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The Causal Relationship between Government Revenue and Expenditure in Jordan

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I. Introduction

Government budget deficits have significant impact on the economy. Such fiscal imbalance tends to reduce national savings and economic growth. Therefore, the decrease of the fiscal deficit by reducing government expenditures and/or raising revenues would stimulate economic growth. (Saeed and Somaye, 2012) However, one of the most studied topics in macroeconomics is the testing of relationship between government expenditures and its revenues.

The causality between government expenditures and revenues has important public policy implications because the controls of the size of the government and budget deficits are dependent on the relationship between these variables (Baffes and Shah, 1994; Baghestani and McNown, 1994; Darrat, 1998; Ross and Payne, 1998).

Theoretically, there are three main hypotheses on this relationship in the literature. The first hypothesis; the tax-and-spend hypothesis revenue changes expenditure was argued by Friedman (1978). According to this hypothesis unidirectional causality runs from revenue to expenditure so an increase in tax or revenue will lead to increases in public expenditure, and this may result in the inability to reduce budget deficits (Chang, 2009).

On the contrary, Buchanan and Wagner (1978) propose an increase in taxes revenue as remedy for deficit budgets. Their point of view is that with a decline in taxes the public will perceive that the cost of government programs has fallen. The second hypotheses; spend and tax hypothesis suggests that government spending leads revenue (Baghestani and McNown, 1994).The third hypotheses; Fiscal synchronization was suggested by Musgrave (1966) and Meltzer and Richard (1981), is based on the belief that public revenue and public expenditure decisions are jointly determined. It is, therefore, characterized by contemporaneous feedback or bidirectional causality between government revenue and government expenditure Chang, (2009).

In general, there are three reasons why the nature of link between government expenditure and revenue is important. First, if the "revenue-and-spend" hypothesis holds, budget deficits can be avoided by implementing policies that stimulate government revenue. Second, if bi-directional causality does not hold, then government revenue decisions are made independently from government expenditure decisions. Third, if the spend-revenue hypothesis holds, then government spends first and pay for this spending later by raising revenues Narayan and Narayan(2006). Jordan has been facing persistent budget deficits since long hence it is appropriate to find the causality between government revenue and expenditure. But on the empirical side, there is very limited literature on the issue for Jordan.

II. Literature Review

In this section, theoretical literature is reviewed; numerous empirical studies available on revenue and expenditure nexus all over the world but there is no consensus about the linkage between these variables. Unidirectional causal evidences from revenue to expenditure and from expenditure to revenue are available in the literature whereas some studies claims bidirectional linkage between these important variables. Besides that revenue and expenditure independence are also reported in the literature.

Rafaqet and Mahmood (2012) examine government revenue and expenditure nexus for Pakistan by using annual data for the period 1976-2009. Using

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Johansen cointegration and Granger causality techniques, they found that there is no long run relationship among the variables whereas short run Granger causality analysis unveils that government revenue and expenditure have no causal linkage in Pakistan.

Muhammad, et.al.(2012)investigate on the unidirectional causality between government expenditures and the revenues, Annual data for Pakistan from the period of 1979 to 2010 using Granger causality for the outlined variables. The results indicate that there is an uni-directional causality between the expenditures and revenues, which runs from tax revenues to govt. expenditures, that is the previous lags of tax revenue has a causal impact on the current govt. spending.

Omo and Taofik (2012) examine the long-run relationships and dynamic interactions between the government revenues and expenditures in Nigeria over the period 1970 to 2008. using Autoregressive Distributed Lag (ARDL) bound test the results, indicate that there is the existence of a long run relationship between government expenditures and revenues when government expenditure is made the dependent variable. When revenue was made the dependent variable, no evidence of a long run relationship was found. The tax- spend hypothesis was therefore confirmed.

Mohsen, et.al.(2012) examine the causal relationship between the government expenditure and non oil revenues in a panel of 11 selected oil exporting countries by using panel unit root tests and panel cointegration analysis. The results show a strong causality from GDP and non oil revenues to government spending in the oil exporting countries. Yet, spending does not have any significant effects on revenues in short- and long-run. This supports the tax-and-spend hypothesis of Friedman (1978), implying that raising taxes in an attempt to reduce deficit will also cause expenditure to rise. Therefore it will not be possible to reduce deficit by increasing taxes.

Saeed and Somaye (2012) investigate the causality and the long-run relationships between government expenditure and government revenue in oil exporting countries during 2000-2009 by using P-VAR framework. Since the major share of total revenue in these countries is related to the oil revenue, hence the oil revenue is applied as proxy of total revenue. The results show that there is a positive unidirectional long-run relationship between oil revenue and government expenditures.

