Government Revenue and Government Expenditure Nexus in Asian Countries: Panel Cointegration and Causality

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Abstract
The relationship between government revenue and government expenditure has been an important topic in public economics, given its relevance for policy especially with respect to the budget deficit. The purpose of this paper is to investigate the relationship between government revenue and government expenditure in 40 Asian countries for the period of 1995 to 2008. We include GDP as a control variable into the model. Data properties were analyzed to determine their stationarity using the LLC and IPS unit root tests which indicated that the series are I(1). We find a cointegration relationship between government revenue and government expenditure by applying Kao panel cointegration test. The causality tests indicate that there is a bidirectional causal relationship between government expenditure and revenues in both the long and the short run and *Fiscal synchronization* hypothesis is confirmed. The policy implication of the results suggests that there is interdependence between government expenditure and revenues. The government makes its expenditure and revenues decision simultaneously. Under this scenario the fiscal authorities of these countries with budget deficits should raise revenues and decrease spending simultaneously in order to control their budget deficits.

Keywords: Government revenue/expenditure; Panel Cointegration; Causality

JEL classification: C23; H10; H50

1. Introduction

A sound fiscal policy is important to promote price stability and sustain growth in output and employment. Fiscal policy is regarded as an instrument that can be used to lessen short-run fluctuations in output and employment in many debates of macroeconomic policy. It can also be used to bring the economy to its potential level. If policymakers understand the relationship between government expenditure and government revenue, without a pause government deficits can be prevented. Hence the relationship between government expenditure and government revenue has attracted significant interest. This is due to the fact that the relationship between government revenue and expenditure has an impact on the budget deficit. The causal relationship between government revenue and expenditure has remained an empirically debatable issue in the field of public finance, (Eita & Mbazima, 2008). Over the Past three decades, a large number of studies have investigated the relationship between government revenue and government expenditure. This is not surprising given the importance of the subject matter in public economics; particularly the direction of causality has important implications for budget deficits. Understanding the relationship between government revenue and government expenditure is important from a policy point of view, especially for Asian countries, which is suffering from persistent budget deficits. The focus of this paper is to examine the intertemporal relationship between government revenues and government expenditures for a sample of 40 Asian countries and it tests whether government revenue causes government expenditure or whether the causality runs from government expenditure to government revenue, and if there is bidirectional causality. This discussion is very important since it corroborates the size of government, budget deficit and the structure of taxation and expenditure themselves. The rest of the paper is organized as follows. In the next section, we explain the overview of the theoretical literature for analyzing the government revenue and government expenditure relationship, section 3 is the review of the empirical literature. The data described in section 4, methodologies explained in section 5. In the last section, we discuss the empirical results and final section provided concluding remarks and some policy implications.

2. Theoretical Literature Review

The causal relationship between revenues and government expenditure is a classic problem of Public Economics. There are four propositions that can potentially explain observed spending-revenue behavior. The propositions are briefly discussed as follows: Friedman leads the *tax-and-spend* school, which contends that raising taxes will simply lead to more spending. Friedman (1982) [cited in Narayan (2005: 1205)] puts his point in the following way: “You cannot reduce the deficit by raising taxes.

Increasing taxes only results in more spending, leaving the deficit at the highest level conceivably accepted by the public. Political rule number one is government spends what government receives plus as much more as it can get away with". Also Milton Friedman (1982) suggests cutting taxes as a remedy to budget deficits, since taxes have a positive causal impact on government expenditure. According to Friedman, a cut in tax leads to higher deficits, which should influence government to reduce its level of spending, (Moalusi, 2004). Buchanan and Wagner (1978) share the same view that tax lead government expenditure but that the direction of causal relationship is negative. Their point of view is that with a cut in taxes the public will perceive that the cost of government programs has fallen. As a result they will demand more programs from the government which if undertaken will result in an increase in government spending. Higher budget deficits will then be realized since tax revenue will decline and government spending will increase. Their remedy for budget deficits is therefore an increase in taxes, (Moalusi, 2004).

The second school known as *spend-and-tax* school is built on the tenet that expenditure causes revenue proposed by Peacock and Wiseman (1961, 1979). They state that increases in government spending brought by crisis situations lead to permanent changes in expenditure. They are of the view that severe crisis that initially force up government expenditure, more than taxes, is capable of changing public attitudes about the proper size of government. This leads to a displacement of fiscal variables as some of the tax increases originally justified by the crisis situation become permanent tax policies, (Narayan, 2005).

