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Government Spending and Exchange Rate in ASEAN Countries: Evidence from ARDL and Toda &Yamamoto Approach

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Abstract
This paper examines the relationship between government spending and exchange rate in the ASEAN countries over the period 1986 to 2016. The article employs an autoregressive distributed lag (ARDL) model to capture the existence of level relationship between the variables and applies a modified version of Toda & Yamamoto Granger causality to fit a standard vector autoregressive model and circumvent some flaws deriving from the traditional causality. Results found the presence of long run relationship (co-integration) between government spending and exchange rate in Vietnam, Philippine, Malaysia, Indonesia and Cambodia, while the rest of countries found no evidence of long run relationship. The results of Toda & Yamamoto causality indicated a bidirectional causality between government spending and exchange rate for Thailand, whereas there exists a unidirectional causality running from exchange rate to government spending for Vietnam and Philippine, from government spending to exchange rate for Cambodia. However, results confirmed the absence of causality between variables for the remaining countries. More importantly, results are crucial for policy implications in the ASEAN countries
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1. Introduction

For many decades, the levels of relationship among the variables have been paid enormous attentions in empirical economics. The existence of long run relationship between dependent variables and explanatory variables was formally introduced by Granger (1981) and Engle Granger (1987), which has been extensively applied in research up to the present. Meanwhile, the relationship between government spending and exchange rate is of essential interests for empirical evidences and has long been discussed from numerous previous literatures. Empirical evidences confirmed the balanced budget of fiscal expansion conduces to real appreciation and current account surplus when the expansion falls on traded goods (Penati, 1987), while an increase in government expenditure spurs to appreciate real exchange rate and rises consumption in developing countries, but it depreciates real exchange and decreases consumption in advanced countries (Miyamoto et al., 2016). Other empirical study also affirms a rise of government spending leads to aggrandize in output, private consumption, a decline of balance of trade and spawns to push an appreciation of real exchange rate (Ravn et al., 2007).

As for ASEAN countries, the skeptical issues on government expenditure and exchange rate has been discussing and debating widely since the ASEAN financial crisis in 1997, which has resulted in structural change of macroeconomic mechanisms and engendered the adjustments of reform policy for various ASEAN members. There are numerous scholars pay special attentions on the exchange rate among and insisted the non-existence of evidence that central banks target specific exchange rate levels against any currency or basket in ASEAN-5 countries (Klyuev & Dao, 2016). Policy makers pursuing stable price in economy should accentuate on exchange rates and interest rate policy with great circumspection and the relationship between foreign exchange risk premium and interest rate differentials has still been contradictory (Engel, 2016).

Numerous previous studies have developed the traditional view and pioneering works of Mundell and Fleming to explain the effect of monetary and fiscal policy on exchange rate. The adoption of monetary policy rose output through an appreciation of exchange rate, whilst fiscal expansion had no output impact (Sachs, 1980). Likewise, the valid assumptions are constructed that residents holds foreign exchange apart from their own currency and have rational expectations, which affirms an increase of expansion rate for money supply in economic system prompts to simultaneous decline of the real exchange rate (Calvo & Rodriguez, 1977). While the investigation of aggregate spending and the terms of trade: Is There a Laursen-Metzler Effect? (Obstfeld, 1982) substantiated that a permanent worsening in the terms of trade must generate a current account deficit, and also insisted a counter-example to argument of Laursen and Metzler (1950) and Harberger (1950). Others endeavored to develop the seminal work and asserted that an increase in the monetary expansion rate induces in generating of appreciation of the real exchange rate and a deterioration for balance of payments, which contradicted on the notion

of Calvo and Rodriguez (Liviatan, 1981). The research suggested an innovative perspective on the international welfare spillovers due to monetary and fiscal policies (Obstfeld & Rogoff, 1995).

Other empirical evidences have examined the effects of shocks to U.S. monetary policy on exchange rate, which found the robust evidence of a nexus between monetary policy and exchange rate and the contractionary shock to monetary policy conduces to persistent and significant appreciation in real and nominal exchange rate (Eichenbaum & Evans, 1995). The relative prices of nontraded goods was appeared to account for almost none of the movement of U.S. real exchange rates (Engel, 1999). Likewise, is there twin deficit or twin divergence? fiscal policy, current account, and real exchange rate in the U.S. (Kim & Roubini, 2008) and do monetary policy shocks matter in the G-7 countries? using common identifying assumptions about monetary policy across countries (Kim, 1999). The development of a two-sector small open-economy model, in which a rise in government consumption is related with real appreciation, whilst an increase in government investment may spawn a depreciation of real exchange rate (Galstyan & Lane, 2009). and also constructed a two-sector model in which intersectoral capital movements involve adjustment costs, expressed as capital lost in the transformation process (Mahbub Morshed & Turnovsky, 2004). The development of a theory of exchange rate movements under the perfect capital mobility, a slow adaptation of goods markets relative to asset markets, and consistent expectations (Dornbusch, 1976). Moreover, it is found that major questions regarding the equilibrium approach to exchange rate have not been unanswered, still regards as the additional and skeptical issues (Stockman, 1987).

