall economic growth, and it eliminates the problem of spurious causal effect due to the omission of a significant variable from the investigated relationship. For a stable growth policy, it is essential to explore the causality between revenues and expenditures, along with the causal connections between revenues and GDP, and expenditures and GDP, i.e., GR and GE, GR-GDP and GE-GDP. The first null hypothesis for GE is that "GE does not cause GR". In Table 6, the W and Zbar statistics are significant and reject the null hypothesis, which means government expenditures (GE) cause government revenues (GR) homogenously. The null hypothesis for GR is that "GR does not cause GE". Both statistic values are significant and reject the null hypothesis, which shows that

GR cause GE homogenously. Therefore, the DH Granger causality analysis shows a bidirectional relationship between GR and GE. The presence of a bidirectional relationship between GR and GE suggests that decision regarding revenues and expenditures is to be taken simultaneously in the ASEAN region. Both expenditures and revenues are triggering each other.

Further, the analysis shows that DH Granger causality exists between GDP and GR. The null hypothesis for GDP is "GDP does not cause GR". However, the probability value for both statistics is highly significant (rejects the null hypothesis) as sown in Table 6. Likewise, the null hypothesis for GR is "GR does not cause GDP" is rejected. It means that the causal connection between GR and GDP is bidirectional. For GE and GDP connection, a bidirectional or two-way causality existed.

4.6. Discussion

Different studies have reported different results concerning causal relations between expenditures and revenues (GE and GR) in ASEAN (Magazzino, 2014; Rajan, et al., 2015; Thanh & Mai Hoai, 2014). This study explores the fiscal causality analysis for economic growth and its implications for economic policy in the ASEAN region. The investigation of causality is an essential precondition for considering the impact produced by the driving forces.

Table 5: Cointegration Regression Analysis

Variables (Independent)	FMOLS			DOLS		
	Coefficient	t-statistic (std. error)	Probability	Coefficient	t-statistic (std. error)	Probability
GR	-0.0003	0.0124 (0.003)	0.9901	-0.0191	-2.38 (0.008)	0.010*
GE	0.9986	116.72 (0.0085)	0.0000*	1.0155	103.64 (0.009)	0.001*
	R2	0.9469		R2	0.9982	

Notes: Independent variables are GR and GE, while dependent is GDP. Values in parentheses presenting standard errors, and * denotes significance.

Table 6: Results of Panel Causality using DH Test

Null Hypothesis ()	W-statistic	Zbar-statistic	Probability
$GE \nrightarrow GR$	6.40	5.53	0.0024*
$GR \nrightarrow GE$	7.16	6.52	0.0072*
$GDP \nrightarrow GR$	7.74	7.28	0.0013*
$GR \nrightarrow GDP$	5.59	4.47	0.0006*
$GDP \nrightarrow GE$	11.49	12.20	0.0000*
$GE \nrightarrow GDP$	10.74	11.22	0.0000*

(note: * represent a rejection of null hypothesis and significance; Zbar statistics represent statistics for Homogenous non-causality. W-stat is Wald statistics.

4.6.1. Economic Growth in ASEAN

Economic growth linked with long-term economic planning has the utmost importance for the economic well-being of the present as well as the future generation. Several empirical studies discussed their findings on fiscal sustainability and its ratios estimation (Bui, 2019; Rajan, et al., 2015), but regrettably, there is a need for improvements in the current views whereas fiscal causality consideration and long-run examination should be taken into account for stable economic policy. Government expenditures (GE) and government revenues (GR) are taken as fiscal components because the contraction and expansion of fiscal policy are to be done through these two components GE and GR as explored in the analysis of this study. GE, GR, and GDP have significant long-run relationships, suggesting that the fiscal policy in ASEAN can control constraint budget and capable of repaying future financial obligations. Besides, this study has incorporated the panel ARDL and cointegration regression analysis to analyze the long-run relationship further. Accordingly, from panel ARDL, the estimated sustainability ratios highlight the following two facts which would not be possible by just using the panel cointegration tests:

1). GE is contributing more toward economic growth, holding the sustainability ratio close to unity; while GR is having a lower sustainability ratio close to zero.
2). In long-run testing, GE shows a positive and substantial effect on economic growth. However, GR has an inverse and insignificant relationship. A negative consequence of GR on economic growth is expected in ASEAN.

4.6.2. Two-way Causal Relation between GR and GE

A two-way causal relation exists between GR and GE, supporting the fiscal synchronization hypothesis in the ASEAN region. The estimated causal relationship is suggesting that GR and GE can converge the budget toward long-run equilibrium, and these fiscal components can tackle the problem of persistent fiscal deficit.

For economic growth, revenues play a critical role, because an increase or decrease in revenue level may affect the GDP level (Brueckner, Dabla-Norris, Gradstein, & Lederman, 2018). For instance, tax evasion is one of the factors which can slow down economic growth and put the economy on a slow growth path both in the present and in the future as well (Iriqat & Anabtawi, 2016). Similarly, if the GDP gets decreases because of any regional or global impact, it will affect the revenues level (Habibullah, Baharom, Din, & Ibrahim, 2017). For example, presently, the world is facing the COVID-19 pandemic, in such situations Government cannot increase the expenditure level, which demotivates the public to pay taxes, leading to a low level of revenues.

The existence of two-way causality relation between GE and GDP confirms that the governments of member nations in ASEAN may employ expenditures as an influential variable of economic growth and ensure the well-organized utilization and allocation of resources to accelerate economic growth. Furthermore, due to the Keynesian multiplier effect, an increase in GDP can rise the expenditure level (Farhi & Werning, 2016).

5. Conclusion with Policy Remarks

This empirical study explores the causal relationships between government expenditures (GE) and government revenues (GR) in the ASEAN-10 economies and examines the impact of GE and GR on GDP, and the long-run relations between tested variables. At the first difference, the findings determined all the variables are stationary, and the tested variables hold a long-run association. The GE is determined as a sensitive and impactful variable, contributing more to accelerate the economic growth as compared to government revenues. The influence of GR is insignificant and negative to economic growth, only significant in the short run. Furthermore, the fiscal synchronization view is supported as there exists a two-way causal association between GE and GR.

After analyzing the results, this study recommends policy implications that are based on long-term planning, delivery of public goods, policy integration, and cost-effectiveness.

The policymakers in ASEAN should apply fiscal policy according to the causality relationships between fiscal components, i.e., GE and GR. Consideration of cost-effectiveness is vital because GE and GR are working simultaneously in the economies. So, policymakers must consider cost and benefit while deciding tax and expenditure levels.

Long-run planning is critical for the successful implementation of policies, so the Governments should utilize the resources efficiently and adequately to get acceleration in economic growth in the long-run.

The tax rate should not be that high which can make taxpayers demotivated, because high taxation makes public goods expensive and affects their availability. The positive effect should offset an adverse effect from raising the fiscal resources after the fiscal resources are deployed through expenditure policies.

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