Fiscal synchronization hypothesis as the third school of thought argues that governments may change expenditure and taxes concurrently (Meltzer & Richard, 1981; Musgrave, 1966). This implies bidirectional causality between government expenditure and revenue. Under the fiscal synchronization hypothesis, citizens decide on the level of spending and taxes. This is done through comparing the benefits of government to citizen's marginal cost, (Narayan, 2005). Barro's (1979) tax smoothing model provided further credence to the fiscal synchronization hypothesis. His model was based on the Ricardian equivalence view that deficit-financed government expenditure today results in future tax increases, (Narayan, 2005).

Finally, fourth school, *fiscal neutrality school*, proposed by Baghestani and McNown (1994) believe that none of the above hypotheses describes the relationship between government revenues and expenditure. Government expenditure and revenues are each determined by the long run economic growth reflecting the institutional separation between government revenues and expenditure that infers that revenue decisions are made independent are expenditure decisions.

3. Empirical Literature Review

Direction of causal relationship between government revenue and expenditure and its implication in order to budget deficit has not been empirically resolved. Though over the last three decades several studies have been carried out in different countries to investigate the issue in the public economics, findings vary from country to country and also within the country. Considerable empirical works have been done with respect to the four above mentioned hypotheses. Using different econometric methods, studies have reached to different results. Different studies have focused on different countries, time periods, and have used different proxy variables for government revenue and expenditure. The empirical outcomes of these studies have been varied and sometimes conflicting. The results differ even on the direction of causality and it is long-term versus short-term impact on government policy. Depending upon what kind of causal relationship exists, the policy implications of these relationships can be significant. The nexus between government revenues and expenditures is an issue that has been investigated for several countries though a consensus is yet to be reached. We now move on to review some of the empirical studies of the relationship between government revenue and expenditure.

There have been studies for developing countries. E.g. Shah and Baffes (1994) in their study for Latin American countries concluded bidirectional causality between government revenue and expenditure for Argentina over the 1913-1984 periods and for Mexico over the 1895-1984 periods; while for Brazil they found unidirectional causality running from revenue to expenditure. Owoye (1995) investigated the issue for the G7 countries. He found bidirectional causality for five of the seven countries and for Japan and Italy he found causality running from revenue to expenditure. Ewing and Payne (1998) have examined the case of five Latin American countries finding mixed results for this set of countries. The Chile and Paraguay results supported the evidence of bidirectional causality between revenues and expenditures or the fiscal synchronization hypothesis. For Colombia, Ecuador, and Guatemala they found evidence of causality from revenues to expenditures thus supporting the tax-spend hypothesis. Park (1998) looked at the case of Korea and found supporting evidence for the tax-spend hypothesis over the period 1964 to 1992. Abdul Aziz and Shah Habibullah (2000) investigated causality between taxation and government spending by using an application of Toda-Yamamoto approach in Malaysia for the period 1960 to 1997. Their evidence generally supports the existence of bidirectional causality between government spending and tax revenues.

Fasano and Wang (2002) investigated this relationship for oil-dependent GCC countries and found evidence of unidirectional causality running from revenue to expenditure in Bahrain, the United Arab Emirates and Oman while they found bidirectional causality for Kuwait, Qatar and Saudi Arabia. They suggest that the GCC countries could enhance the effectiveness of their fiscal policy by making budget expenditure less driven by revenue availability. Li (2001) by applying the cointegration and error correction models over the period 1950-1997 for China found bidirectional causality between government expenditure and revenue.

AbuAI-Foul and Baghestani (2004) investigated the causal relation between government revenue and spending for Egypt for (1977-1998) and Jordan for (1975-2001). Empirical findings for Egypt indicate unidirectional causation from revenue to spending, with higher revenue leading to higher spending and indicate bidirectional causation between revenue and spending for Jordan. Hussain (2004) investigated the relationship government revenue-expenditure for Pakistan using revised estimates of expenditure and revenue from 1973 to 2003. He found evidence of unidirectional causality from expenditure to revenue in Pakistan. Maghyereh and Sweidan (2004) examined tax-spend, spend-tax and fiscal synchronization hypothesis for Jordan using annual time series data from 1969 to 2002. The authors used real GDP as control variable along with real government expenditures and real government revenues and Granger causality test based on Multivariate ECM. They conclude evidence in favor of bidirectional causality between revenue and expenditure. The result also suggests that there is long-run interdependence between output and fiscal variables indicating effectiveness of fiscal policy in Jordan. Chang and Ho (2002.a) examined causal relationship between taxes and spend for Taiwan by using annual data over the period 1967 to 1999 and found that there is a cointegrating relationship between GDP, government revenues and expenditures in real terms. They found unidirectional causality running from revenues to expenditure. Also Chang and Ho (2002.b) tested these propositions for China over the period 1977 to 1999 and found fiscal synchronization hypothesis. Carneiro *et al.* (2005) investigated this issue for Guinea-Bissau over the period 1981 to 2002. They found that Guinea-Bissau's experience is consistent with the "spend - tax" hypothesis. Barua (2005) examined revenue and expenditure causality in Bangladesh by using annual data over the period 1974-2004. The results of Johansen test suggest that there is a long-run relationship between government expenditure, revenue and GDP and the Granger Causality test on the corresponding Vector Error Correction (VEC) model suggests that there is no causal relationship between revenue and expenditure in the short run. It is also observed that the short-run relation extends from both the fiscal variables to GDP, and not the other way around. Narayan (2005) reported mixed results for the relationship between government revenue and government expenditure in nine Asian countries. (a) For Indonesia, Singapore, and Sri Lanka in the short-run and for Nepal in both the short- and long-run he finds support for the tax-and-spend hypothesis; (b) Indonesia and Sri Lanka are in conformity with the spend-and-tax hypothesis in the long-run; and (c) for other countries there is evidence of neutrality. Author uses bound testing approach for cointegration and VECM for causality between the variables. However, this study was found that in three out of the nine countries government revenue and expenditure are cointegrated.