Albeit, there are numerous previous literatures for both the theoretical affirmation and empirical evidences including the possibly burgeoning studies with respect to the government expenditure and exchange rate. This paper aims to explore the levels of relationship between government spending and exchange rate in both the short run dynamics and long run relationship in ASEAN countries by applying the superior technique (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) to handle with the issues of time series analysis, as well as the order of integrated variables in levels. We also investigate the causal relationship between the underlying variables employing a modified Wald test (MWALD) introduced by (Toda & Yamamoto, 1995) to correctly construct a standard vector autoregressive model in the levels of considering variables. The major contributions of this paper are to fill the existing gaps based on previous studies as previously mentioned report by endeavoring to develop the nexus between government spending and exchange rate, which has allotted into two forms of econometric analysis. In the first place, the paper employs the innovative developed co-integration best known as the auto-regressive distributed lag (ARDL) to test the long run relationship (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001). For the second episode, we explore the causal relationship between the underlying variables adopting a new modified version for Granger causality test (Toda & Yamamoto, 1995) in order to take care of some existent shortcomings deriving from traditional causality. Importantly, this paper attempts to uncover new crucial information to provide innovative development of research and would be considerable bases in the future research. We strongly believe that this research could be one of the useful mechanisms and essential directions in formulating and enriching policy development and could allow adopting them as new economic tools for policy makers, as well as relevant aspects that provide deeper insights into the link between government spending and the exchange rate in ASEAN countries.

2. Literature Reviews

Despite the fact that there are numerous scholars examining the relationship between government spending and exchange rate internationally. However, most of them have discovered and contributed in divergent angles in term of acquired outcomes markedly (Y. Chen & Liu, 2018) applied structural VAR framework to investigate government spending shocks and the real exchange rate in China. The findings confirm that appreciation of real exchange rate shocks is influenced by expansion of government consumption and investment shocks, which differs from some empirical evidence of developed countries, but it was supported and asserted consistent with the prediction of traditional Mundell and Fleming model. The effect of government expenditure on real exchange rate is critically conditional on the sectoral composition of public spending, the sectoral intensity of private capital in production, the intersectoral mobility costs for capital, the relative sectoral productivity of public infrastructure, the elasticity of substitution in production, and the underlying financing policy (Chatterjee & Mursagulov, 2012). Likewise, (Bouakez & Eyquem, 2015) revealed the contradiction of the findings for a number of recent empirical evidence, which documents a significant and persistent depreciation of the real exchange rate following an expansionary government spending shock. The nominal and real exchange rates appreciate in response to anticipated and unanticipated in government spending (Di Giorgio et al., 2015) while, the appreciation of real exchange rate leads to an increase in domestic public spending in line with most empirical evidences (Di Giorgio et al., 2018).

Using the survey of professional forecasters, Forni & Gambetti (2016) demonstrates new evidence on effects of government spending in the open economy which accentuates on a well-known puzzle in the literature reviews affirms the appreciation of real exchange rate in response to a fiscal expansion. Fornaro (2015) substantiated that the appreciation of exchange rate during a financial crisis is a positive effect on welfare due to impetus of currency

appreciation sustains asset prices, value of collateral and can be accessible to the international credit market. The real exchange rate can be depreciated after a positive shocks of government spending which has been corresponding between the theoretical model and empirical evidence and insisted a positive shock to the government expenditure tends to engender real exchange rate appreciation and deterioration in balance of trade (Çebi & Çulha, 2014). By applying co-integration test, one indicated that government spending is implicated with overvaluation of real exchange rate (Cakrani, Resulaj, & Kabello, 2013). Ravn et al., (2012) conducted by using penal structural VAR and identified that a rise of government spending spurs to increase output, private consumption, declines the balance of trade and leads to depreciation of real exchange rate.