Yousef and Mohammad (2012) investigate the relationship between government revenue and government expenditure in Iran by applying the bounds testing approach to cointegration. The results of the causality test show that there is a bidirectional causal relationship between government expenditure and revenues in both long run and short run. Therefore, the results of this paper are consistent with fiscal synchronization hypothesis.

Owoye and Onafowora (2011) examined the causal relationship between tax revenues and government expenditures in twenty-two OECD countries, eleven European Union (EU) member states, and eleven non-EU using ARDL bounds test and the Toda-Yamamoto approach to test for causality. The results show that the long-run and short-run causal patterns differ across these groups within OECD. For the long-run causal patterns they find evidence to confirm the tax-and-spend hypothesis in eight of the twenty-two countries; but the evidence is more prevalent within the EU countries, where tax burdens are much higher than in the non-EU OECD countries.

Keho (2010) Study the data from 1960 to 2005 of European space to analyze the cause and effect relationship between government expenditure and revenue Collection while integrating and confirming the unidirectional causality between them as, his findings of granger causality test indicate the unidirectional causality from government revenue to expenditures.

Chang and Chiang (2009) investigate the relationship between government revenue and government expenditure in 40 Asian countries and indicate that there is a bidirectional causal relationship between government expenditure and revenues in both the long and the short run so that fiscal synchronization hypothesis is confirmed.

The summary of the literature from the foregoing and generally is that understanding the relationship between government expenditures and revenues is best done through country specific analysis. In addition, the hypothesis regarding the relationship between government revenues and expenditures has no discernable pattern among countries, in terms of whether developed or developing. Lastly, the results obtainable are sensitive to the nature of the data utilized as well as the estimation approach.

III. Econometric Methodology

The objective of this section is to examine the presence of interdependence and directions of causality between government revenue and expenditure in the case of Jordan. This examination is based on time series data from 1990 to 2011. The existing empirical work on the direction of causality between government revenue and expenditure uses granger-causality tests which we is applied in this study too.

In order to examine the relationship between government revenue and expenditure in Jordan, a two-step procedure is adopted. The first step investigates the existence of a long-run relationship between the variables through a cointegration analysis. The second step explores the causal relationship between the series. If the series are non-stationary and the linear combination of them is nonstationary, then standard granger's causality test should be employed. But, if the series are nonstationary and the linear combination of them is stationary, Error Correction Method (ECM) should be adopted. For this reason, testing for cointegration is a necessary prerequisite to implement the causality test.

We perform our analysis in two steps. First, we test for unit root vs. stationarity. Then we test for no co-integration vs. co-integration. The objective of unit root test to empirically examine whether a series contains a unit root. Since many macroeconomic series are non stationary (Nelson and Plosser 1982), unit root test are useful to determine the order of integration of the variables and, therefore, to provide the time-series properties of data. If the series contains a unit root, this means that the series is nonstationary. Otherwise, the series will be categorized as stationary. In order to implement a more rigorous test to verify the presence of a unit root in the series, an Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test are employed.

a) Unit root test

In order to model the variable in a manner that captures the inherent characteristics of its time-series, we use the Schwarz Information Criterion (SIC) to determine the lag structure of the series. This test represents a wider version of the standard Dickey-Fuller (AD) test (1979). Given a simple AR(1) process:

$$y_t = \rho y_{t-1} + \delta x_t + \varepsilon_t \qquad (1)$$

Where (y_t) is a time series (in this case, GR and GE), (x_t) represents optional exogenous regressors (e.g. a constant or a constant and a trend), (ρ) and (δ) are parameter to be estimated and (ε_t) is a white noise error component, the standard DF is implemented through the Ordinary Least Squares (OLS) estimation of the above AR(1) process after subtracting the term (y_{t-1}) from both sides of the equation. This leads to the following first difference equation:

$$\Delta y_t = \alpha y_{t-1} + \delta x_t + \varepsilon_t \qquad (2)$$

Where (Δ) is the first difference operator, α=p-1, and (ε_t) is the error term with zero mean and constant variance. Now, adopting a simple t-test, if α=0 (i.e. if p=1), then (y) is a nonstationary series and its variance increases with time. Under such cases, the series is said to be I(1), requiring to be differenced once to achieve stationary. However, if the series is correlated at higher order lags, the assumption of white noise error is violated. In such case, the ADF test represents a possible solution to this problem: it permits to correct for higher order correlation employing lagged differences of the series (y_t) among the regressors. In order words, the ADF test "augments" the traditional DF test to assuming that the (y) series is an AR(p) process and, therefore, adding (p) lagged difference terms of the dependent variable to the right hand side of the first difference equation given above. This gives the following equation:

$$\Delta y_t = \alpha y_{t-1} + \delta x_t + \sum_{i=1}^{p} \phi \Delta y_{t-i} + \varepsilon_t \qquad (3)$$