In another study, Narayan and Narayan (2006) found tax-and-spend hypothesis for Mauritius, El Salvador, Chile, Paraguay and Venezuela. For Haiti, there is evidence for supporting the fiscal synchronization hypothesis, while for Peru, South Africa, Guatemala, Guyana, Uruguay and Ecuador there is evidence of neutrality by application of the Toda and Yamamoto (1995) test for Granger causality. Nyamongo *et al.* (2007) investigated the relationship between government expenditure and government revenue in South Africa within the framework of a VAR approach and finds that government revenue and government expenditure have unit roots at all frequencies. The Johansen procedure test results reveal that these variables are cointegrated. It is further established that revenue and expenditure are linked bidirectional by Granger causality in the long-run, while there is no evidence of Granger causality in the short-run in South Africa. The findings of the study's Gounder *et al.* (2007) show that government revenue and government expenditure in both the aggregate and disaggregate sense are cointegrated in Fiji Islands.

In the short-run government expenditure Granger causes government revenue in an aggregate sense, departmental expenditure Granger causes aggregate revenue, and there is bidirectional causality running between government expenditure and customs duties; and in the long-run there is evidence of fiscal synchronization, implying that expenditure decision are not made in isolation from revenue decisions. Eita & Mbazima (2008) by applying Granger causality test through cointegrated vector autoregression (VAR) methods for the period 1977 to 2007 in Namibia shows the unidirectional causality from government revenue to government expenditure. This suggests unsustainable fiscal imbalances (deficit) can be mitigated by policies that stimulate government revenue.

Results of the study Wolde-Rufael (2008) for 13 African countries by using Toda and Yamamoto causality test show the direction of causation are mixed and his empirical evidence suggests that there was a bidirectional causality running between expenditure and revenue for Mauritius, Swaziland and Zimbabwe; no causality in any direction for Botswana, Burundi and Rwanda; unidirectional causality running from revenue to expenditure for Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia; and an un-directional causality running from expenditure to revenue for Burkina Faso only. Recently in Malaysia, Hong (2009) uses a Johansen cointegration test and an error-correction model for causality and annual data over the period 1970 to 2007. His results show that government revenue and expenditure are cointegrated and the spend-and-tax hypothesis is confirmed. Chaudhuri and Sengupta (2009), by using an error-correction model and Granger causality test for southern states in India reported that the tax-spend hypothesis is supported by the analysis and also the spend-tax hypothesis is valid for some states.

Ho and Huang (2009) tested the hypothesis of tax-spend, spend-tax, or fiscal synchronization applies to the 31 Chinese provinces using panel data covering 1999 to 2005. Their results based on multivariate panel error-correction models show that there is no significant causality between revenues and expenditures in the short run. However, in the long-run, bidirectional causality exists between revenues and expenditures, thus supporting the fiscal synchronization hypothesis for Chinese provinces over this sample period. Recently for developed country, Afonso and Rault (2009) investigated causality between government spending and revenue in the EU by new econometric technical bootstrap panel analysis in the period 1960-2006. Spend-and-tax causality is found for Italy, France, Spain, Greece, and Portugal, while tax-and-spend evidence is present for Germany, Belgium, Austria, Finland and the UK, and for several EU New Member States. Chang and Chiang (2009) consider a sample of 15 OECD countries test for the long-run relationship between government revenues and government expenditures over the period 1992-2006. They find evidence of bidirectional causality between government revenues and expenditures, supporting the fiscal synchronization hypothesis by using panel cointegration, and panel Granger causality test techniques.