Other study attempted to identify fiscal shocks and real exchange rate dynamics by using a two-country model, as well as dynamic simulation techniques for output, government spending, labor input and relative price. The results found for the most part, fiscal shocks are the fundamental driving force of fluctuation of real exchange rate (Maria, Ciferri, & Girardi, 2011). Some literature proposed and explained the effects of government spending shocks on consumption and the real exchange rate based on the deep-habit model, it predicted in response to an anticipated rise in government expenditure consumption and wages were not increased the impact. The findings confirmed in line with the empirical evidence obtaining from the narrative identification approach (X. Chen et al., 2010). Government consumptions and government investment induces to differential effects on the real exchange rate and the relative price of non-tradable (Galstyan & Lane, 2009). The shock of expansionary fiscal policy or a government budget deficit shock improves the current account and depreciate the real exchange rate, while the depreciation of nominal exchange rate, as opposed to a relative price level change is predominantly responsible for depreciation of the real exchange rate (Kim & Roubini, 2008). The positive government spending shocks has a positive effect on output, while positive tax shocks is a negative effect. In addition, an increase of taxes and government spending confirm a robust negative impact on investment spending (Blanchard & Perotti, 2002).

3. Research methodology and model specification

The relationship between the underlying variables has been prevalent use in econometric model to investigate empirical evidence among the considering variables. The problems of time series analysis (unit root or stationarity) has long been discussed in numerous literature reviews for decades, which it is considerable concept for researchers to decide whether the considering techniques (or models) are fit in practical application, in order to avoid the inefficient estimation and wrongly applied for interpreted results. Similarly, most of time series data are not stationary characteristics at the order of I (0) and they are predominantly stationary at first difference I (1). However, there are many methods to handle with problematic checking of unit root proposed by economists (Dickey and Fuller 1979, 1981), (Dickey et al., 1984), (Kwiatkowski et al., 1992), (Phillips & Perron, 1988), (Zivot & Andrews, 1992), which such these techniques have been extensively employed for time series analysis.

This paper manifests that many studies mentioned above have examined by accentuating on the effect of government spending shock on real exchange rate, vice versa. By using structural vector autoregressive model (VAR) and various instruments in both theoretical affirmations and empirical evidences to expound the interaction between government spending and real exchange rate. However, the long run relationship of considering variables is still questionable and skeptical notion, which there has no empirical evidence to be affirmed in case of ASEAN countries. Hence, this paper contributes to fill the existing gaps by using the autoregressive distributed lag proposed by (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) for investigating the long run relationship. The causality relationship is conducted by making use of the special technique, which is best known as a modified version of Granger causality test introduced by (Toda & Yamamoto, 1995) to correctly construct a standard vector autoregressive model in the levels of considering variables and to avoid some existing deficiencies of original Granger causal testing.

Moreover, the ubiquities of numerous empirical evidences have affirmed the levels of relationship (co-integration) between a dependent variable and a set of regressors and the causality correlation are mostly taken into consideration under the assumption of time series are at the order of I (1). In other words, such the underlying variables must be stationary at the first difference (Johamen & Jtiselius, 1990) and require to be integrated of purely I(0), I(1) or mixture of both, but none of them must be I(2) (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) where the valid inference can be made. In contrast, if the property of time series is stationary at second difference or I (2), and thus (Johamen & Jtiselius, 1990; Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) cannot be applicable, and likely to be wrongly applied and inefficient estimation and a modified Wald test version of Granger causality becomes more superior (Toda & Yamamoto, 1995). Nevertheless, providing the unit root tests like past empirical evidences leads to low power against the alternative hypothesis which those tests may be suffered from pre-testing distortion (Pesaran et al., 2001; Toda & Yamamoto, 1995). The traditional F-statistics uses to test for Granger causality may not be fit, as well as there is no standard distribution in the event of the time series has the property of integration or co-integration (Wolde-Rufael, 2005).

3.1 Bounds testing technique to co-integration

To achieve the goals of research, this paper adopts the special technique and advanced econometric models specifically the Autoregressive Distributed Lag (ARDL) bounds testing approach to co-integration introduced by (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) to examine the short run dynamics and long run relationship between the underlying variables. This superior procedure can handle many problems occurring in time series analysis particularly ARDL model enables to be adopted regardless of whether the time series are stationary at level I (0), I (1) or even mixture of both (Purely I (0), purely I (1) or mutually integrated), but none of them must be I (2). Likewise, the major features of ARDL approach including: 1) this technique can be taking care of endogeneity problem due to it is freely residual correlation. 2) It can be differentiated between dependent and explanatory variables in case of there is a single long run relationship. 3) This approach lies in its own identification of the co-integrated vectors, which there are multiple co-integrated vectors. 4) The Error Correction Model (ECM) can be constructed by ARDL model through the simple linear transformation and enables to integrate the short run adjustments with long run equilibrium without losing long run information. 5) The associated ECM model adopts a sufficient lagged number to document data generating process in general, in order to specify the modelling frameworks (Nkoro & Uko, 2016; Pesaran, M. H., Shin, 1999; Shin & Smith, 2001).

