The Relationship Between State's Revenues and Expenditures in Malaysia: Some Robust Results

MUZAFAR SHAH HABIBULLAHa , JUDHIANA ABD. GHANI b*, ASNA ATQA

ABDULLAHb AND ZATI AQMAR ZAHARUDDINc

a Putra Business School,

b School of Business and Economy, Universiti Putra Malaysia, Malaysia
c School of Computing, Informatics and Mathematics,Universiti Teknologi
MARA, Seremban Campus, Negeri Sembilan, Malaysia

Corresponding author: Judhiana Abd. Ghani, Email: judhiana@upm.edu.my
(+6011-10743900)

Authors:
Muzafar Shah Habibullah, Email: muzafar@upm.edu.my (+6012-2143451)
Asna Atqa Abdullah, asnaatqa@upm.edu.my (+6019-3807045)
Zati Aqmar Zaharudin, zati@uitm.edu.my (+6012-3362155)

ABSTRACT

This study focuses on the intertemporal dynamics between revenues and expenditures, as well as the strategies used by state governments in managing their public deficits. This study provides an opportunity to explore several hypotheses in order to investigate the Malaysian government's tax collection and spending behavior. The tax-spend hypothesis posits that governments generate tax revenues prior to initiating new expenditures. In contrast, the spend-tax hypothesis posits that governments first engage in spending activities and afterwards augment tax receipts in order to fund their expenditures. Another concept that exists is the fiscal synchronization hypothesis, which posits that governments make choices about both revenues and spending concurrently. Choices pertaining to expenditure and the generation of income may allow for autonomy. Based on an empirical investigation conducted on yearly data including revenue and expenditure in 13 Malaysian states from 1990 to 2018, the findings derived from our Granger long-run causality, as corrected by the error-correction framework provide consistent results that support the fiscal synchronization hypothesis.

Keywords: E62, H50, H72
JEL Classification: Tax-spend, Spend-tax, Fiscal synchronization, Malaysia

INTRODUCTION

The relationship between government expenditures and tax receipts has been extensively examined in macroeconomic research, reflecting its significance for understanding fiscal policy dynamics. Investigating the causal link between these two variables is critical for policymakers, as it enables them to identify the root causes of fiscal imbalances. Understanding whether changes in expenditures drive tax receipts or vice versa is essential for designing effective strategies to maintain fiscal discipline and economic stability. This analysis helps in tailoring fiscal reforms that address specific imbalances, whether they stem from revenue shortfalls or expenditure inefficiencies. Consequently, such insights are crucial for developing well-informed policies that promote sustainable public finances and enhance long-term economic growth

The examination of the causal relationship between revenues and expenditures has led to the emergence of several opposing theories. The fiscal synchronization concept posits that the fiscal authorities make tax and expenditure choices concurrently. According to the Granger concept, the link between tax income and government expenditure may be characterized as a bi-directional association. Furthermore, a unidirectional connection means that income influences spending, thus providing support for the tax-and-spend concept. The hypothesis asserts that there is a relationship between government income and expenditure, suggesting that controlling tax revenue might serve as an effective strategy to decrease the magnitude of government expenditure. Conversely, the spend-and-tax theory posits that there exists a relationship between government spendi13ng and subsequent fluctuations in tax collections. To clarify, the direction of causation may be seen as flowing from government expenditure

towards tax income. Lastly, the concept of institutional separation between government spending and taxing choices posits that revenues and expenditures are mutually exclusive.

One of the earlier works on the tax-spend nexus in Malaysia was conducted by Aziz et al. (2000) first examined the tax-spend nexus in Malaysia. Malaysia's government expenditures have continuously surpassed government earnings during the majority of the decades since 1959, with the exception of the years between 1959-1961 and 1993-1997. Budget deficits may primarily be attributed to the government's dedication to pursuing fast economic growth programs, as seen in the several five-year Malaysian development plans. However, the increased involvement of the public sector has led to a significant increase in government spending. In their study, Aziz et al. (2000) found that the annual data on Malaysia's tax revenue and expenditures provided support for the fiscal synchronization hypothesis during the testing of the aforementioned hypotheses. The statement suggests the presence of a reciprocal causal link, as defined by Granger, between government income and expenditure. Findings by Taha and Loganathan (2008), who discovered bidirectional Granger causation extending from government spending to both direct and indirect tax receipts for the years 1970–2006, provided more support for this conclusion.

Nevertheless, unidirectional Granger causality between tax spending and tax revenue was also found in several studies on Malaysia. For example, the work of Wong and Lim (2005) shows that government revenue leads government expenditure for the period 1965–2002, supporting the tax-spend hypothesis. On the other hand, recent work by Khan et al. (2021) also supported the tax-spend hypothesis for Malaysia. Using data for the period 1990–2019 and by employing the vector error-correction model framework, the Granger causality showed a one-way relation

between government revenues and expenditures; expenditures are supported by tax revenues, indicating that the tax-spend hypothesis is validated.

Nonetheless, the spend-tax hypothesis is not without support in Malaysia. Karim et al. (2006) investigate the tax-spend behavior of five ASEAN economies, including Malaysia, for the period 1972–2000. They found that Malaysia, Indonesia, and the Philippines supported the spend-tax hypotheses, while Thailand and Singapore supported the tax-spend hypotheses. The tax-spend hypothesis for Malaysia was also supported by the work of Tan (2009) using annual data from 1970–2007; Sanusi et al. (2012) using data spanning from 1975–2006; and Mele et al. (2020) for the period 1985–2016. As an alternative, utilizing quarterly data covering 1970:1–1990:4, Mithani and Goh (1999) found a one-way Granger causality running from government expenditure to government revenue, thus supporting the spend-and-tax hypothesis implying higher government spending leads to higher taxes.

Saha and Mukhopadhyay (2014) investigated the correlation that existed in Malaysia between government revenue and spending from 1963 till 2007.They discovered that Malaysia exhibits evidence in favor of the fiscal neutrality hypothesis, which postulates the independence of tax collection and tax spending, over the years 1963 to 2007. This finding indicates that changes in tax collection had no immediate impact on government spending over the years 1963 to 2007 in Malaysia. However, when the periods of the study were divided into three sub-periods of 1963–1980, 1981–1997, and 1998–2007, the directions of the causality gave mixed results. For the sub-period 1963–1980, the annual data support the fiscal neutrality hypothesis, while for both sub-periods 1981–1997 and 1998–2007, they support the spend-and-tax hypotheses.

At the state level, Asri et al. (2015) investigated the tax and spending nexus using annual data for the period 1970–2008 for 11 states, namely, Negeri Sembilan, Selangor, Perlis, Kedah, Kelantan, Terengganu, Pahang, Johor, Melaka, Perak, and Penang. Using the popular autoregressive distributed lag (ARDL) model approach, their findings suggest that the tax-spend hypothesis was supported, implying that the state's government determines the level of tax revenue before making a decision to spend. However, the work of Jalil and Harun (2012) found that using data from 1980–2009, the spend-and-tax hypothesis was supported in Kelantan, while Penang supported the fiscal neutrality hypothesis.

At the municipality level in the state of Sabah, Dayang-Affizzah et al. (2006) examined annual data on revenues and expenditures for 16 municipalities in Sabah over the period 1965 to 2003, by employing the vector error correction model procedure and the results are at best mixed. On one hand, municipals in Papar, Sandakan, Tambunan, Tawau, Tenom and Tuaran support the tax-and-spend hypothesis. This implies that these municipals decide first on the amount of tax collections and then decide on how much to spend. On the other hand, municipals in Keningau, Lubuk and Sugut, Lahad Datu and Ranau support the spend-and-tax hypothesis. This would imply that the fiscal authorities of these municipals decide to spend first and then increase tax collection to cover expenses. Only Kota Kinabalu supports the fiscal synchronization hypothesis and implies that under this scenario, the fiscal authority of Kota Kinabalu should try to raise revenues and cut spending simultaneously in order to control budget deficits; while municipals in Beaufort and Kuala Penyu suggest that revenues and expenditures are not interrelated in the long-run.

The above results imply that the independent determination of revenue and spending suggest the absence of coordination between expenditure and revenue decisions in the respective

municipalitiesThis would suggest that in order to pay for expenses, these towns' fiscal authorities choose to spend money first and then raise taxes. While municipalities in Beaufort and Kuala Penyu suggest that revenues and expenditures are not related in the long run, Kota Kinabalu is the only local government that endorses the fiscal synchronization hypothesis and suggests that, in this scenario, the fiscal authority of Kota Kinabalu should try to raise revenues and cut spending simultaneously in order to control budget deficits. This analysis of revenues and expenditures indicates a lack of coordination at the local government level.

The primary objective of this study is to examine the causative relationship between revenue and expenditure at the state level in Malaysia for the time frame spanning from 1990 to 2018. The novelty of the present study is: First, there is a lack of evidence on the relationship between tax revenue and government spending at the state level in Malaysia. As to the best of our knowledge, this is the first attempt to investigate the long-run relationship between tax and spend for all thirteen states in Malaysia. And secondly, in this study by using several estimators, we provide robust evidences on the tax-spend relationship at the state level in Malaysia. Furthermore, the use of cointegration and causality models allows for the analysis and evaluation of the proposed hypotheses.

The present paper is organized as follow. In the next section, a concise summary of the hypotheses will be presented, along with discussions on several scholarly works pertaining to the tax-spend and spend-tax issues. Section 3 provides an in-depth examination of the technique used and the data utilized in the study. The empirical results are presented in Section 4, and the conclusion is provided in Section 5.