In both cases, a constant and a linear trend were included since this represents the most general specification.

b) Co-integration test

In order to test for causality between the series (GR) and (GE) through the ECM, it's necessary to verify if the two series are co-integrated. Two or more variables are said to be co-integrated if they share a common trend. In other words, the series are linked by some long-run equilibrium relationship from which they can deviate in the short-run but they must return to in long-run, i.e. they exhibit the same stochastic trend (Stock and Watson, 1988).

Co-integration can be considered as an exception to the general rule which establishes that, if two series are both I(1),then any linear combination of them will yield a series is integrated of a lower order in this case, in fact, the common stochastic trend is cancelled out, leading to something that is not spurious but that has some significance in economic terms.

The existence of a co-integration relationship between the series (GR) and (GE) was verified implementing a unit root ADF and PP tests on the residuals from the two long-run regressions between the levels variables, estimated through the OLS method:

$$GR = \beta_0 + \beta_1 GE + \varepsilon_i \qquad (4)$$

$$GE = \beta_0 + \beta_1 GR + \varepsilon_i \qquad (5)$$

In the language of co-integration theory, regression such as (equation 4 and 5) are known as co-integrating regressions and the slope parameters and β0 and β1 are known as the co-integrating parameter (Gujarati & Sangeetha, 2007).

However, Johansen and Juselius procedure is considered better than Engle-Granger even in a two variables context and has better small sample properties since it allows feedback effects among the variables. The Johansen technique enables us to test for the existence of non-unique Cointegration relationships in more than two variables cases. The Johansen procedure of Cointegration is a test of the rank of the matrix .

Co-integration between two non-stationary series requires that the matrix Π does not have full

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rank ($0 < r(\Pi) = r < n$) where (r) is the number of Co-integration vectors.

Two tests statistics are suggested to determine the number of Co-integration vectors determined based on a likelihood ratio test (LR): the trace test and the maximum eigenvalues test statistics.

The trace test (λ_{trace}) is defined as:

$$Trace = -T \sum_{i=r+1}^{n} \log(\hat{\lambda}_i) \quad (6)$$

The null hypothesis is that the number of Cointegration vectors is $\leq$ r against the alternative hypothesis that the number of Cointegration vectors = r.

The maximum eigenvalues test (λ_{max}) is defined as:

$$\lambda_{max} = -T \log(1 - \hat{\lambda}_i) \quad (7)$$

Which tests the null hypothesis that the number of Cointegration vectors = r against the alternative that they are r+1.

c) Causality Test

Given the results from co-integration test, the causality relationship between (GR) and (GE) should be tested through the implementation of an ECM. Before proceeding with it, the standard Granger (1969), the concept of "causality" assumes a different meaning with respect to the more common use of the term. The statement(GR) Granger causes (GE) or vice versa, in fact, does not imply that (GR) and (GE) is the effect or the result of (GR) and (GE), but represents how much of the current (GR) and (GE) can be explained by the past values of (GR) and (GE) and whether adding lagged values of (GR,GE) can improve the explanation. For this reason, the causality relationship can be evaluated by estimating the following two regressions:

$$\Delta GR_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta GE_{t-i} + \varepsilon_i \quad (8)$$

$$\Delta GE_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta GE_{t-i} + \sum_{i=1}^{m} \beta_{2i} \Delta GE_{R-i} + \varepsilon_i \quad (9)$$

Where (m) represents the lag length and should set equal to the longest time over which one series could reasonable help to predict the other.

Following this approach, the null hypothesis that (GE) does not granger cause (GR) in regression (8) and that (GR)does not Granger cause (GE) in regression (9) can be tested through the implementation of a simple F-test for the joint significance of, respectively, the parameters β1i and β2i.Following the equations (8) and (9) were estimated using four lags of each variable which should represent and adequate lag-length over which one series could help to predict the other.

d) Error Correction Model

Once the variables in a VAR system are co-integrated, following Johansen–Juselius, we can use a vector error-correction models (VECM) in which an unconstrained VAR is used in order to assess the direction of Granger causality and to estimate the speed of adjustment to the deviation from the long-run equilibrium between government revenue (GR) and Expenditure (GE).