$\Delta lnGS_t = \beta_0 + \sum_{i=1}^{k} \delta_{1i}\, \Delta lnGS_{t-1} + \sum_{i=1}^{k} \emptyset_{1i}\, \Delta lnEXC_{t-1} + \gamma_1 lnGS_{t-1} + \gamma_2 lnEXC_{t-1} + \mu_{1t}$ As (Johansen and Jtiselius 1990) have developed co-integration procedure to investigate the long run relationship between the underlying variables. Likewise, this technique is applicable in the condition of all the considering variables have non-stationary property at the order of I (0) (at level) and became stationary at the first difference I (1). Nevertheless, when the underlying variables are combination of both I (0) and I (1). In this condition, (Johansen and Jtiselius 1990) co-integration approach cannot be applied and the result of estimated model will lead to the problem of spurious model, inefficient estimations and wrongly utilized in practice. Subsequently, (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) introduced new seminal technique which has been best known as Autoregressive Distributed Lag (ARDL) bounds testing approach to co-integration. The superior feature of this advanced econometric model can be applicable irrespective of whether the underlying variables are purely I (0), I (1) or mutually co-integrated, but none of them must be I(2) where such this procedure will provide more factual and efficient estimations than (Johansen and Jtiselius 1990) co-integration approach. In addition, when there are multiple long run relationships among the underlying variables, ARDL bounds approach cannot be employed, the alternative approach namely (Johansen and Jtiselius 1990) becomes more appropriate than (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001). Conversely, if there is a single long run relationship and the sample data size is small or finite, ARDL error correction representation becomes relatively more efficient (Nkoro & Uko, 2016). Hence, this research employs ARDL bounds approach to co-integration in order to examine the short run dynamics and long run relationships between the underlying variables of consideration can be demonstrated as followings:

$\Delta lnEXC_t = \beta_1 + \sum_{i=1}^{k} \delta_{2i}\, \Delta lnEXC_{t-1} + \sum_{i=1}^{k} \emptyset_{2i}\, \Delta lnGS_{t-1} + \gamma_2 lnEXC_{t-1} + \gamma_2 lnGS_{t-1} + \mu_{2t}$ (1)

$\Delta lnGS_t = \beta_0 + \sum_{i=1}^{k} \delta_{1i}\, \Delta lnGS_{t-1} + \sum_{i=1}^{k} \emptyset_{1i}\, \Delta lnEXC_{t-1} + \gamma_1 lnGS_{t-1} + \gamma_2 lnEXC_{t-1} + \mu_{1t}$ (2)

Where, $lnGS_t$ is the log of government expenditure, $lnEXC_t$ denotes the log of real exchange rate, Δ implies the first difference operator, β_0 signifies the constant coefficient of estimated model. δ_1, $\emptyset_1$ and γ_1, γ_1 is the short run and long run coefficient respectively and μ_{1t} means the white noise process.

Likewise, the long run relationship or co-integration can be tested by considering from joint significance of the lagged levels and based on F-statistics testing, which the assumptions are stipulated that the null hypothesis of no co-integration or long run relationship has determined as $H_0: \gamma_1 = \gamma_2 = 0$ against the alternative hypothesis $H_0: \gamma_1 \neq \gamma_2 = 0$ (the existence of long run relationship or variables are co-integrated). To summarize whether or not there is long run relationship (Co-integration) between the considering variables, we consider from F-statistics. That is to say, if the computed F-statistics falls above the critical bounds value, the null hypothesis is rejected irrespective of whether the series are I (0) or I (1). In other words, the alternative hypothesis will have been accepted, which demonstrates the existence of co-integration (long run relationship). In contrast, when the computed F-statistics is less than the lower critical bounds, the initial hypothesis will be accepted regardless of whether the time series are I (0) or I (1). While, the alternative hypothesis will have been rejected. In this case, it affirms the absence of long run relationship (no co-integration or variables are not co-integrated). However, in the event of the computed F-statistics lies in between lower and upper bounds, the outcome of co-integration testing is inconclusive inference and the order of integration will be check again to ensure whether the time series are integrated under consideration.