As one can see there appears to be some disparity in the results of the studies reported. The task of this paper is to extend this line of literature to a sample of 40 Asian countries which have not been examined in the literature. In addition, we investigate the relationship within a multivariate by including GDP as a control variable in the model like Baghestani and McNown (1994), Barua (2005), Chang and Ho (2002), Maghyereh and Sweidan (2004), Narayan and Narayan (2006) and Chang and Chiang (2009). This approach allows us to distinguish between the direct causality relation between revenues and expenditures and the indirect causality effects via GDP, Chang and Chiang (2009). Narayan and Narayan (2006) argue GDP is an important variable, for government's expenditure and government revenue are both contingent on the level of economic activity. The following sections will elaborate on the methodology to be used in this study along with a description of the data. The methodology includes testing for unit roots, cointegration and a panel estimation approach to identify the Granger causal relation in our panel data. The use of panel techniques enables the power of the tests to be increased and makes it possible to include heterogeneity between countries. We thus overcome some of the problems associated with single country studies. However, the use of panel data infers that the different countries are treated as a unity and as such the results represent those of the average member of the panel. To avoid the problem of omitted variable bias. Therefore, we consider a panel vector error correction model (VECM) and estimate it.

4. Data

The study uses annual data and covers the period of 1995 to 2008. We select these period because time series data on government revenue and government expenditure for the countries of the sample are only available for these period. The data are obtained from Asian Development Bank (ADB) Key Indicators (2009). Total government revenue (Gr), total government expenditure (Ge) and gross domestic product (GDP) that obtained from World Development Indicators (WDI) are the three variables used in our estimation. The logarithm of the overall government expenditures and the logarithm of overall government revenues and the logarithm of overall GDP are used in the empirical analysis. The transformation of the series to logarithms is intended to eliminate the problem of heteroskedasticity. For each country all variables are in real terms (2000=100). The countries used in this study are as 40 Asian countries.[1]

1 - The countries considered in this study are Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, Uzbekistan, China People's Rep. of, Hong Kong; China, Korea Rep. of, Mongolia, Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Fiji Islands, Kiribati, Marshall Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu, Australia, Japan, New Zealand

5. Methodology

The purpose of this paper is to evaluate the relationship between government revenue and expenditure and its implication for managing the budget deficit. In order to do this a three variable model is formulated comprising government expenditure, revenue and GDP. Given our discussion in the previous section let us briefly outline the approach taken to determine the presence of cointegration and the resulting error correction terms to be used in formulating the error correction models. The test for causality between government revenue and government expenditure will be performed in three steps. First, I test for the order of integration in the variables. We implement the panel unit root test proposed by Levin *et al.* (2002) and Im *et al.* (2003), to determine the order of integration of the three variables. Second, conditional on finding that these variables are integrated of order one we test for panel cointegration using the approach suggested by Kao (1999), we use panel cointegration to test for the long run relationships between the variables in question. Third, we test for Granger causality between government revenues and government expenditures. Panel Granger causality will be used to assess the short run cointegration and the direction of causality between the two variables. The panel vector error correction model is used to describe both long run relationships and short run dynamic adjustments between real government revenue and expenditure variables of the 40 Asian countries over the period of 1995 to 2008.

5.1. Panel unit root test

Conventional unit roots tests for individual series (Augmented Dickey Fuller (ADF) and Phillips and Perron, among others) are known to have low power against the alternative of stationarity of the series, particularly for small samples. Panel data provide a larger number of point data, increasing the degrees of freedom and reducing the collinearity between the regressors. Therefore, panel data allow for more powerful statistical tests and the test statistics asymptotically follow a normal distribution instead of nonconventional distributions. In this paper, Im *et al.* (2003), (hereinafter called IPS), and Levin *et al.* (2002), (hereinafter called LLC), tests are used to test unit roots in the panel data. The IPS test is based on the following model:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \ , \qquad i = 1,\ldots,N \ , \ t = 1,\ldots,T \tag{1}$$

Where Δ is the first difference operator, y_{it} is the series for country *i* in the panel over period t, p_i is the number of lags selected for the ADF regression and ε_{it} are independently and normally distributed random variables for all *i* and *t* with zero means and finite heterogeneous variances, σ_i^2.

IPS tests the null hypothesis of the unit root for each individual (country) in the panel, that is, $H_0 : \beta_i = 0 \ \forall i$ against the alternative $H_1 : \beta_i < 0, i = 1,\ldots,N_1; \beta_i = 0, i = N_1 + 1,\ldots,N$, which allows for some of the individual series to be integrated. The proposed $Z_{tbar}(p,\rho)$ statistic converges in distribution to a standard normal variate sequentially, as $T \to \infty$ followed by N. The LLC unit root test is also based on model (1) but it considers the coefficients of the autoregressive term as homogeneous across all individuals, that is $H_0 : \beta_i = \beta \ \forall i$. LLC tests the null hypothesis that each individual in the panel has integrated time series, that is, $H_0 : \beta_i = \beta \ \forall i$ against the alternative $H1 : \beta_i < \beta \ \forall i$. Therefore, under the alternative, all single series are stationary. The resulting statistic, t*, asymptotically follows a standard normal distribution.