The error correction model is based on the two following equations:

$$\Delta GR_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta GE_{t-i} + \beta_3 \eta_{t-1} + \varepsilon_i \quad (10)$$

$$\Delta GE_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta GE_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta GR_{t-i} + \beta_3 \mu_{t-1} + \varepsilon_i \quad (11)$$

Where (η_{t-1}) and (μ_{t-1}) represent the error-correction term lagged residual from the co-integration relations. The error correction terms (η_{t-1}, μ_{t-1}) will capture the speed of the short run adjustments towards the long run equilibrium. Furthermore, the error correction model equations (10) and (11) allow testing for short run as well the long run causality between government expenditure and revenues.

The short run causality is based on a standard F-test statistics to test jointly the significance of the coefficients of the explanatory variable in their first differences. The long run causality is based on a standard t-test. Negative and statistically significant values of the coefficients of the error correction terms indicate the existence of long run causality.

IV. Data Analysis

In this section, first we see the results of the primary analysis of the data series. Basically the time series data has a trend; it was proved by the graphs of government revenue (GR) and government expenditure (GE) during the period from 1990 to 2011. The results of unit root test are discussed below with the output of Augmented Dickey-Fuller test. To see the long run relationship, co-integration results also elaborated. Finally, the direction of causality will be analyzed. Table 1 shows the descriptive statistics of these two series.

Table 1 : Descriptive Statistics

variables	Mean	Median	Max	min	Std. Dev.	Skewness	Kurtosis
LGR	0.79765	0.62217	1.72330	0.01489	0.51218	0.32826	1.92439
LGE	0.91817	0.72829	1.92512	0.20049	0.54036	0.49333	1.94916

a) Testing unit roots

The first step in empirical work was to determine the degree of integration of both variables. The ADF and PP unit root test with intercept and with intercept and trend are adopted to check whether the variables contain a unit root or not. The results of ADF and PP test are reported in the Table 2 for the level as well as for the first difference of each of variable. The result shows that the null hypothesis that the series contain unit root cannot be rejected in both cases at zero order levels. But the hypothesis of a unit root is strongly rejected for the differenced series of both variables. Given the consistency and ambiguity of the results from this testing approach, we conclude that the series under investigation are I(1). This reveals that all both the government revenue and expenditure are non-stationary in its levels and stationary in first difference.

Table 2 : Results of ADF and PP test

Series	With intercept		With intercept and trend	
Levels	ADF	PP	ADF	PP
LGR	-3.012363 [0.249573]	-3.012363 [0.791300]	-3.644963 [-1.721988]	-3.644963 [-1.637502]
LGE	-3.012363 [1.418137]	-3.012363 [1.597031]	-3.644963 [-1.100418]	-3.644963 [-1.100418]
First difference				
ΔLGR	-3.020686* [-5.032742]	-3.020686* [-5.052478]	-3.658446* [-4.931242]	-3.658446* [-4.959425]
ΔLGE	-3.020686* [-4.140659]	-3.020686* [-4.145667]	-3.658446* [-4.865945]	-3.658446* [-4.865945]

*Note: * test critical values which denotes significant at 5% level.*

The number in parenthesis is the (t) statistic value.

b) Testing Co-integration and Error Correction mechanism

Since the first difference series are stationary, Let us examine the existence of co-integration between government revenue and expenditure. To test the co-integration or long run relationship, first we run the regression, Table 3-1 reports the results obtained from the co-integration tests.

Table 3-1: co-integration tests

Regression	ADF of residual
LGR on LGE	-3.012363* [-4.460183]
LGE on LGR	-3.012363* [-4.295122]

*Note: * test critical values which denotes significant at 5% level*

The number in parenthesis is the (t) statistic value.

The ADF unit root test suggests that the estimated residuals from equation 4 and 5 are stationary: in both the cases, the null hypothesis of a unit-root can be rejected, meaning that there is evidence of a co-integration relationship between the series government revenue and expenditure.

Having established the long run relationship by the Engle-Granger two-steps co-integration test, Johansen-Juselius procedure is used to further test for co-integration between government expenditure and revenues. Table 3-2 presents the result of the trace test (λ_{trace}) and maximum eigenvalues test (λ_{max}) statistics for the existence of long run equilibrium between the government expenditure and revenues .

Table 3-2 : co-integration test

Null Hypothesis	λ_{trace}	λ_{max}
r=0	44.63141 [25.87211]	40.61260 [19.38704]
$r \leq 1$	4.018808 [12.51798]	4.018808 [12.51798]

**terms in [ ] indicates 5% level critical value*

The null hypothesis of no Cointegration (r=0) based on both the trace test and the maximum eignvalues test between government expenditure and revenues is rejected at (5%) level of significance. However, the null hypothesis that $(r \leq 1)$ could not be rejected. The estimated two tests indicate that there is only one Cointegration vector.

c) causality tests

The above analysis suggests that there exists a long-run relationship between government revenue and expenditure in the country. But in order to determine which variable causes the other, granger causality test was used. The granger causality test results are presented in Table 4.