REVIEW OF LITERATURE

In developed countries, the relationship between government income and spending may be classified into four primary conflicting hypotheses. The fiscal synchronization concept posits that the fiscal authorities make tax and expenditure choices in a synchronized manner. According to the Granger concept, the link between tax income and government expenditure is characterized as a bi-directional association. Musgrave (1966) posits that voters engage in a comparative analysis of the incremental advantages and disadvantages associated with government services in order to make informed decisions on the optimal levels of government income and expenditures. Therefore, according to the fiscal synchronization concept, choices about income and spending are concurrently decided. Several studies have provided support for the fiscal synchronization concept, including the works of Musgrave (1966), Meltzer and Richard (1981), Miller and Russek (1990), Bohn (1991), Bhat et al. (1993), Payne (1998), Koren and Stiassny (1998), Kollias and Makrydakis (2000), Kollias and Paleologou (2006), Chang and Chiang (2009), Vamvoukas (2011), Mutascu (2016), Irandourst (2017), Jaen-Garcia (2019), Karakas and Turan (2019), and Tashevska et al. (2020).

Furthermore, there exists a unidirectional causation that originates from income and leads to spending, so providing support for the tax-and-spend theory. The hypothesis posits that there exists a relationship between government income and government spending, suggesting that controlling tax revenue might serve as an effective policy measure to decrease the magnitude of government expenditure. Friedman (1978) posits the tax-and-spend hypothesis, which asserts that alterations in government income result in corresponding adjustments in government spending. According to Friedman, the implementation of tax hikes is likely to result in corresponding increases in government expenditures, hence limiting the effectiveness

of such measures in reducing budget deficits. Several studies conducted by Friedman (1972, 1978), Buchanan and Wagner (1977, 1978), Darrat (1998), Blackley (1986), Marlow and Manage (1987), Joulfaian and Mookerjee (1990, 1991), Payne (1998), and Koren and Stiassny (1998) have consistently shown that government tax collections have a causal effect on government spending. More recent studies that support the tax-and-spend hypothesis include Tashevska et al. (2020), and Kollias and Makrydakis (2000).

Conversely, the spend-and-tax theory posits that government spending has a causal effect on alterations in tax income. To clarify, the direction of causation may be seen as flowing from government expenditure towards tax income. According to Peacock and Wiseman (1979), it is posited that transient surges in government spending triggered by crises have the potential to result in enduring augmentations in government revenues. The spend-and-tax theory finds support in many research studies conducted by Peacock and Wiseman (1961, 1979), Jones and Joulfaian (1991), Anderson et al. (1986), von Furstenberg et al. (1986), Provopoulos and Zambaras (1991), Joulfaian and Mookerjee (1991), Hondroyiannis and Papapetrou (1996), Darrat (1998), Koren and Stiassny (1998), Almasri and Shukur (2003), Konstantinou (2004), Richter and Dimitrios (2013), Mutascu (2016, 2017), Karakas and Turan (2019), and Kirikkaleli and Ozbeser (2023).

According to Wildavsky (1988) and Baghestani and McNown (1994), in cases in which there is no causal relationship between revenue and expenditure, the collection of tax income and spending are considered to be independent of each other. A non-causal relationship between revenue and expenditure is known as the fiscal neutrality, institutional separation, or fiscal independence hypotheses. Kollias and Paleologou (2006) found that Austria, Belgium, and Germany support the institutional separation hypothesis. Other studies by Ewing et al. (2006)

have also found the fiscal neutrality hypothesis for the United States; for Estonia, Latvia, Lithuania, Poland, and Romania by Mutascu (2016); and Karakas and Turan (2019) for Romania and Poland.

As shown above, even in developed nations, the empirical data pertaining to the aforementioned conflicting hypotheses is, at best, mixed and inconclusive. Various studies examining the relationship between government income and spending have shown diverse outcomes, which may be attributed to variations in the time frame considered, the duration of lag, and disparities among various tiers of government. For example, the study conducted by Manage and Marlow (1986) revealed that using varying lag durations had distinct outcomes. By manipulating the lag length within the range of two to five, the findings consistently demonstrate a unidirectional link in all instances. Specifically, the lower and higher lag lengths consistently reveal a causative relationship, where expenditures have a significant impact on revenues. Conversely, the utilization of an intermediate lag time offers substantiation for a bidirectional causal association between the two variables.

In their study, Ram (1988) used a combination of yearly and quarterly data to investigate the relationship between expenditures and revenues in both the Federal government and State and Local government. The investigation yielded contradictory findings as well. For instance, when examining yearly data, the findings provide empirical support for the fiscal synchronization theory within the context of the federal government. However, the use of quarterly data yielded findings that indicate a causal relationship from revenues to expenditures, hence providing support for the tax-and-spend theory. However, when examining data at the state and municipal level, both yearly and quarterly figures show outcomes that align with the spend-and-tax theory.

In a separate investigation, Owoye (1995) conducted an examination of the causal association between taxes and expenditures among the G7 nations. Owoye observed that while the sample nations have comparable economic environments, the outcomes of the causal linkages differ. The findings derived from the error-correction models provide empirical evidence that supports the fiscal synchronization theory in the context of the United States, Germany, the United Kingdom, Canada and France. This suggests that these countries' fiscal authorities engage in collaborative decision-making processes about taxation and expenditure. In contrast, it can be seen that the direction of causation in Japan and Italy is from revenues to expenditures, providing support for the tax-and-spend theory.

There have also been contradictory findings on the link between government tax revenue and government expenditures in developing countries. A significant amount of study has been conducted on the tax-spend relationship in developing economies. Notable studies, among others, include Chang and Ho (2002a) for China, Fuess et al. (2003) and Chang and Ho (2002b) for Taiwan, Al-Foul and Baghestani (2004) for Egypt and Jordan, Ewing and Payne (1998) for Latin America, and Carneiro et al. (2004) for Guinea-Bissau. Chang and Ho (2002a) conducted a study using annual time series data for China from 1977 to 1999. They employed multivariate error correction models to scrutinize the relationship between government revenues and government expenditures. Their findings revealed the presence of bi-directional Granger causality, providing support for the fiscal synchronization hypothesis in the context of China. Regarding Taiwan, the tax-and-spend hypothesis, which posits a unidirectional causal relationship from government revenues to expenditures, is supported by the research conducted by Chang and Ho (2002b) as well as Fuess et al. (2003).

According to Ewing and Payne's (1998) research, it was determined that Chile and Paraguay provide support for the fiscal synchronization concept among Latin American nations. There exists empirical data in the cases of Colombia, Ecuador, and Guatemala that suggests a causal link between revenues and expenditures, hence providing support for the tax-and-spend theory. According to the research conducted by Al-Foul and Baghestani (2004) on the countries of Egypt and Jordan, the findings reveal that the data pertaining to Egypt demonstrate unidirectional causation from income to expenditure. Specifically, it was seen that an increase in revenue is associated with a corresponding increase in spending. The findings pertaining to Jordan demonstrate a reciprocal relationship between revenue and expenditure, hence providing empirical support for the fiscal synchronization concept.

On the other hand, a study by Alagidede and Tweneboah (2015) examined the fiscal synchronization hypothesis for Latin America for the period 1990–2012. Cheng (1999) shows that Chile, Panama, Brazil, and Peru have bidirectional causality between taxes and expenditure, supporting the institutional separation hypothesis. Studies by Gounder et al. (2007) support the fiscal neutrality hypothesis for Fiji, while for Nigeria by Shuaibu and Ibrahim (2013), Ghana by Takumah (2014), South Africa by Moyo et al. (2021) and Nyamongo et al. (2007), India by Akram and Rath (2019), China by Chang and Ho (2002a), Ho and Huang (2009), Li (2001), and Karlsson (2019), and Pakistan by Raza et al. (2019).

Carneiro et al. (2004) discovered the presence of a durable equilibrium between government spending and income in Guinea-Bissau. The spend-and-tax theory posits that the government exhibits a tendency to first allocate cash towards expenditures and thereafter seek to generate tax revenues and/or get grants to finance these outlays, as opposed to adopting a strategy of acquiring funds to support spending first. Similar spend-and-tax hypotheses can be found in

the work by Narayan and Narayan (2006) for Haiti; Diky et al. (2023) for Indonesia; Hayat et al. (2017) for Pakistan; Sanusi (2020) for South Africa; and Nzimande and Ngalawa (2021) for Mauritius and Mozambique.

A study conducted by Chang et al. (2002) examined the tax-and-spend hypothesis in three newly industrialized countries in Asia (South Korea, Taiwan, and Thailand) as well as seven industrialized countries (Australia, Canada, Japan, New Zealand, South Africa, the UK, and the USA). The findings of this study revealed that the data supported the tax-and-spend hypothesis for Japan, South Korea, Taiwan, the UK, and the USA. However, the spend-and-tax hypothesis was found to be applicable only to Australia and South Africa. Canada, in the context being discussed, aligns with and provides evidence for the fiscal synchronization concept. Moreover, the study conducted by Chang et al. (2002) revealed that there is no significant correlation between revenues and expenditures in both New Zealand and Thailand.

In another study, the tax-and-spend hypothesis was also found by Nzimande and Ngalawa (2021) for Botswana; Narayan and Narayan (2006) for Mauritius, El Salvador, Haiti, Chile, and Venezuela; Sriyana (2009), and Solikin and Nizar (2023) for Indonesia; Mohanty and Mishra (2017) for India; Rahman and Wadud (2014) for Bangladesh; Al-Khulaifi (2012) for Qatar; Rezael (2014) for Iran; Yinusa and Adedokun (2017), and Obioma and Ozughalu (2010) for Nigeria; Craigwell et al. (1994) for Barbados; Masenyetse and Motelle (2012) for Lesotho; and Cheng (1999) for Columbia, the Dominican Republic, Honduras, and Paraguay.