5.2. Panel cointegration Approach

If two time series are respectively nonstationary, but some linear combination of them is a stationary process then the two time series are said to be cointegrated. A time series is said to be covariance stationary if its mean, variance, and covariances are all invariant with respect to time, in which case it is integrated of order zero, or I(0). In this section we apply panel cointegration test, the DF and ADF-type tests proposed by Kao (1999) for the null hypothesis of no cointegration in homogeneous and heterogeneous panels. Given that each variable is integrated of order one, we test for panel cointegration using Kao's (1999) tests. Consider the following system of cointegrated regressions:

$$y_{it} = \alpha_i + x_{it}\beta + u_{it} \tag{2}$$

Where $i=1,\ldots,N$, $t=1,\ldots,T$

Where α_i are individual constant terms, β is the slope parameter, it u_{it} are stationary disturbance terms, and finally, by construction, it y_{it} and it x_{it} are integrated processes of order one for all *i*. Kao (1999) derives two types of panel cointegration tests. The first is a Dickey-Fuller (DF) type test and the second is an Augmented Dickey-Fuller (ADF) type test. Both tests can be calculated from:

$$\hat{u}_{it} = \rho \hat{u}_{it-1} + v_{it} \quad (3)$$

and

$$\hat{u}_{it} = \rho \hat{u}_{it-1} + \sum_{j=1}^{p} \varphi_j \Delta \hat{u}_{it-j} + v_{it} \quad (4)$$

Where the residuals $\hat{u}_{it}$ are obtained from Equation (2). The following specification of null and alternative hypotheses is used:

$$H_0 : \rho = 1, \quad H_A : \rho < 1 \quad (5)$$

Kao (1999) proposes four DF-type statistics. The first two DF statistics are based on assuming strict exogeneity of the regressors with respect to the errors in the equation, while the remaining two allow for endogeneity of the regressors. In addition, Kao (1999) proposes an ADF test statistic. Finally the DF statistics, which allow for endogeneity, and the ADF statistic involve deriving some nuisance parameters from the long-run conditional variances Ω. The asymptotic distributions of all tests converge to a standard normal distribution N (0, 1) as $T \to \infty$ and $N \to \infty$.

5.3. Panel causality

The next step is to examine the direction of causality between the variables in a panel context. Engle and Granger (1987) show that if two non-stationary variables are cointegrated, a vector autoregression (VAR) in first differences will be mis-specified. If a long-run equilibrium relationship is found to exist between government revenue and expenditure when testing for Granger causality, we need to specify a model with a dynamic error correction representation. This means that the traditional VAR model is augmented with a one-period lagged error correction term that is obtained from the cointegrated model. The Granger causality test is based on the following regressions:

$$\Delta GE_{it} = C_{1i} + \sum_{p} \theta_{11ip} \Delta GE_{it-p} + \sum_{p} \theta_{12ip} \Delta GR_{it-p} + \sum_{p} \theta_{13ip} GDP_{it-p} + \mu_{1i} ECT_{it-1} + \varepsilon_{1t} \quad (6)$$

$$\Delta GR_{it} = C_{2i} + \sum_{p} \theta_{21ip} \Delta GR_{it-p} + \sum_{p} \theta_{22ip} \Delta GE_{it-p} + \sum_{p} \theta_{23ip} GDP_{it-p} + \mu_{2i} ECT_{it-1} + \varepsilon_{2t} \quad (7)$$

Here all variables are as previously defined, Δ denotes the first difference of the variable, ECT is the error-correction term, and p denotes the lag length. That ECT_{it} are the estimated residuals from the long-run model in Equation (2), $\mu_{i,i} ECT_{it}$ reflect the long-run equilibrium relationship among the variables. We include the GDP according to context of third section. From the system, the panel Granger-causality tests are examined by testing whether all the coefficients of ΔGE_{it-1} or ΔGR_{it-p} are statistically different from zero as a group based on a standard F-test and/or the $\mu_{i,i}$ coefficient of the error correction is also significant (denoting long-run causation). The coefficients of the ECTs measure how fast the values of the variables of the system come back to the long-run equilibrium levels when they deviate from it.