3.2 Modified version approach of Granger causality testing

The paper also examines the causal relationship between the underlying variables by applying Toda & Yamamoto Granger causality (a modified Wald test: MWALD) to fit a standard vector autoregressive model for variables in the levels, and to avoid the existing problems involving the traditional Granger causality test. The superior hallmark of this procedure can be ignored of pretests for a unit root and a co-integrating property, and it enables to be applicable irrespective of whether a time series is I (0), I (1), I (2), integrated or co-integrated of any arbitrary

order. This method can also be tested either linear or nonlinear restrictions conditional on the coefficients by estimating the levels of VAR and applying Wald test. To deduce the implicated direction between the considering variables in the estimated models, we have constructed VAR system based on (Toda & Yamamoto, 1995), (Wolde-Rufael, 2005) which can be written as the form of a modified Wald (MWALD) Granger causality test as followings:

$$lnGS_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i}\, lnGS_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j}\, lnGS_{t-j} + \sum_{i=1}^{k} \delta_{1i}\, lnEXC_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j}\, lnEXC_{t-j} + \mu_{1t} \quad (3)$$

$$lnEXC_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i}\, lnEXC_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j}\, lnEXC_{t-j} + \sum_{i=1}^{k} \emptyset_{1i}\, lnGS_{t-i} + \sum_{j=k+1}^{d_{max}} \emptyset_{2j}\, lnGS_{t-j} + \mu_{2t} \quad (4)$$

Given $lnGS_t$ denotes the log of government spending, $lnEXC_t$ is the log of real exchange rate Whilst α_0, and β_0 is the intercept or constant value in each equation, α_{1i}, α_{2j}, δ_{1i}, δ_{2j}, β_{1j}, β_{2j}, $\emptyset_{1i}$ and $\emptyset_{2j}$ determines as the coefficient of each variable in succession, k implies the number of appropriate lags, d_{max} represents the maximal order of integration, and γ_{rt} and γ_{st} is the white noise process (Error term). Similarly, the result of Toda & Yamamoto Granger causality test can be conclusive inference, is considered from null hypothesis against alternative hypothesis. From equation (3) the H_0 (Null hypothesis) is determined that $lnEXC_t$ does not Granger cause $lnGS_t$. In other words, if $\delta_{1i} \neq 0 \forall_i$, implying that there is a unidirectional causality running from $lnEXC_t$ to $lnGS_t$. Simultaneously, as equation (4), the H_0 (Null hypothesis) has stipulated that $lnGS_t$ is not the cause of $lnEXC_t$. That is, if $\emptyset_{1i} \neq 0 \forall_i$, demonstrating the existence of unilateral causal correlation flowing from $lnGS_t$ to $lnEXC_t$. What is more, in the event of the null hypothesis (H_0) in all the stipulated equations is rejected. For this case, it can be made inference that the bidirectional causality between variable exist. Conversely, if initial assumption in each equation cannot be rejected, manifesting the absence of causal relationship between two variables.

More significantly, Toda & Yamamoto a modified Wald (MWALD) Granger causality test can be performed by the use of VAR system model. The basic concept of this procedure is to construct the correct VAR order and maximum order of integration (unit root or stationarity) for the considering variables must be smaller than the true lagged length (k). Likewise, the appropriate lagged property of Toda & Yamamoto is determined the actual optimal lags (k) added by one special lag. Say, we estimate a [(k+(d_{max})]th-order of VAR system model, which the coefficient matrices of the last lagged (d_{max}) vectors in the estimated model are irrespective since these are postulated to equal to zero. In addition, the adoption of Toda& Yamamoto technique can ensure the relevant statistic test of Granger causal attribute has the standard asymptotic distribution and thus, adding extra lag may be very useful in practical application (Toda & Yamamoto, 1995).

4. Empirical Results

4.1 Long run relationship (Co-integration)

As Table 1 demonstrates the long run relationship when the real exchange rate was considered as the dependent variables. Our results affirm the existence of long run relationship between the underlying variables have been discovered for five countries (Vietnam, Philippine, Malaysia, Indonesia and Cambodia). Whilst, there is no a long run relationship (Co-integration) for another three countries notably Thailand, Singapore and Lao PDR and the long run relationship was inconclusive inference for (Myanmar and Brunei) when the real exchange rate has been adopted as dependent variable.