Several studies have also found a fiscally independent relationship between government tax revenue and government expenditure. Works by Babarinde (2022) for the fiscal independent

hypothesis hold for Nigeria; Sere and Choga (2017) for South Africa; and Narayan and Narayan (2006) for Peru, South Africa, Guatemala, Uruguay, and Ecuador.

RESEARCH METHODOLOGY

Testing for Long-Run Relationship between Revenue and Expenditure

Following the existing literature and preserving a suitable degree of flexibility, we construct the long-term model for state revenue and spending in this study as follows:

$$exp_t = \theta_0 + \theta_1 rev_t + \omega_t \tag{1}$$

where $\omega_t \sim NID(0, \sigma^2)$; exp_t is the total states' expenditure to states' GDP ratio; rev_t is states' total tax revenue to states' GDP. The error term ω_t is assumed to has mean zero and constant variance.

To estimate Equations (1), we employ the Ordinary Least Square (OLS) with robust standard error due to the Newey-West (1987) procedure. The Newey-West standard error method is a robust method or estimator that is highly accurate when there is a presence of heteroskedasticity and autocorrelation. As the time series variables are nonstationary and, most likely, the regression results will be spurious, we test the model for the presence of cointegration. To test for cointegration, we employ the conventional cointegration test that was suggested by Granger and Engle in 1987. The two-step Engle-Granger cointegration test is done by estimating Equation (1) using OLS first. In the second step, the residuals are saved and then tested for the presence of a unit root. The rejection of a unit root in the residuals will suggest cointegration.

If the variables are found to be cointegrated in Equations (1), the estimated long-run models are said to be valid, the OLS estimation is efficient, and the results are nonspurious.

We also employ the Fully Modified OLS (FMOLS), Dynamic OLS (DOLS), Canonical Cointegrating Regression (CCR) procedure, and robust regression using the M-estimator to estimate the long-run models as per Equations (1). The FMOLS, DOLS, and CCR are robust and more efficient than the OLS, particularly for small samples, to work with models with heteroscedasticity, autocorrelation, and non-normality of errors (Phillips & Hansen, 1990; Stock & Watson, 1993; Park, 1992). For the long-run models estimated using FMOLS, DOLS, and CCR, the test for cointegration is performed using Hansen statistics (Hansen, 1992), with a null hypothesis that there is cointegration and the alternative hypothesis that there is no cointegration.

For further robustness test, we also employ the Robust regression. The Robust regression is efficient to the presence of outliers. Barnett and Lewis (1994) stated that the presence of outliers can lead to inflated error rates and substantial distortions of parameter and statistical estimates when using either parametric or non-parametric tests. Statistically, the increase in error variance will reduce the power of statistical tests, decrease normality, and seriously bias or influence parameter estimates (Perez et al., 2013). According to Rousseeuw (1984), robust regression is the best method to detect outliers and provides results that are resistant to outliers. The most common general method of robust regression is the M-estimation method introduced by Huber (1964).

The present analysis employs an error-correction model that is used to determine the tax-spend hypothesis (Granger, 1986; Engle & Granger, 1987).

$$\Delta \exp_t = \gamma_0 + \sum_{i=1}^{m} \gamma_{1i} \Delta \exp_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta \text{rev}_{t-i} + \lambda_1 ECM_{t-1} + \eta_t \qquad (2)$$

$$\Delta \text{rev}_t = \delta_0 + \sum_{i=1}^{m} \delta_{1i} \Delta \exp_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta \text{rev}_{t-i} + \lambda_2 ECM_{t-1} + \mu_t \qquad (3)$$

where $\exp_t$ and rev_t are expenditure and revenue respectively, and Δ is the difference operator. The ECM term was derived from the residual lagged one period of the long-run Equation (1) above,

$$ECM_{t-1} = \omega_{t-1} = \exp_{t-1} - [\theta_0 + \theta_1 \text{rev}_{t-1}] \qquad (4)$$

The Granger long-run causality between revenue and expenditure is tested using the statistically significant of the parameter lambda (λ) in Equations (2) and (3). A negative and significant of the estimated coefficient of λ_1 in Equation (2) and a negative and non-significant of λ_2 in Equation (3) would suggest the tax-and-spend hypothesis; while a negative and non-significant of the estimated coefficient of λ_1 in Equation (2) and a negative and significant of λ_2 in Equation (3) would suggest the spend-and-tax hypothesis. A bi-directional causal relationship between revenue and expenditure or a fiscal synchronisation hypothesis is supported when λ_1 in Equation (2) and λ_2 in Equation (3) are both negative and significant. On the other hand, the negative and non-significant of both λ_1 in Equation (2) and λ_2 in Equation (3) would suggest the fiscal neutrality hypothesis of the institutional separation hypothesis. The estimated value for λ's usually lies between 0 and -2 (Fromentin & Leon, 2019; Loayza & Rancière, 2006; Samargandi et al., 2015).

Sources of Data

The data pertaining to the total tax revenue and expenditures of thirteen Malaysian states from 1990 to 2018 were gathered from various editions of the State Financial Yearbook, which is produced by the Department of Statistics Malaysia. The series variables were converted into ratios to the state's gross domestic product and into natural logarithms for the purpose of the analysis in this study. Figure 1 demonstrates the trends in real gross domestic product (GDP) for the 13 states in Malaysia, while Figure 2 illustrates the trend in the ratios of tax revenue and expenditure to GDP for all thirteen states in Malaysia for the period 1990–2018. Both figures clearly suggest that the revenue and expenditure series are integrated economic variables.

Insert Figure 1 here

Insert Figure 2 here

RESULTS AND DISCUSSION

Descriptive Statistics and Correlation Matrix

The descriptive statistics of each of the study's variables are presented in Table 1. In general, the means for all series are positive. States with a mean expenditure ratio to GDP of more than 5% include Perlis, Sabah, Sarawak, and Terengganu, while the states with a mean tax revenue ratio to GDP of more than 5% include Sabah and Sarawak. At the mean level, all states experienced deficits, implying that mean expenditure is greater than mean revenue.

Insert Table 1 here

As shown in Figure 2, the majority of the time, the state-to-GDP ratios of spending are larger than the state-to-GDP ratio of revenue, suggesting that the states are typically running fiscal deficits. More importantly, most variables demonstrate substantial standard deviations, skewness, and kurtosis. All twenty-six variables are skewed, showing asymmetry. As for kurtosis, the variables that show a size greater than 3 include expenditure for Johor, Kelantan, Sabah, and Selangor, and revenue for Johor, Perak, Perlis, Sabah, and Sarawak. On the right side of the distribution, this suggests that the variables display a longer or fatter tail. Stated differently, the series' kurtosis indicates a leptokurtic distribution type. However, for Johor (expenditure and revenue), Kelantan (expenditure), Perak (revenue), Perlis (revenue), Sabah (expenditure and revenue), Sarawak (revenue), and Selangor (expenditure and revenue), the Jarque-Bera tests for the normality of the series are rejected. As a result, a large number of the variables in our analysis have non-normal distributions and exhibit high skewness and kurtosis. Transforming all variables into logarithms is a common solution to these issues (McKinney et al., 2009; Naidoo & Adamowicz, 2001; Ehrhardt-Martinez et al., 2002).

In Table 2, we present the correlation matrix between the ratios of expenditure to GDP and ratios of tax revenue to GDP for each state. In all cases, data from all thirteen states suggest that the correlation between revenue and expenditure is favorable and, at the 1% level, statistically significant. In other words, an increase in states' tax revenue is correlated with an increase in states' expenditure.

Insert Table 2 here

Results of Unit Root Tests

Before conducting the cointegration test on Equations (1), it is necessary to ascertain each variable's integration order. To test for integration, we employ the standard Augmented Dickey-Fuller (Dickey & Fuller, 1981) unit root test. The test is conducted for both variables in terms of level as well as their first differences. For each unit root test, we include the intercept and/or trend as the deterministic components when conducting a unit root test. The results of the unit root test are presented in Table 3. The unit root test results suggest that all variables in their levels are integrated of order one, that is, I(1). No unit root is found after the first difference, indicating that their log changes are stationary. Each series is I(0), meaning they are all stationary in first-differences.

Insert Table 3 here

Results of the Long-run Models

The estimated long-run spend-tax equations for the thirteen states in Malaysia is presented in Table 4. First, results in Table 4 suggest that the OLS-robust estimates of Equation (1) are cointegrated as shown by the DF_t statistics which reject the null hypothesis of a unit root of the residuals at least at the 10% level (Johor, Negeri Sembilan, and Sarawak), 5% level (Kelantan, Penang, and Terengganu) and 1% level (Kedah, Melaka, Pahang, Perak, Perlis, Sabah, and Selangor). Second, the results of the L_c statistics for the FMOLS, DOLS and CCR estimates suggest that the null hypothesis of cointegration cannot be rejected, thus implies long-run relationships between states' expenditure and states' revenue for the period 1990-2018. Third, in all estimated equations, the revenue variable is statistically significant at least at the 10%

18

level and show positive sign. This suggest that in the long-run an increase in state's tax revenue will increase state's expenditure. And fourthly, the elasticity of revenue of more than one is registered for the states of Johor, Melaka, Pahang, Sabah and Sarawak, thus, implies that a 1% increase in the state's tax revenue, state's expenditure will increase by more than 1%. On the other hand, states that are having elasticity of revenue less than one include Kedah, Kelantan, Negeri Sembilan, Penang, Perak, Perlis, Selangor and Terengganu. A 1% increase in state's tax revenue will increase state's expenditure by less than 1%.