6. Empirical results

6.1. Unit root test results

We begin our empirical analysis by testing for unit roots in the government revenue, government expenditure and GDP. To establish the integrational properties of series, we apply the LLC and IPS test. The results of the IPS, LLC panel unit root tests are presented in Table 1. The LLC and IPS statistics for the levels of government revenues, government expenditures, and GDP do not reject the null hypothesis of a unit root. However, we take the first difference of each of the variables. Therefore, we conclude that GE, GR and GDP are each integrated of order one or I(1) and the variables are no stationary in the level for 40 countries in Asia. In the next stage, we will test whether there is a long-run equilibrium relationship among these three variables.

Table 1- Results for panel unit root tests

Variable	GE	GR	GDP
Levels	Statistic(P-values)	Statistic(P-values)	Statistic(P-values)
LLC	1.96148 (0.9751)	1.77570 (0.9621)	5.05445 (1.0000)
IPS	5.25135 (1.0000)	5.36480 (1.0000)	9.73727 (1.0000)
First difference			
LLC	-8.01966 (0.0000)***	-7.94717 (0.0000)***	-10.8647 (0.0000)***
IPS	-7.94717 (0.0000)***	-5.59480 (0.0000)***	-5.88836 (0.0000) ***

***: Null hypothesis rejected at 1% significant level

Source: authors calculated

6.2. Panel Cointegration Approach results

Taking into account these results, we conclude that the series are integrated of order one and proceed to test for cointegration. Thus the second stage involves testing for the existence of a long-run equilibrium relationship among government revenues, government expenditures, and GDP within a trivariate framework. Based on Kao's (1999) ADF test statistics reported in Table 2, According Table 2, we find that government revenues, government expenditures, and GDP are cointegrated within the panel of these 40 Asian countries.

Table 2- Results of Kao's Residual Cointegration Test

	t-Statistic	Prob.
ADF	-4.424831	0.0000

Next given that the Kao test indicates cointegration, we can now estimate the long-run coefficients of the panel model. A central assumption in random effects estimation is the assumption that the random effects are uncorrelated with the explanatory variables. One common method for testing this assumption is to employ a Hausman (1978) test to compare the fixed and random effects estimates of coefficients**.** The Hausman test is frequently used in order to choose between the fixed effects and the random effects specification. The results of Husman test are presented in Table 3. Based on the Hausman test, the null hypothesis is rejected at the 1% significance. However this outcome suggests that fixed effect models are more appropriate, for all the following extensions, we present fixed effect regressions.

Table 3- Description of the Hausman test

Hausman Test	χ^2. Statistic	P-values
Cross-section random	11.138241	0.0038

The results on the long-run coefficients are reported in Table 4. The empirical results reveal that in the long-run that all of the coefficients are significant affect at %1. Also empirical results indicate when government revenue increased by I percent, government expenditure increased by 0.40 percent.

Table 4- Estimated Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	P-values
C	-0.181341	0.286103	-0.633832	0.5265
GR	0.402179	0.042797	9.397332	0.0000
GDP	0.582911	0.060103	9.698587	0.0000
R^2= 0.997721	$\bar{R}^2 = 0.997534$	F-statistic= 5338.469		0.0000

6.3. Granger causality test results

Although the existence of a long-run relationship between the variables suggests that there must be Granger causality in at least one direction, it does not indicate the direction of causality between the variables. Since our variables are cointegrated in specifying the equations for Granger causality we augment the panel VAR model with the lagged error correction term, as explained earlier. This allows us to derive both the speed of adjustment to equilibrium following a shock and the significance of the long-run causation. The results of a panel Granger causality test between GE and GR are reported in Table 5.

Table 6- Granger causality test results

Dependent	Source of causation (Independent)				
	Short run		Long run	Joint (Short Run and Long Run)	
	Δ GE	Δ GR	ECT_{it-1}[t- statistics]	Δ GE/ECT	Δ GR/ECT
Δ GE	-	88.695(0.000)	-0.182(0.0001)	-	46.487 (0.000)
Δ GR	76.275 (0.000)	-	-0.380(0.0000)	90.738 (0.000)	-

The results reported in Table 5 show The F-statistics on the independent variables in each of the two equations (6 and 7) indicate statistical significance of the short-run, long-run, and joint causal effects at the 1% level. This finding supports the fiscal synchronization hypothesis, which argues that revenue and expenditure decisions are made jointly. The results show that there is bidirectional Granger causality between government revenues and government expenditures during the period of 1995–2008 under study. This outcome is consistent with Musgrave (1966) and Meltzer and Richard (1981).