Table 1. Testing for long run relationship (EXC as a dependent variable)

Countries	Variables	F-statistic	Long run coefficient	ECM	Conclusion
Vietnam	lnEXC/lnGS	182.19***	0.3509***	-0.3720***	Co-integration
Thailand	EXC/lnGS	1.07	32.6094***	-0.2237*	No co-integration
Singapore	EXC/lnGS	2.25	-0.1788	-0.1625**	No co-integration
Philippine	EXC/lnGS	4.79**	33.1614**	-0.1940***	Co-integration
Myanmar	lnEXC/lnGS	3.34	-0.1006	-0.0462***	Inconclusive
Malaysia	EXC/lnGS	5.05***	0.3272	-0.0299***	Co-integration
Lao PDR	lnEXC/lnGS	1.66	0.9378	-0.0676**	No co-integration
Indonesia	lnEXC/lnGS	8.56***	3.3685	0.0363***	Co-integration
Brunei	EXC/lnGS	3.25	-0.5282***	-0.2254***	Inconclusive
Cambodia	lnEXC/lnGS	3.91*	0.0234	-0.1040***	Co-integration

Source: Author's calculation

Note: we firstly considered three maximum lags of structure for model selection. The appropriate lag length was selected according to Akaike Information Criterion and contemplate of suitable star in each criterion. The outcomes indicated that one lag was appropriate for Vietnam, three lags used for Philippine, and the rest of countries were considered and determined two lags. Which ***, ** and * denotes the significant level at 1%, 5% and 10% respectively.

The outcomes of bounds testing approach also indicate that government spending is statistical significance

and positive impact on the appreciation of real exchange rate for Vietnam and Philippine. That is to say, an increase in government expenditure for both countries will induce to aggrandize 4.76% and 33.16% in real exchange rate. While. It has negative effect but not statistical significance for Singapore and for the rest of countries (Myanmar, Malaysia, Lao PDR, Indonesia and Cambodia) are not statistically significant but positive influence. That is, the injection of money supply in economic system (An injection of government spending) for the countries does not engender to increase real exchange rate (an appreciation of real exchange rate) any more. In addition, when considering as for error correction term demonstrates the speed of adjustment from the short run towards long run equilibrium. As a result, ECT_{t-1} has negative effect and statistically significant, which reveals the speed of adjustment of disequilibrium in each year has been corrected ranging from 2% to 37% for ASEAN countries.

By way of contrast, when taking into consideration the government spending was adopted as dependent variable, as presented in table 2 we found and confirmed the existence of a long run relationship between government spending and real exchange rate for six ASEAN countries (Vietnam, Singapore, Philippine, Malaysia, Indonesia and Cambodia). Likewise, the absence of a long run relationship found for (Thailand, Myanmar and Brunei) and the inconclusive inference has not been made for the test of a long run relationship between the underlying variable in Lao PDR.

Table 2. Testing for long run relationship (lnGS as dependent variable)

Countries	Variables	F-statistic	Long run coefficient	ECM	Conclusion
Vietnam	lnGS/lnEXC	37.07***	4.7696	0.0079***	Co-integration
Thailand	lnGS/EXC	0.96	0.0304***	-0.1950*	No co-integration
Singapore	lnGS/EXC	12.65***	-1.9829**	-0.0488***	Co-integration
Philippine	lnGS/EXC	7.48***	0.0190*	0.0712***	Co-integration
Myanmar	lnGS/lnEXC	0.99	0.3958	-0.0655*	No co-integration
Malaysia	lnGS/EXC	20.98***	1.2891	-0.0165***	Co-integration
Lao PDR	lnGS/lnEXC	3.17	-0.0672	0.0349***	Inconclusive
Indonesia	lnGS/lnEXC	21.71***	0.5132***	-0.0539***	Co-integration
Brunei	lnGS/EXC	2.76	0.2862	-0.0268***	No co-integration
Cambodia	lnGS/lnEXC	5.58***	-0.8465	-0.0664***	Co-integration

Source: Author's calculation

Note: ***, ** and * denotes the significant level at 1%, 5% and 10% respectively

Moreover, the findings of econometric model also substantiate the real exchange rate is positively and statistically significant influence on government spending for (Thailand, Philippine and Indonesia), implying that the real exchange rate increases by 1% leads to accrue 3.04%, 1.90% and 0.51% of government expenditure in each country respectively. In contrast, there is only a country namely Singapore, which has polar effect to the injection of government spending. In other words, an increase in government spending spurs to decline 1.98% for real exchange rate and the rest of countries (Vietnam, Myanmar, Malaysia, Brunei and Cambodia) has no effect on the dependent variable.