Insert Table 4 here

Table 5 presents the estimated long-run model for all thirteen states in Malaysia employing robust regression using the M-estimator. The state's revenue variable is statistically significant at the 1% level in all cases and shows a positive relationship with the state's expenditure. The expenditure in the states of Johor, Melaka, Pahang, Sabah, and Sarawak is more responsive to the changes in the state's tax revenue, while the expenditure in the states of Kelantan, Kedah, Perak, Negeri Sembilan, Perlis, Penang, Selangor, and Terengganu was less responsive to the changes in the state's tax revenue during the period 1990–2018. These results were consistent with the earlier results indicated by OLS-Robust, FMOLS, DOLS, and CCR.

Insert Table 5 here

Results of Granger Long-run Causality

In estimating the error-correction framework as per Equations (2) and (3), we follow the work of Pesaran et al. (2001). According to Pesaran et al. (2001), the optimal lag structure of the

error-correction models can be estimated by estimating the autoregressive distributed lag (ARDL) model with its optimal lag structure. In Table 6, the optimal lag structure of the ARDL(p,q) model, where p is the lag period for the dependent variable and q is the lag period for the independent variable, is shown for each state. It varies from ARDL (1,0) for Sarawak to ARDL (3,3) for Terengganu. The Akaike Information Criterion, or AC, was used to determine the optimal lag length.

Insert Table 6 here

In this study, we are interested in testing the long-run tax-spending hypothesis (as shown by the significant of the lambda, $\lambda's$) for Malaysia rather than the short-run tax-spending hypothesis (as shown by the significant of the Δ's operator). In Table 6, we present the estimated coefficients of the parameter λ, that is, the coefficient of the ECM_{t-1} term. If the ECM_{t-1} term is negative and significant in the expenditure equation but not in the revenue equation we have unidirectional Granger long-run causality running from revenue to expenditure, thus supporting the tax-and-spend hypothesis; while a unidirectional Granger long-run causality running from expenditure to revenue is established if the ECM_{t-1} term in the revenue equation is negative and significant but not in the expenditure equation, thus supporting the spend-and-tax hypothesis. On the other hand, if the ECM_{t-1} term in both the revenue and expenditure equations are negative and significant, then we have bidirectional Granger long-run causality running between revenue and expenditure, thus supporting the fiscal synchronization hypothesis. Lastly, if ECM_{t-1} term is not significant in both the revenue and expenditure equations, the data support the institutional separation hypothesis or the fiscal neutrality hypothesis.

As shown in Table 6, in all thirteen states, the ECM_{t-1} term is negative and statistically significant at least at the 5% level in the expenditure equation; and similarly, again in all thirteen states, the ECM_{t-1} term is negative and statistically significant at least at the 10% level in the revenue equation. These results suggest bidirectional Granger long-run causality running in both direction between revenue and expenditure. It therefore supports the fiscal synchronization hypothesis.

The fiscal synchronization hypothesis, thus implies that the states' government of the thirteen states, make decision about state's consumption expenditure and state's tax collection simultaneously; and that the public understand the benefits of the state's government services in relation to their costs. Nevertheless, the best strategy for narrowing fiscal deficits is to undertake simultaneous measures to increase revenues and cut spending. Our findings are in contrast to the earlier findings by Asri et al. (2015) which support the tax-spend hypothesis for 11 states in Malaysia for the period 1970-2008; and spend-tax hypothesis for Kelantan found by Jalil and Harun (2012). Nevertheless, our finding for Penang supports the fiscal synchronization hypothesis found by Jalil and Harun (2012) using data from 1980-2009.

CONCLUSION

The purpose of the present study is to test the revenue and expenditure, or tax and spend, nexus in the thirteen states in Malaysia for the periods 1990 to 2018. The thirteen states included in the study are Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Perak, Perlis, Penang, Sabah, Sarawak, Selangor, and Terengganu. Four tax-spending hypotheses were tested, namely the spend-and-tax hypothesis, the tax-and-spend hypothesis, the fiscal synchronization hypothesis, and the institutional separation or fiscal neutrality hypothesis.

We used the ratio of states' tax revenue and expenditure to states' GDP and transformed them into logarithms. In this study, the revenue and expenditure variables were tested for unit root, and we employed several estimators to test for cointegration to establish whether there is a long-run relationship between expenditure and revenue in the thirteen states. The estimators are Ordinary Least Square (OLS) with robust standard error, Fully Modified OLS (FMOLS), Dynamic OLS (DOLS), Canonical Cointegrating Regression (CCR), and Robust Regression with M-estimator. On the other hand, the tax-spending hypotheses were tested using the error-correction model framework following Pesaran et al. (2001). Within the error-correction framework, we employed the ECM term-lag one period to ascertain the Granger long-run causality between revenue and expenditure.

Our results suggest that, first, both ratios of states' revenue and expenditure to states' GDP are non-stationary in levels, but they are stationary in first-difference. Second, in all thirteen states, revenue and expenditure are cointegrated, implying that there is a long-term link between states' expenditure and states' revenue over the time periods 1990–2018, and all five different estimators give consistent results. Third, the long-run tax-spending models indicate that 5 states respond more to 1% changes in revenue, while 8 states respond less to 1% changes in revenue. And fourthly, our study supports the fiscal synchronization hypothesis between states' expenditure and states' revenue for all thirteen states in Malaysia for the period 1990–2018.

The most important policy implication is that if a country supports the fiscal synchronization hypothesis, where taxation and government spending decisions are made simultaneously, in the sense that taxation and spending are interdependent, so changes in one require adjustments in the other to maintain fiscal balance. Policymakers must carefully coordinate tax revenues

and expenditure to avoid budget deficits or surpluses. Furthermore, the hypothesis suggests a preference for policies that aim to match revenues with expenditures, reducing reliance on borrowing. By ensuring that taxation and spending decisions are made jointly, the fiscal synchronization hypothesis promotes a balanced and stable fiscal environment. However, effective implementation requires political will, institutional strength, and robust economic governance frameworks.

ACKNOWLEDGEMENT

REFERENCES

Akram, V., & Rath, B.N. (2019). Is there any evidence of tax-and-spend, spend-and-tax or fiscal synchronization from panel of Indian state? *Applied Economics Letters*, 26(18), 1544-1547.

Al-Foul, B.A., & Baghestani, H. (2004). The causal relation between government revenue and spending: Evidence from Egypt and Jordan. *Journal of Economics and Finance*, 28(2), 260-269.

Al-Khulaifi, A.S. (2012). The relationship between government revenue and expenditure in Qatar: A cointegration and causality investigation. *International Journal of Economics and Finance*, 4(9), 142-148.

Alagidede, P., & Tweneboah, G. On the sustainability and synchronization of fiscal policy in Latin America. *Latin American Journal of Economics*, 52(2), 213-240.

Almasri, A., & Shukur, G. (2003). An illustration of the causality relation between government spending and revenue using wavelet analysis on Finnish data. *Journal of Applied Statistics*, 30(5), 571-584.

Anderson, W., Wallace, M.S., & Warner, J.T. (1986). Government spending and taxation: What causes what? *Southern Economic Journal*, 52(3), 630-639.

Asri, N.M., Karim, Z.A., Ahmad, F., & Ramli, R. (2015). Pengurusan fiscal kerajaan negeri di Semenanjung Malaysia: Analisis Autoregressive Distributed Lag (ARDL). *Jurnal Ekonomi Malaysia*, 49(2), 97-120.

Aziz, M.A., Habibullah, M.S., Azman-Saini, W.N.W., & Azali, M. (2000). Testing for causality between taxation and government spending: An application of Toda-Yamamoto approach. *Pertanika Journal of Social Science and Humanities*, 8(1), 45-50.

Babarinde, G.F. (2022). Fiscal neutrality hypothesis: An analysis of the Nigerian local government revenue and expenditure. *Journal of Public Administration, Finance and Law*, 23, 119-130.

Baghestani, H., & NcNown, R. (1994). Do revenues or expenditures respond to budgetary disequilibria? *Southern Economic Journal*, 63, 311-322.

Barnett, V., & Lewis, T. (1994). *Outliers in Statistical Data*. 3rd edition. Chichester: J. Wiley & Sons.

Bhat, K.S., Nirmala, V., & Kamaiah, B. (1993). Causality between tax revenues and expenditure of Indian states. *The Indian Economic Journal*, 40(4), 108-117.

Blackley, P. (1986). Causality between revenues and expenditures and the size of the federal budget. *Public Finance Quarterly*, 14, 139-156.

Bohn, H. (1991). Budget balance through revenue or spending adjustments? Some historical evidence for the United States. *Journal of Monetary Economics*, 27, 333-359.

Buchanan, J., & Wagner, R.W. (1977). *Democracy in Deficit*. New York: Academic Press.

Buchanan, J., & R.W. Wagner. (1978). Dialogues concerning fiscal religion. *Journal of Monetary Economics*, 4, 627-636.

Carneiro, F.G., Faria, J.R., & Barry, B.S. (2004). Government revenues and expenditures in Guinea-Bissau: Causality and cointegration. Africa Region Working Paper Series No. 65. World Bank.

Chang, T., & Chiang, G. (2009). Revisiting the government revenue-expenditure nexus: Evidence from 15 OECD countries based on the panel data approach. *Czech Journal of Economics and Finance*, 59(2), 165-179.

Chang, T., & Ho, Y.H. (2002a). A note on testing "tax-and-spend, spend-and-tax or fiscal synchronization: The case of China. *Journal of Economic Development*, 27(1), 151-160.

Chang, T., & Ho, Y.H. (2002b). Tax or spend, what causes what: Taiwan's experience. *International Journal of Business and Economics*, 1(2), 157-165.