The evidence of Granger causality between government expenditure and government revenue is consistent with the findings of Shah and Baffes (1994) for Argentina and Mexico, Ewing and Payne (1998) for some Latin American countries, Abdul Aziz and Shah Habibullah (2000), Li (2001) and AbuAI-Foula and Baghestani (2004) for Jordan, Maghyereh and Sweidan (2004), Ho and Huang (2009) and Chang and Chiang (2009). The findings of this paper have important implications for fiscal policy decision-making in these Asian countries. This outcome suggests that fiscal policymakers in these 40 Asian countries do not make expenditure (revenue) decisions in isolation from revenue (expenditure) decisions. The joint determination of revenues and expenditures is appealing as long as it effectively restrains the budget deficit. This means that efforts to enhance sources of revenue should be accompanied by reductions in spending for those Asian countries with budget deficits.

Finally the one period lagged error correction term measures budgetary disequilibrium (Narayan, 2005). The size and statistical significance of the lagged error correction term in the revenue and expenditure equations have important implications for policy, for it allows one to deduce the extent to which each fiscal variable has the tendency to return to long-run equilibrium. We find the budgetary equilibrium to be negatively signed and statistically significant in both expenditure and government equation. This implies that in the long-run for countries under the study revenue and expenditure is function of disequilibrium in the cointegration relation, which means bidirectional Granger causality between government revenues and government expenditures, consist with the fiscal synchronization hypothesis.

7. Conclusion and Policy Implications

This paper re-examined an important topic-the nexus between government expenditure and government revenue- in the area of public economics. It has attempted to extend the literature on the tax-spend debate to a sample of 40 Asian countries over the period 1995-2008. Determining which hypothesis best characterizes an economy in more than intellectual exercise because it can potential contribute towards of a solution to the problem of growing budget deficits. The number of existing literature dedicated to the study expenditure-revenue relationships indicates the seriousness of research in this field. We utilize a developed panel unit root test, the LLC test (2002) and IPS test (2003), the panel cointegation test proposed by Kao (1999) to analyze and test the interaction between government expenditures and revenues and the panel Granger causality test. Unit root tests reveal that all time series contain a unit root, indicating that all the real variables are non-stationary or I(1). The cointegration test suggests that these three variables are cointegrated. We find a bidirectional causal relation between government revenues and government expenditures, which lends support to the fiscal synchronization hypothesis in these countries, implying that expenditure decisions are not made in isolation from revenue decisions. This outcome suggests that fiscal policymakers in these countries should set revenues and expenditures simultaneously. Under this scenario the fiscal authorities of these countries with budget deficits should raise revenues and decrease spending simultaneously in order to control their budget deficits. However, the one period lagged error correction term measures budgetary disequilibrium. We find the budgetary equilibrium to be negatively signed and statistically significant in both expenditure and government equation. This implies that in the long-run for these countries revenue and expenditure is function of disequilibrium in the cointegration relation.

References

1. Abdul Aziz, Mariam and Shah Habibullah, Muzafar (2000) "Testing For Causality between Taxation and Government Spending: An Application of Toda-Yamamoto Approach." *Pertanika Journal of Social Science & Humanities*, 8(1): 45-50.
2. Abuai-Foul, Bassam and Baghestani, Hamid (2004) "The Causal Relation between Government Revenue and Spending: Evidence from Egypt and Jordan." *Journal of Economics and Finance*, 28(2): 260-269.
3. Afonso, António, and Rault, Christophe (2009) "Spend-and-tax: a panel data investigation for the EU." *Economics Bulletin*, 29(4): 2542-2548.
4. Asian Development Bank (2009) "Key Indicators for Asia and the Pacific 2009.".
5. Baghestani, Hamid, and Mcnown, Robert (1994) "Do Revenue Or Expenditure Respond To Budgetary Disequilibria?" *Southern Economic Journal*, 61(2): 311-322.
6. Barua, Shubhasish (2005) "An Examination of Revenue and Expenditure Causality in Bangladesh: 1974-2004.", *Working Paper Series*: WP 0605, Policy Analysis Unit (PAU).
7. Carneiro Francisco G.; Joao R. Faria, & Boubacar Sid Barry (2005) "Government Revenues and Expenditures in Guinea-Bissau: Causality and Cointegration." *Journal of Economic Development*, 30(1): 107-117.
8. Chang, Tsangyao and Chiang, Gengnan (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): 165-172.