Table 4 : Granger causality test

Regression	Lag	F-statistics	P-Value	Granger causality
LGE on LGR Null hypothesis: LGR does not granger cause LGE	1	6.26239	0.0222	YES
LGR on LGE Null hypothesis: LGE does not granger cause LGR	1	3.63803	0.0726	YES

As shown in table 4, GR on GE is statistically significant at the 5% level, implying that there is causality running from GR to GE. The F statistics imply that the null hypothesis GR does not granger cause GE can be rejected at the 5% significance level. This means, higher revenue would lead to higher government expenditure. On the other hand, GE on GR is statistically significant at 10% level and the F statistics imply that the null hypothesis that GR does not granger cause GE can be rejected at the 10% significance level. This indicates that a increases in expenditure would induce higher revenue. Therefore, the study reveals bidirectional causation between government revenue and expenditure in Jordan, which is running from revenue (GR) to expenditure (GE) and vice versa.

Above findings lend support to the fiscal synchronization hypothesis, implying that government of Jordan makes its revenue and expenditure decisions simultaneously.

d) Vector Error Correction Model (VECM)

The vector Error Correction Model (VECM) is used to generate the short run dynamics. The number of lags in the model is one lag. Table 5 reports the results of vector error correction model. The findings from VECM are similar the ones resulting from the application of standard Granger causality test. Which is meaning that evidence of causal relationship in Jordan results from data.

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Table 5 : vector error correction model

Regression	ΔLGR	ΔLGE
CONSTANT	0.056605 [1.60716]	0.091267 [3.67732]
η_{t-1}	-0.857538 [-2.11952]	
μ_{t-1}		-0.575836 [-2.36852]
ΔLGR_{-1}	0.255915 [0.80378]	-0.019922 [-0.08879]
ΔLGE_{-1}	0.109249 [0.35991]	-0.103984 [-0.48614]
R^2	0.257861	0.398926
S.E	0.084514	0.059555

(terms in brackets are t – ratios)

Table (5) presents the error correction models estimations. The error terms (η_{t-1}, μ_{t-1}) in both equations are statistically significant and negative at (5%) level of significance based on(t) test statistics which indicate that there is a bidirectional causality between government expenditure and revenues in the short run. Therefore, there is bi-directional causality between government expenditure and revenues in the long as well as in the short run. The value of (η_{t-1}) indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium eighty five percent of the disequilibrium in (GR) is corrected each year, as well, The value of (μ_{t-1})indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium fifty seven percent of the disequilibrium in (GE) is corrected each year. In addition, the significant error terms in both equations support the existence of a long run equilibrium relationship between (GR) and (GE).Furthermore, the estimates of the VECM indicate the existence of bidirectional causality running between (GR) and (GE).

The result of VECM emphasizes the bidirectional Granger causality between government revenue and expenditures which consists with the fiscal synchronization hypothesis.

V. Conclusions

This study tried to investigate the relationship between government revenues and expenditures in Jordan for the period 1990-2011 using cointegration and Granger causality tests. Investigation this relationship is important for understanding the role of government in allocation of its resources.

Based on empirical results we are able to accept the fiscal synchronization hypothesis. In addition, our empirical results further discover that there is a stable long-run equilibrium relationship between government revenues and expenditures, although, they may be in disequilibrium in the short run, as well, there exists bidirectional causality running between government revenue and government expenditure. This means that we can't reject the hypothesis that an increase in government revenue would lead to higher expenditure in Jordan, at the same time, we can't reject the hypothesis that an increase in government expenditure would induce higher government revenue. The results coincide with (AbuAl-Foul and Baghestani, 2004) in case of Jordan, (Gounder et al, 2007), (Aslan and Taşdemir, 2009), (Chang and Chiang, 2009), and (Chang et al., 2002) for Canada, who found that there is a bidirectional causality running between government revenue and government expenditures. Implying that government makes simultaneously its revenues and expenditures.

Finally, For the case of Jordan this paper lifts a very thoughtful suggestion for policy makers that Jordan is an economy where impositions of revenues (taxes) are decided on basis of allocated government expenditures. On other hand, expenditures would positively induce revenue which in turn affects the expenditures for the present and the next fiscal year(s). The bidirectional causality between government expenditures and revenues might complicate the government's efforts to control the budget deficit and may contribute in explaining the high national debt figure.

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