Chang, T., Liu, W.R., & Caudill, S.B. (2002). Tax-and-spend, spend-and-tax, or fiscal synchronization: New evidence for ten countries. *Applied Economics*, 3, 1553-1561.

Cheng, B.S. (1999). Causality between taxes and expenditures: Evidence from Latin American countries. *Journal of Economics and Finance*, 23(2), 184-192.

Craigwell, R.C., Leon, H., & Mascoll, C. (1994). Government revenue and expenditure causality in the presence of seasonality in Barbados. *Social and Economic Studies*, 43(4), 197-228.

Dayang-Affizzah, A.M., Habibullah, M.S., & Azman-Saini, W.N.W. (2006). Expenditures and revenues: Testing for causality in Sabah local government finances. *International Journal of Economics and Management*, 1(1), 1-23

Darrat, A.F. 1998. Tax and spend, or spend and tax? An inquiry into the Turkish budgetary process. *Southern Economic Journal*, 64, 940-956.

Dickey, D.A., & Fuller, W.A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49, 1057-1077.

Diky, J.C., Sapulette, S.G., Laluamury, J., Usmany, A.E.M., & Limba, F.B. (2022). A cointegration and causal analysis of the government revenue and expenditure relationship in Indonesia. *Journal of Business and Banking*, 12(2), 267-275.

Ehrhardt-Martinez, K., Crenshaw, E.M., & Jenkins, J.C. (2002). Deforestation and the environmental Kuznets curve: A cross-national investigation of intervening mechanisms. *Social Science Quarterly*, 83(1), 226–243. https://doi.org/10.1111/1540-6237.00080

Elliott, G., Rothenberg, T.J., & Stock, J.H. 1996. Efficient tests for an autoregressive unit root. *Econometrica*, 64, 813–836.

Engle, R.F., & Granger, C.W.J. (1987). Cointegration and error-correction: Representation, estimation and testing. *Econometrica*, 55, 251-276.

Ewing, B.T., & Payne, J.E. (1998). Government revenue-expenditure nexus: Evidence from Latin America. *Journal of Economic Development*, 23(2), 43-56.

Ewing, B.T., Payne, J.E., Thompson, M.A., & Al-Zoubi, O.M. (2006). Government expenditures and revenues: Evidence from asymmetric modeling. *Southern Economic Journal*, 73(1), 190-200.

Friedman, M. (1972). *An Economist's Protest*. New Jersey: Horton and Co.

Friedman, M. (1978). The limitation of tax limitation. *Policy Review* (Summer), 7-14.

Fromentin, V., & Leon, F. (2019). Remittances and credit in developed and developing countries: A dynamic panel analysis. *Research in International Business and Finance*, 48(April), 310–320. https://doi.org/10.1016/j.ribaf.2018.12.010

Fuess, Jr. S.M., Hou, J.W., & Millea, M. (2003). Tax or spend, what causes what? Reconsidering Taiwan's experience. *International Journal of Business and Economics*, 2(2), 109-119.

Gounder, N., Narayan, P.K., & Prasad, A. (2007). An empirical investigation of the relationship between government revenue and expenditure: The case of the Fiji Islands. *International Journal of Social Economics*, 34(3), 147-158.

Granger, C.W.J. (1986). Developments in the study of cointegrated economic variables. *Oxford Bulletin of Economics And Statistics*, 48, 213-228.

Hansen, B.E. (1992). Testing for parameter stability in linear models. *Journal of Policy Modeling*, 14(4), 517-533.

Hayat, U., Takrim, K., & Hussain, I. (2017). An empirical analysis of fiscal policy hypothesis: Finding the most suitable for Pakistan. *PUTAJ-Humanities and Social Sciences*, 24(2), 73-82.

Ho, Y.H., & Huang, C.J. (2009). Tax-spend, spend-tax or fiscal synchronization: A panel analysis of the Chinese provincial real data. *Journal of Economics and Management*, 5(2), 257-272.

Hondroyiannis, G., & Papapetrou, E. (1996). An examination of the causal relationship between government spending and revenue: A cointegration analysis. *Public Choice*, 89, 363-374.

Huber, P.J. (1964). Robust estimation of a location parameter. *The Annals of Mathematical Statistics*, 35, 73–101. https://www.jstor.org/stable/2238020

Irandoust, M. (2018). Government spending and revenues in Sweden 1722-2011: Evidence from hidden cointegration. *Empirica*, 45, 543-557.

Jaen-Garcia, M. (2019). Tax-spend, spend-tax, or fiscal synchronization. A wavelet analysis. *Applied Economics*, 52(28), 3023-3034.

Jalil, A.Z.A., & Harun, H. (2012). Fiscal decision and fiscal performance: The case of Kelantan and Penang. *Procedia Economics and Finance*, 1, 193-202.

Jones, J.D., & Joulfaian, D. (1991). Federal government expenditures and revenues in the early years of the American Republic: Evidence from 1792 to 1860. *Journal of Macroeconomics*, 13(1), 133-155.

Joulfaian, D., & Mookerjee, R. (1990). The government revenue-expenditure nexus: Evidence from a state. *Public Finance Quarterly*, 18(1), 92-103

Joulfaian, D., & Mookerjee, R. (1991). Dynamics of government revenues and expenditures in industrial economies. *Applied Economics*, 23, 1839-1844.

Karakas, M., & Turan, T. (2019). The government spending-revenue nexus in CEE countries: Some evidence for symmetric effects. *Prague Economic Papers*, 28(6), 633-647.

Karavitis, N. (1987). The causal factors of government expenditure growth in Greece, 1950-80. *Applied Economics*, 19, 789-807.

Karim, Z.A., Asri, N.M., Abdullah, A.A.-H, Antoni, A., & Yusoff, Z.Z.M. (2006). The relationship between federal government revenue and spending: Empirical evidence from ASEAN-5 countries. *Jurnal Ekonomi Pembangunan*, 11(2), 91-113.

Karlsson, H.K. (2020). Investigation of the time-dependent dynamics between government revenue and expenditure in China: A wavelet approach. *Journal of the Asia Pacific Economy*, 25(2), 250-269.

Khan, H., Marimuthu, M., & Lai, F.W. (2021). A Granger causal analysis of tax-spend hypothesis: Evidence from Malaysia. *SHS Web Conferences*, 124, 04002. https://doi.org/10.1051/shsconf/202112404002

Kirikkaleli, D., & Ozbeser, B. (2023). Government expenditures and tax revenues in the United States of America. *SAGE Open*, January-March 2023, 1-6. https://doi.org/10.1177/21582440231161265

Kollias, C., & Makrydakis, S. (2000). Tax and spend or spend and tax? Empirical evidence from Greece, Spain, Portugal and Ireland. *Applied Economics*, 32, 533-546.

Kollias, C., & Paleologou, S.M. (2006). Fiscal policy in the European Union: Tax and spend, spend and tax, fiscal synchronization or institutional separation? *Journal of Economic Studies*, 33(2), 108-120.

Konstantinou, P.T. (2004). Balancing the budget through revenue or spending adjustments? The case of Greece. *Journal of Economic Development*, 29(2), 81-105.

Koren, S., & Stiassny, A. (1998). Tax and spend or spend and tax? An international study. *Journal of Policy Modeling*, 20(2), 163-191.

Li, X. (2001). Government revenue, government expenditure and temporal causality: Evidence from China. *Applied Economics*, 33, 485-497.

Loayza, N. V., & Rancière, R. (2006). Financial development, financial fragility and growth. *Journal of Money, Credit, and Banking*, 38(4), 1051–1076. https://doi.org/10.1353/mcb.2006.0060

MacKinnon, J.G. (1996). Numerical Distribution Functions for Unit Root and Cointegration Tests. *Journal of Applied Econometrics*, 11, 601-618.

Manage, N., & Marlow, M.L. (1986). The causal relation between federal expenditures and receipts. *Southern Economic Journal*, 52(3), 617-629.

Marlow, M.L., & Manage, N. (1987). Expenditures and receipts: Testing for causality in state and local government finances. *Public Choice*, 53(3), 242-255.

Masenyetse, R.F., & Motelke, S.I. (2012). Government revenue – expenditure nexus in Lesotho: The decline in SACU revenue. *American Journal of Economics*, 2(1), 8-14.

McKinney, L.A., Fulkerson, G.M., & Kick, E.L. (2009). Investigating the correlates of biodiversity loss: A cross-national quantitative analysis of threatened bird species. *Human Ecology Review*, 16(1), 103–113. https://www.jstor.org/stable/24707741

Mele, M., Quarto, A., & Abbafati, C. (2020). On the fiscal policy in Malaysia: An econometrical analysis between the revenue and expenditure. *Research in World Economy*, 11(1 Special Issue), 1-10. Doi:105430/rwe.v1n1p1

Meltzer, A.H., & Richard, S.F. (1981). A rational theory of the size of government. *Journal of Political Economy*, 89, 914-924.

Miller, S.M., & Russek, F.S. (1990). Cointegration and error-correction models: The temporal causality between government taxes and spending. *Southern Economic Journal*, 57(1), 221-229.

Mithani, D.M., & Goh, S.K. (1999). Causality between government expenditure and revenue in Malaysia. *ASEAN Economic Bulletin*, 16(1), 68-79.

Mohanty, A.R., & Mishra, B.R. (2017). Cointegration between government expenditure and revenue: Evidence from India. *Advances in Economics and Business*, 5(1), 33-40.

Moyo, D., Samour, A., & Tursoy, T. (2021). The nexus between taxation, government expenditure and economic growth in South Africa. New evidence from combined co-integration test. *Estudios de Economia Aplicada*, 39(3), 1-15. https://doi.org/10.25115/eea.v39i3.3835

Musgrave, R. (1966). Principles of budget determination. In H. Cameron and W. Henderson (eds.). *Public Finances: Selected Readings*. New York: Random House.