The results consider the error correction term ECTt-1 as the speed of adjustment from short run towards long run equilibrium. As presented in Table 2 shows that ECT_{t-1} has negatively effect and statistically significant. That is to say, the starting point of the variation from short run to long run equilibrium is corrected ranking from 1.65% to 19.5% within one year of disequilibrium in each country, this indicates the low speed of adjustment to long run equilibrium. More importantly, according to table (1) and (2) depicted above, the findings has also been asserted the presence of multiple[1] long run relationship between real exchange rate and government spending for five ASEAN countries in particular Vietnam, Philippine, Malaysia, Indonesia and Cambodia in succession. While, a single[2] long run relationship merely exists for Singapore when government spending was adopted as dependent variables

4.2 Toda & Yamamoto Granger causality

By deriving from the outcomes of a long run relationship confirmed above, we also adopt a modified version of Granger causality developed by (Toda & Yamamoto, 1995) to fit a standard vector autoregressive model and to alleviate existing problems involved in the use of traditional Granger causality test as mentioned above. According to the result indicated that the smallest value for criterions are tallied and determined by four lags for Vietnam[3].

[1] When there are multiple long run relationships among the underlying variables, ARDL bounds approach cannot be employed, the alternative approach namely (Johansen and Jtiselius 1990) becomes more appropriate than (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001)

[2] Conversely, if there is a single long run relationship and the sample data size is small or finite, ARDL error correction representation becomes relatively more efficient (Nkoro & Uko, 2016).

[3] We estimated a long run relationship using one appropriate lag for ARDL model in Vietnam. However, Toda & Yamamoto Granger causality test requires that the true lag length must be greater than one. Therefore, we initially determine four maximum lags and the result affirmed using four optimal lags in VAR system.

That is, the true lag length is 4. Likewise, Toda and Yamamoto causality test can be implemented by adding the one extra lag (d_{max}=1) to the actual lag length (k=5). Hence, the final VAR model can be estimated at the integrated of 5th order. Say [(k+ d_{max}) =4+1=5] and modified Wald test (MWALD) has been performed to identify the causal relationship between government spending and real exchange rate. Moreover, we postulate that the error terms are conditional on zero mean, a constant variance exists (Homoscedasticity) and the problem of autocorrelation (serial correlation) does not present in the estimated model. The results of Toda & Yamamoto Granger Causality test (a modified version) shows that there is causality correlation only for four ASEAN countries (Vietnam, Thailand, Philippine and Cambodia) and the absence of causality for the rest of six countries (Singapore, Myanmar, Malaysia, Lao PDR, Indonesia, Brunei and Cambodia).

Table 3. Toda & Yamamoto Granger Causality Test.

Countries	From EXC to GS		From GS to EXC		Causal Direction
	P-value	Sum of lagged coefficients	P-value	Sum of lagged coefficients	
Vietnam	0.0112***	0.0667	0.6887	-0.0329	EXC GS
Thailand	0.0017***	0.0413	0.0004***	-52.4705	EXC GS
Singapore	0.659	0.1327	0.5103	0.2709	No
Philippine	0.0518**	-0.0004	0.6827	-1.5741	EXC GS
Myanmar	0.2528	0.0133	0.6822	-0.1323	No
Malaysia	0.5821	0.0402	0.6475	-1.0062	No
Lao PDR	0.5288	-0.1009	0.7944	0.2033	No
Indonesia	0.7703	0.0405	0.4342	-1.2987	No
Brunei	0.6017	0.0812	0.9482	-0.0303	No
Cambodia	0.4463	-0.1112	0.0001***	0.0456	GS EXC

Source: Author's calculation
Note: ***, ** and * denotes the significant level at 1%, 5% and 10% respectively

The results of a modified version Granger causality test are reported in table 3, demonstrating that there is a positive unidirectional causality running from real exchange rate to government spending in Vietnam, which signifies that real exchange rate is influenced by government spending. Vietnam government has launched the export-oriented economy policy in order to improve the trade balance and the exchange rate has regarded as one of the most important monetary policy tools of the State Bank of Vietnam that contributes to drive the Vietnamese's exporting activities. Similarly, the adoption of this policy leads to the depreciation of domestic currency (Dong) against dollar (USD) and the price level was increased during the period of 1995 to 2008 (Phuong, 2015). Nevertheless, the higher inflation in Vietnam in the spanning of 2008 to 2012 conduces to the depreciation of domestic currency and prompts to deteriorate in the real exchange rate during the period.

For Thailand, we found the presence of bidirectional causality relationship between government spending and real exchange rate, which indicates that both of them are conditional on each other. That is, government expenditure is affected by real exchange rate and vice versa. Likewise, Thailand's high exchange rate and excessive spending are two of the country's leading currency crisis indicators. Meanwhile, Thai government got down to excessive official spending and encouraged the country's banks to lend enormous amounts of money for private real estate and other spending. Thailand could have foreseen the dangers to its economy that caused from the nation's excessive spending. Instead, became overconfident in its currency, since it took place the financial crisis derived from Thailand in 1997 and this could be established policymakers to have intimate insights and be more circumspect consideration regarding to the government spending and the fluctuation of exchange rate which may lead to influence the change of other macroeconomic structure (Quan B. Lai, 1998).