9. Chang, Tsangyao and Yuan-Hong Ho (2002.a) "Tax or Spend, What Causes What: Taiwan's Experience." *International Journal of Business and Economics*, 1(2): 157-165.
10. Chang, Tsangyao and Yuan-Hong Ho, (2002.b), 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.
11. Chaudhuri, Kausik. And Sengupta, Bodhisattva (2009) "Revenue-Expenditure Nexus for Southern States: Some Policy Oriented Econometric Observations" *Madras School of Economics*, India, Working Paper 48/2009.
12. Eita, Joel Hinaunye and Mbazima, Daisy (2008) "The Causal Relationship between Government Revenue and Expenditure in Namibia" *MPRA Paper,* No. 9154.
13. Engle, Robert F., and Clive.W. J. Granger (1987) "Cointegration and Error Correction Representation: Estimation and Testing." *Econometrica,* 55(2): 251–276.
14. Ewing, Bradley T. and Payne, James E. (1998) "Government Revenue-Expenditure Nexus: Evidence from Latin America." *Journal of Economic Development*, 23(2): 57-69.
15. Fasano, Ugo, and Wang, Qing (2002) "Testing the Relationship between Government Spending and Revenue: Evidence from GCC Countries" Washington: Policy and Development Review Department, IMF Working Paper WP/02/201.
16. Gounder, Neelesh; Narayan, Paresh K.; and Prasad, Arti (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.
17. Hausman, Jerry A. (1978) "Specification tests in econometrics". *Econometrica* 46(6), 1251–1271.
18. Ho, Yuan-Hong and Huang, Chiung-Ju (2009) "Tax- Spend, Spend- Tax, or Synchronization: A Panel Analysis of the Chinese Provincial Real Data." *Journal of Economics and Management*, 5(2): 257-272.
19. Hong, Tan Juat (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.
20. Hussain, M. Haider (2004) "On the Causal Relationship between Government Expenditure and Tax Revenue in Pakistan."*The Lahore Journal of Economics,*9(2): 105-118.
21. Im, K.S., Pesaran, M.H., Shin, Y. (2003) "Testing For Unit Roots in Heterogeneous Panels." *Journal of Econometrics* 115(1): 53–74.
22. Kao, Chihwa (1999) "Spurious regression and residual-based tests for cointegration in panel data." *Journal of Econometrics*, 90(1): 1-44.
23. Levin, Andrew, Lin, Chien-Fu, Chu, Chia-Shang James (2002) "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties." *Journal of Econometrics*, 108(1): 1–24.
24. Li, Xiaoming (2001) "Government Revenue, Government Expenditure and Temporal Causality: Evidence from China." *Applied Economics*, 33(4): 485-497.
25. Maghyereh, Aktham Issa & Osama Daifalla Sweidan, (2004), "Government Expenditure and Revenues in Jordan, What Cause What? Multivariate Cointegration Analysis." Social Science Research Network Electronic Paper Collection.
26. Meltzer, Allan. H., and Richard, Scott. F (1981) "A Rational Theory of the Size of the Government." *the Journal of Political Economy*, 89(5): 914-927.
27. Moalusi, Daniel K. (2004) "Causal Link between Government Spending and Revenue: A Case Study of Botswana." Fordham Economics Discussion Paper Series, Number dp2007-07.
28. Musgrave, Richard A. (1966). "Principles of Budget Determination. In A. H. Cameron & W. Henderson (Eds.)", *Public* Finance*: Selected Readings* (Pp. 15-27). New York: Random House.
29. Narayan, Paresh Kumar and Narayan, Seema (2006) "Government Revenue and Government Expenditure Nexus: Evidence from Developing Countries." *Applied Economics*, 38(3): 285-291.
30. Narayan, Paresh Kumar (2005) "The Government Revenue and Government Expenditure Nexus: Empirical Evidence from Nine Asian Countries." *Journal of Asian Economics*, 15(6): 1203-1216.
31. Nyamongo, Morekwa Esman; Sichei, Moses M.; and Schoeman, Niek J. (2007) "Government Revenue and Expenditure Nexus in South Africa." *South African Journal of Economic and Management Sciences*, 10(2): 256-268.
32. Owoye, Oluwole (1995), "The Causal Relationship between Taxes and Expenditures in the G7 countries: Cointegration and Error Correction Models." *Applied Economics Letters*, 2(1): 19-22.
33. Park, Wan Kyu (1998), "Granger Causality between Government Revenues and Expenditures in Korea." *Journal of Economic Development*, 23(1), 145-155.
34. Peacock, Alan T. and Wiseman, Jack. 1961. *The Growth of Public Expenditure in the United Kingdom*. Princeston, NJ: Princeton University Press for the National Bureau of Economic Research.
35. Peacock, Alan T., & Wiseman, Jack. 1979. "Approaches to the analysis of government expenditure growth." *Public Finance Quarterly*, 7(1): 3–23.
36. Shah, Anwar, and Baffes, John (1994) "Causality and Comovement between Taxes and Expenditure: Historical Evidence from Argentina, Brazil and Mexico." *Journal of Development Economics*, 44(2): 311-331.
37. Wolde-Rufael, Yemane (2008) "The Revenue-Expenditure Nexus: The Experience of 13 African Countries." *African Development Review*, 20(2): 273-283.