Mutascu, M. (2016). Government revenues and expenditures in the East European economies: A bootstrap panel Granger causality approach. *Eastern European Economics*, 00, 1-14. Doi: 10.1080/00128775.2016.1204237

Mutascu, M. (2017). The tax-spending nexus: Evidence from Romania using wavelet analysis. *Post-Communist Economies*, 29(3), 431-447.

Naidoo R, Adamowicz WL (2001) Effects of economic prosperity on numbers of threatened species. *Conservation Biology*, 15(4), 1021–1029. https://doi.org/10.1046/j.1523-1739.2001.0150041021.x

Narayan, P.K., & Narayan, S. (2006). Government revenue and government expenditure nexus: Evidence from developing countries. *Applied Economics*, 38, 285-291.

Newey, W.K., & West, K.D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3), 703-708. https://doi.org/10.2307/1913610

Nyamongo, M.E., & Sichel, M., & Schoeman, N.J. (2007). Government revenue and expenditure nexus in South Africa. *SAJEMS*, 10(2), 256-268.

Nzimande, N.P., & Ngalawa, H. (2022). Tax-spend or spend-tax? The case of Southern Africa. *Economies*, 10. 85. https://doi.org/10.3390/economies10040085

Obioma, E.C., & Ozughalu, U.M. (2010). An examination of the relationship between government revenue and government expenditure in Nigeria: Cointegration and causality approach. *Economic and Financial Review*, 48(2), 35-57.

Owoye, O. (1995). The causal relationship between taxes and expenditures in the G7 countries: Cointegration and error-correction models. *Applied Economics Letters* 2: 19-22.

Park, J.Y. (1992). Canonical cointegrating regressions. *Econometrica*, 60(1), 119-143.

Payne, J.E. (1998). The tax-spend debate: Time series evidence from state budgets. *Public Choice*, 95, 307-320.

Peacock, A. and Wiseman, J. (1961). *The Growth of Public Expenditures in the United Kingdom*. Princeton, N.J: Princeton University Press.

Peacock, A., & Wiseman, J. (1979). Approaches to the analysis of government expenditure growth. *Public Finance Quarterly*, 7, 3-23.

Perez, B., Molina, I., & Pena, D. (2013). Outlier detection and robust estimation in linear regression models with fixed group effects. *Journal of Statistical Computation and Simulation*, 84, 2652–2669. https://doi.org/10.1080/00949655.2013.811669

Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.

Phillips, P. & Hansen, B. (1990). Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies*, 57, 99-125.

Provopoulos, G., & Zambaras, A. (1991). Testing for causality between government spending and taxation. *Public Choice*, 68, 277-282.

Rahman, S.M.A., & Wadud, M.A. (2014). Tax and spend, spend and tax, fiscal synchronization or fiscal neutrality: Evidence from Bangladesh. *The International Journal of Applied Economics and Finance*, 8(3), 98-108.

Ram, R. (1988). Additional evidence on causality between government revenue and government expenditure. *Southern Economic Journal*, 54(3), 763-769.

Raza, S.A., Hassan, S.Z., & Sharif, A. (2019). Asymmetric relationship between government revenues and expenditures in a developing economy: Evidence from a non-linear model. *Global Business Review*, 20(5), 1-17. https://doi.org/10.1177/0972150919846800

Rezael, A. (2015). Tax-spend, spend-tax or fiscal synchronization hypothesis: Evidence from Iran. *International Journal of Innovation and Applied Studies,* 10(3), 844-857.

Richter, C., & Dimitrios, P. (2013). Tax and spend, spend and tax, fiscal synchronization or institutional separation? Examining the case of Greece. *Romanian Journal of Fiscal Policy*, 4(2), 1-17.

Rousseeuw, P.J. (1984). Least median of squares regression. Journal of the American Statistical Association, 79,871–880. https://doi.org/10.2307/2288718

Saha, S., & Mukhopadhyay, C.K. (2014). Effects of structural changes on the intertemporal relationship between government revenue & government expenditure: A case study of Malaysia. *Indian Journal of Economics and Development*, 2(3), 42-56.

Samargandi, N., Fidrmuc, J., & Ghosh, S. (2015). Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries. *World Development*, 68(April), 66–81. https://doi.org/10.1016/j.worlddev.2014.11.010

Sanusi, K.A. (2020). On the relation between government expenditure and revenue in South Africa: An empirical investigation in a nonlinear framework. *Cogent Economics & Finance*, 8, 1803523. https://doi.org/10.1080/23322039.2020.1803523

Sanusi, N.A., Kamil, N.F.N.M., & Alwi, A. (2012). The sustainability of Terengganu fiscal adjustment and dynamic economics performance. *Journal of Sustainability Science and Management*, 7(1), 94-102.

Sere, K.A., & Choga, I. (2017). The causal and cointegration relationship between government revenue and government expenditure. *Public and Municipal Finance*, 6(3), 23-32.

Shuaibu, M., & Ibrahim, T.M. (2023). Analysis of the fiscal synchronization hypothesis in selected sub-nationals in Nigeria. *Journal of Economics and Allied Research*, 8(1), 108-124.

Solikin, A., & Nizar, M.A. (2023). Government revenues and government spending nexus: A testing hypothesis for Indonesia. *Jurnal Borneo Administrator*, 19(1), 103-116.

Sriyana, J. (2009). A causality relationship between tax revenue and government expenditure in Indonesia. *Economic Journal of Emerging Markets*, 1(2), 93-101.

Stock, J. & Watson, M.W. (1993), A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, 61(4), 783-820.

Taha, R., & Loganathan, N. (2008). Causality between tax revenue and government spending in Malaysia. *The International Journal of Business and Finance Research*, 2(2), 63-73.

Takumah, W. (2014). The dynamic causal relationship between government revenue and government expenditure nexus in Ghana. *International Research Journal of Marketing and Economics*, 1(6), 45-62.

Tan, J.H. (2009). Tax-and-spend or spend-and-tax? Empirical evidence from Malaysia. Asian *Academy of Management Journal of Accounting and Finance*, 5(1), 107-115.

Tashevska, B., Trenovski, B., & Trpkova-Nestorocska, M. (2020). The government revenue-expenditure nexus in Southeast Europe: A bootstrap panel Granger-causality approach. *Eastern European Economics*, 58(4), 309-326.

Vamvoukas, G.A. (2011). The tax-spend debate with an application to the EU. *Economic Issues*, 16(Part 1), 65-88.

Von Furstenberg, G.M., Green, R.J., & Jeong, J.H. (1986). Tax and spend, or spend and tax? *The Review of Economics and Statistics*, 58(2), 179-188.

Wildavsky, A. (1988). *The New Politics of the Budgetary Process*. Glenview, IL: Scott, Foresman.

Wong, H.T., & Lim, K.P. (2005). The relationship between government revenue and expenditure in Malaysia. *International Journal of Malaysian Studies*, 12(2), 53-72.

Yinusa, D.O., & Adedokun, A. (2017). Fiscal synchronization or institutional separation: An examination of tax-spend hypothesis in Nigeria. *Journal of Finance and Accounting*, 5(3), 80-87.

Table 1: Descriptive statistics

Variables	Unit	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	J-B test	Obs
Expenditure:									
Johor	% GDP	2.22	10.32	0.69	2.05	2.56	10.13	93.17***	29
Kedah	% GDP	2.80	4.62	1.59	0.77	0.75	2.70	2.85	29
Kelantan	% GDP	4.45	8.83	2.75	1.66	1.30	3.95	9.28***	29
Melaka	% GDP	2.74	4.83	0.97	1.29	0.06	1.59	2.43	29
Neg.Sembilan	% GDP	2.20	3.85	0.86	1.00	0.12	1.44	3.01	29
Pahang	% GDP	3.35	7.03	1.13	2.08	0.66	1.78	3.91	29
Perak	% GDP	2.45	3.61	1.86	0.45	0.77	2.67	2.97	29
Perlis	% GDP	5.34	8.79	2.99	1.74	0.62	2.36	2.37	29
Penang	% GDP	1.25	1.75	0.76	0.29	0.04	1.97	1.30	29
Sabah	% GDP	7.60	18.69	4.19	3.91	1.58	4.50	14.71***	29
Sarawak	% GDP	22.77	47.99	9.31	11.92	0.57	1.84	3.19	29
Selangor	% GDP	1.92	4.31	1.01	0.85	1.45	4.73	13.74***	29
Terengganu	% GDP	5.48	8.14	1.53	2.01	-0.58	2.24	2.35	29
Revenue									
Johor	% GDP	1.84	6.89	1.01	1.17	3.26	13.74	190.7***	29
Kedah	% GDP	1.50	2.70	0.85	0.57	0.58	1.98	2.89	29
Kelantan	% GDP	2.83	4.34	1.77	0.75	0.36	1.91	2.08	29
Melaka	% GDP	1.74	3.38	0.69	0.75	0.49	2.34	1.69	29
Neg.Sembilan	% GDP	1.83	3.70	0.87	0.99	0.64	1.83	3.64	29
Pahang	% GDP	2.69	5.40	0.91	1.48	0.56	1.82	3.23	29
Perak	% GDP	1.84	3.13	0.94	0.51	1.06	3.92	6.44**	29
Perlis	% GDP	3.41	11.13	1.64	1.78	2.93	13.26	168.5***	29
Penang	% GDP	1.00	1.52	0.63	0.23	0.15	2.15	0.99	29
Sabah	% GDP	5.62	11.91	3.30	2.38	1.50	4.21	12.67***	29
Sarawak	% GDP	16.07	29.48	9.99	5.13	1.06	3.29	5.58*	29
Selangor	% GDP	1.43	3.22	0.60	0.76	1.15	2.94	6.36**	29
Terengganu	% GDP	2.89	6.19	0.81	1.82	0.38	1.54	3.27	29

Notes: Asterisks ***, **, and * denote statistically significant at the 1%, 5% and 10% level, respectively. All variables were in percentage to state's gross domestic product. J-B test denotes Jacque-Bera test on normality of the variables.