Similarly, the existence of negative unilateral causality flowing from real exchange rate to government spending was found for Philippine; demonstrating that real exchange rate seemingly has inverse direction and the appreciation of domestic currency again foreign influence to aggrandize in government expenditure. However, According to (Bautista, 2003), the adjustment of nominal exchange rate is typically needed to bring about real depreciation that can reduce a high degree of real exchange rate overvaluation. However, expenditure—a nominal depreciation will not lead to a less overvalued real exchange rate. It may only raise the general price level without affecting relative prices in the Philippine economy. In contrast, the unidirectional causality relationship running from government spending to real exchange rate was negative effect; the results confirm that an increase in government spending may lead to a depreciation of domestic currency as well as exchange rate, and spawn to increase the level of inflation rate. Therein, the intervention of exchange market still serves as the effective tool to stabilize the exchange rate in order to minimize the effect on inflation. The national bank of Cambodia semester report 2017 revealed that national bank of Cambodia purchased US dollars 65 times ($479.4 million), then converted into domestic currency, and injected in the circulation in order to stabilize the exchange rate. Nevertheless, there was no causality relationship in any direction between the underlying variables for the

remaining six countries (Singapore, Myanmar, Malaysia, Lao PDR, Indonesia, Brunei and Cambodia), which shows that government expenditure appears neither to cause or to spawn real exchange rate, vice versa.

All things considered, we investigated the long run relationship (Co-integration) by using autoregressive distributed lag (ARDL) proposed by (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) and a modified version of Granger causality test (Toda & Yamamoto, 1995) was applied to complement one another (Two econometric models). As a result, the empirical evidence from ARDL and a modified version of Granger causality seemingly support only for Vietnam, Philippine, Cambodia and Thailand, but it does not support for Singapore, Malaysia and Indonesia. However, majority of time series has a unidirectional causality, merely for Vietnam was found to have bidirectional causality between the underlying variables.

5. Conclusions

The uniqueness of empirical evidences regarding investigation of government spending and real exchange rate have discovered in numerous literature reviews. Many scholars and researchers provided disparate essential contributions in term of acquired outcomes, which can inspire to do more research in order to discover the innovative development of scientific research. This paper has intended to investigate the relationship between government spending and real exchange rate by using the newly developed technique autoregressive distributed lag (ARDL) bounds approach to co-integration (Pesaran, M. H., Shin, 1999; Shin & Smith, 2001) to capture the levels of relationship between the underlying series. The research also adopted a modified version of Toda & Yamamoto Granger causality test introduced by (Toda & Yamamoto, 1995) to fit a standard vector autoregressive model (VAR system) and to avoid the existing shortcomings from ordinary Granger causality.

Our results affirm the presence of long run relationship between the underlying variables have been discovered for five countries (Vietnam, Philippine, Malaysia, Indonesia and Cambodia). Whilst, there is no a long run relationship (co-integration) for another three countries notably Thailand, Singapore and Lao PDR and the long run relationship was inconclusive inference for (Myanmar and Brunei) when the real exchange rate was adopted as dependent variable. Likewise, we also confirmed the existence of a long run relationship between government spending and exchange rate for six ASEAN countries (Vietnam, Singapore, Philippine, Malaysia, Indonesia and Cambodia). The absence of a long run relationship was found for Thailand, Myanmar and Brunei, while there was inconclusive inference for long run relationship between the underlying variable in Lao PDR.

The results of Toda &Yamamoto Granger Causality test (a modified version) shows that there is causality correlation only for four ASEAN countries (Vietnam, Thailand, Philippine and Cambodia) and the absence of causality for the rest of six countries (Singapore, Myanmar, Malaysia, Lao PDR, Indonesia, Brunei and Cambodia). Similarly, the application of both the ARDL and a modified version of Granger causality also employed to complement one another (two econometric models). As a result, the empirical evidence from ARDL and a modified version of Granger causality seemingly support only for Vietnam, Philippine, Cambodia and Thailand, but it does not support for Singapore, Malaysia and Indonesia. However, majority of time series has a unidirectional causality, merely for Vietnam found to have bidirectional causality between the underlying variables. Consequently, policy makers and pertinent aspects for Vietnam, Philippine, Cambodia and Thailand should pay circumspect attentions on how to formulate appropriate government expenditure and exchange rate policy consistent with the status quo of economic condition and in order to avoid contingent consequence and devastating disaster experienced from the Asian financial crisis occurred in 1997 and other economic slumps.

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