Table 2: Correlation matrix

States' Expenditure	States' Revenue	Correlation coefficients
Johor	Johor	0.88***
Kedah	Kedah	0.81***
Kelantan	Kelantan	0.57***
Melaka	Melaka	0.87***
Negeri Sembilan	Negeri Sembilan	0.91***
Pahang	Pahang	0.97***
Perak	Perak	0.64***
Perlis	Perlis	0.78***
Penang	Penang	0.75***
Sabah	Sabah	0.94***
Sarawak	Sarawak	0.78***
Selangor	Selangor	0.82***
Terengganu	Terengganu	0.45**

Notes: Asterisks ***, and ** denote statistically significant at the 1%, and 5% level, respectively. All variables were in logarithm.

Table 3: Results of unit root tests

Series	Series in level:		Series in difference:	
	Intercept	Intercept+trend	Intercept	Intercept+trend
Johor:				
Revenue	-1.5619 (0)	-2.2837 (1)	-3.2233***(1)	-5.7665***(0)
Expenditure	-1.1148 (0)	-2.7391 (0)	-5.9847***(0)	-6.8376***(0)
Kedah:				
Revenue	-0.3303 (1)	-2.2779 (2)	-7.0877***(0)	-4.3960***(2)
Expenditure	-1.2729 (0)	-3.0635 (3)	-4.3672***(1)	-5.3138***(1)
Kelantan:				
Revenue	-1.9056 (1)	-2.4592 (2)	-8.0647***(0)	-6.1719***(1)
Expenditure	-1.4813 (1)	-1.9533 (1)	-6.7080***(0)	-6.7637***(0)
Melaka:				
Revenue	-1.1122 (3)	-1.6148 (2)	-5.7435***(0)	-8.1506***(0)
Expenditure	-0.6680 (0)	-2.5938 (2)	-4.4412***(1)	-4.9347***(3)
Negeri Sembilan:				
Revenue	-0.6905 (0)	-1.4863 (2)	-7.0830***(0)	-5.9864***(1)
Expenditure	0.2228 (0)	-2.7986 (0)	-5.0987***(0)	-5.8911***(0)
Pahang:				
Revenue	-0.3230 (0)	-2.3047 (2)	-5.2880***(0)	-6.4114***(0)
Expenditure	0.1344 (0)	-2.0854 (0)	-4.9867***(0)	-5.1155***(0)
Penang:				
Revenue	-1.5862 (0)	-1.6945 (0)	-6.2178***(0)	-6.5048***(0)
Expenditure	-1.4740 (2)	-1.9644 (2)	-5.5077***(0)	-5.9272***(0)
Perak:				
Revenue	-1.2086 (2)	-2.3068 (4)	-5.1458***(3)	-5.1707***(3)
Expenditure	-1.8027 (1)	-2.3966 (4)	-8.7673***(0)	-8.9855***(0)
Perlis:				
Revenue	-1.7029 (0)	-2.6187 (1)	-4.1177***(0)	-5.8757***(0)
Expenditure	-1.1374 (0)	-2.0199 (3)	-7.5927***(0)	-7.7659***(0)
Sabah:				
Revenue	-1.4026 (0)	-2.4102 (0)	-9.2936***(0)	-9.5000***(0)
Expenditure	-0.7392 (0)	-1.5192 (0)	-5.1496***(0)	-5.5407***(0)
Sarawak:				
Revenue	-0.7965 (0)	-2.2331 (0)	-6.2286***(0)	-6.5522***(0)
Expenditure	-1.0411 (0)	-0.8250 (0)	-4.7773***(0)	-5.1993***(0)
Selangor:				
Revenue	-0.6390 (0)	-2.4205 (0)	-5.0511***(0)	-5.0488***(0)
Expenditure	-1.0031 (0)	-2.2472 (0)	-4.1757***(0)	-4.2874***(0)
Terengganu:				
Revenue	-1.3569 (0)	-2.5561 (1)	-3.1298**(0)	-3.3270**(0)
Expenditure	-1.7473 (6)	-1.6372 (6)	-5.2519***(0)	-5.4862***(0)

Notes: Asterisks ***, ** denote statistically significant at the 1% and 5% level, respectively. Critical values for the series with Intercept, refer to MacKinnon (1996); while critical values for series with Intercept and Trend, refer to Elliot et al. (1996, Table 1).

Table 4: Results on long-run models

States/Independent variables	OLS-robust	FMOLS	DOLS	CCR
Johor:				
constant	-0.2588	-0.5108	-0.5153**	-0.4306
	(-1.4717)	(-1.2355)	(-2.1382)	(-1.2962)
revenue	1.5487***	1.9028**	2.1914***	1.7082***
	(8.3941)	(2.4999)	(3.9863)	(3.5591)
R^2	0.777	0.702	0.712	0.701
Cointegration tests:				
$DF_{t-statistic}$	-1.7096*			
$L_{c-statistic}$		0.2581	0.0197	0.1405
Kedah:				
constant	0.5857***	0.7768***	0.8081***	0.7745***
	(18.864)	(20.752)	(20.405)	(19.890)
revenue	0.7970***	0.7241***	0.6600***	0.7203***
	(5.6651)	(9.0698)	(8.3373)	(8.9822)
R^2	0.663	0.686	0.777	0.688
Cointegration tests:				
$DF_{t-statistic}$	-5.3466***			
$L_{c-statistic}$		0.2713	0.0684	0.1560
Kelantan:				
constant	0.7031***	0.5620	0.5258	0.5167
	(3.6754)	(1.1933)	(1.2569)	(0.9559)
revenue	0.7280***	0.8611*	0.9014**	0.9054*
	(3.8672)	(1.9007)	(2.2172)	(1.7334)
R^2	0.334	0.324	0.367	0.315
Cointegration tests:				
$DF_{t-statistic}$	-2.4816**			
$L_{c-statistic}$		0.1227	0.0262	0.1371
Melaka:				
constant	0.3900***	0.4093***	0.3639***	0.4109**
	(4.8695)	(2.8058)	(2.9549)	(2.6587)
revenue	1.0586***	1.0518***	1.1192***	1.0487***
	(10.719)	(4.5545)	(6.1965)	(4.2991)
R^2	0.772	0.766	0.771	0.766
Cointegration tests:				
$DF_{t-statistic}$	-3.1998***			
$L_{c-statistic}$		0.2058	0.0266	0.2094
Negeri Sembilan:				
constant	0.2732***	0.1563	0.2238***	0.1595
	(3.4648)	(1.3460)	(3.0898)	(1.3930)
revenue	0.8597***	0.9701***	0.8635***	0.95928***
	(9.8848)	(5.6648)	(8.6575)	(6.0158)
R^2	0.838	0.797	0.876	0.798
Cointegration tests:				
$DF_{t-statistic}$	-1.9728*			
$L_{c-statistic}$		0.1211	0.0285	0.0783

Notes: Asterisks ***, ** and * denote statistically significant at the 1%, 5% and 10% level, respectively. The two-step cointegration test ($DF_{t-statistic}$) with null hypothesis of non-cointegration; while the Hansen cointegration test ($L_{c-statistic}$) with null hypothesis of cointegration. Prewhitening lag 1 was used for FMOLS and CCR; while for DOLS, lead equals 1, and lag equals 1. The estimated coefficients as shown by the "constant" and "revenue" are referred to θ_0 and θ_1 respectively as per Equation (1).

Table 4: Results on long-run models (continue)

States/Independent variables	OLS-robust	FMOLS	DOLS	CCR
Pahang:				
constant	0.1218**	0.1273	0.1244	0.1297
	(2.3467)	(1.6278)	(1.5193)	(1.5811)
revenue	1.9732***	1.1036***	1.0899***	1.0992***
	(23.374)	(13.852)	(14.421)	(13.656)
R^2	0.954	0.947	0.956	0.948
Cointegration tests:				
$DF_{t-statistic}$	-2.9035***			
$L_{c-statistic}$		0.1582	0.0257	0.1229
Penang:				
constant	0.2160***	0.2017***	0.2278***	0.2027***
	(4.5793)	(3.2756)	(4.7728)	(3.3201)
revenue	0.7502***	0.6859**	0.8149***	0.6937***
	(5.1818)	(2.5455)	(3.6522)	(2.6938)
R^2	0.570	0.533	0.612	0.534
Cointegration tests:				
$DF_{t-statistic}$	-2.2836**			
$L_{c-statistic}$		0.2168	0.0305	0.1421
Perak:				
constant	0.6332***	0.5533***	0.3782***	0.4584***
	(7.7897)	(7.3071)	(3.3129)	(4.2145)
revenue	0.4321***	0.5657***	0.8662***	0.7287***
	(3.9318)	(4.6330)	(4.4208)	(4.0148)
R^2	0.413	0.351	0.535	0.190
Cointegration tests:				
$DF_{t-statistic}$	-4.2245***			
$L_{c-statistic}$		0.3620	0.0743	0.2100
Perlis:				
constant	0.8946***	0.5674***	0.5169***	0.6153***
	(6.9332)	(3.6307)	(4.8466)	(4.1983)
revenue	0.6416***	0.9365***	0.9837***	0.8864***
	(6.0124)	(6.8178)	(10.387)	(7.0975)
R^2	0.623	0.652	0.830	0.659
Cointegration tests:				
$DF_{t-statistic}$	-5.0747***			
$L_{c-statistic}$		0.0761	0.0572	0.0850
Sabah:				
constant	0.0717	-0.0488	-0.0472	-0.0519
	(0.5956)	(-0.4560)	(-0.4125)	(-0.4848)
revenue	1.1210***	1.1866***	1.1777***	1.1876***
	(14.785)	(18.439)	(16.694)	(18.702)
R^2	0.899	0.874	0.957	0.874
Cointegration tests:				
$DF_{t-statistic}$	-5.9550***			
$L_{c-statistic}$		0.1327	0.0316	0.1232

Notes: Asterisks ***, ** and * denote statistically significant at the 1%, 5% and 10% level, respectively. The two-step cointegration test ($DF_{t-statistic}$) with null hypothesis of non-cointegration; while the Hansen cointegration test ($L_{c-statistic}$) with null hypothesis of cointegration. Prewhitening lag 1 was used for FMOLS and CCR; while for DOLS, lead equals 1, and lag equals 1. The estimated coefficients as shown by the "constant" and "revenue" are referred to θ_0 and θ_1 respectively as per Equation (1).

Table 4: Results on long-run models (continue)

States/Independent variables	OLS-robust	FMOLS	DOLS	CCR
Sarawak:				
constant	-0.8187	-1.4852	-2.2995***	-1.2406
	(-0.9788)	(-0.8991)	(-3.2448)	(-1.3071)
revenue	1.3946***	1.5451***	1.8942***	1.4547***
	(4.8418)	(2.5469)	(7.2315)	(4.2297)
R^2	0.609	0.319	0.867	0.318
Cointegration tests:				
$DF_{t-statistic}$	-1.8306*			
$L_{c-statistic}$		0.1220	0.0286	0.0479
Selangor:				
constant	0.4050***	0.2920***	0.3360***	0.2913***
	(6.7847)	(3.6247)	(6.4218)	(3.6541)
revenue	0.6878***	0.7133***	0.6180***	0.7144***
	(4.3368)	(4.3098)	(5.7551)	(4.8961)
R^2	0.682	0.549	0.761	0.548
Cointegration tests:				
$DF_{t-statistic}$	-2.4068***			
$L_{c-statistic}$		0.0996	0.0358	0.1112
Terengganu:				
constant	1.3444***	1.4510***	1.3180***	1.4381***
	(5.3201)	(3.6437)	(6.8041)	(3.8654)
revenue	0.3150*	0.2449	0.3607*	0.2583
	(1.9093)	(0.6763)	(2.0003)	(0.7809)
R^2	0.206	0.188	0.368	0.193
Cointegration tests:				
$DF_{t-statistic}$	-2.4461**			
$L_{c-statistic}$		0.1787	0.0296	0.1305

Notes: Asterisks ***, ** and * denote statistically significant at the 1%, 5% and 10% level, respectively. The two-step cointegration test ($DF_{t-statistic}$) with null hypothesis of non-cointegration; while the Hansen cointegration test ($L_{c-statistic}$) with null hypothesis of cointegration. Prewhitening lag 1 was used for FMOLS and CCR; while for DOLS, lead equals 1, and lag equals 1. The estimated coefficients as shown by the "constant" and "revenue" are referred to θ_0 and θ_1 respectively as per Equation (1).

Table 5: Results on long-run models with Robust regressions

| Independent variables	Johor	Kedah	Kelantan	Melaka	Negeri Sembilan
constant	-0.2862***	0.7714***	0.6615***	0.3399***	0.2624***
	(-2.5533)	(19.294)	(3.5933)	(5.3597)	(4.7958)
revenue	1.5760***	0.6442***	0.7039***	1.0815***	0.8635***
	(9.0383)	(7.9967)	(3.9732)	(10.894)	(10.999)
R^2	0.687	0.548	0.292	0.682	0.734
	Pahang	Penang	Perak	Perlis	Sabah
constant	0.1287***	0.2090***	0.6332***	0.8728***	0.0548
	(2.6468)	(6.5267)	(7.7897)	(7.2409)	(0.4596)
revenue	1.0738***	0.7635***	0.4321***	0.6498***	1.1384***
	(22.183)	(5.6692)	(3.9318)	(6.4906)	(16.162)
R^2	0.744	0.520	0.413	0.564	0.672
	Sarawak	Selangor	Terengganu		
constant	-0.9131	0.4030***	1.6246***		
	(-1.4722)	(7.9552)	(14.771)		
revenue	1.4306***	0.7019***	0.1449***		
	(6.3384)	(7.2291)	(1.4291)		
R^2	0.584	0.603	0.043		

Notes: Asterisk *** denotes statistically significant at the 1% level. Figures in brackets are z-statistics.

Table 6: Results of Granger long-run causality

Dependent variable	Johor	Kedah	Kelantan	Melaka	Negeri Sembilan
Expenditure λ_1, ECM_{t-1}	ARDL(1,1) -0.1465** (-2.0744)	ARDL(4,4) -1.4661*** (-4.1335)	ARDL(1,0) -0.4209*** (-3.8097)	ARDL(4,1) -0.3415** (-2.6758)	ARDL(1,4) -0.4527*** (-3.8525)
Revenue: λ_2, ECM_{t-1}	ARDL(1,1) -0.3453*** (-3.9542)	ARDL(4,1) -0.5200*** (-4.7760)	ARDL(3,1) -0.3782* (-1.7612)	ARDL(2,4) -0.3876** (-2.1613)	ARDL(1,1) -0.3161** (-2.1958)

	Pahang	Penang	Perak	Perlis	Sabah
Expenditure λ_1, ECM_{t-1}	ARDL(2,2) -0.4014*** (-3.0980)	ARDL(1,1) -0.3339** (-2.2535)	ARDL(1,3) -1.0360*** (-5.0231)	ARDL(3,4) -1.5597*** (-4.9871)	ARDL(1,0) -0.4779*** (-6.1022)
Revenue: λ_2, ECM_{t-1}	ARDL(1,0) -0.7022*** (-6.8427)	ARDL(2,4) -0.2544*** (-3.6900)	ARDL(2,0) -1.5618*** (-7.1206)	ARDL(1,0) -0.8923*** (-6.1585)	RDL(1.0) -1.0955*** (-8.2171)

	Sarawak	Selangor	Terengganu
Expenditure λ_1, ECM_{t-1}	ARDL(4.0) -0.2085** (-2.3312)	ARDL(1,0) -0.3298*** (-4.3825)	ARDL(2,0) -0.3028*** (-3.3426)
Revenue: λ_2, ECM_{t-1}	ARDL(1,0) -0.2145*** (-2.7066)	ARDL(1,4) -0.1983*** (-3.0264)	ARDL(3,3) -0.0286*** (-3.6899)

Notes: Asterisks ***, ** and * denote statistically significant at the 1%, 5% and 10% level, respectively. Figures in brackets are t-statistics.

Figure 1: Trend in states' Real GDP, 1990-2018
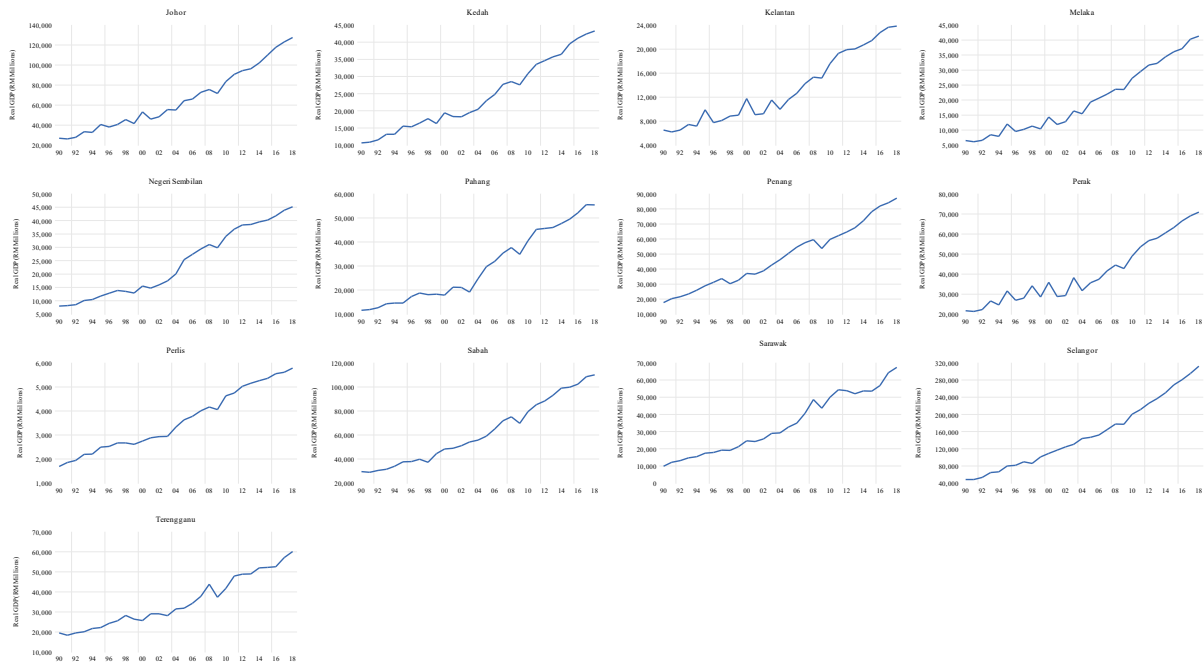
Figure 2: Trends in ratio of states' total tax revenue and expenditure to state's GDP, 1990-2018