

## **The Relationship between Real Government Consumption and Real Private Consumption in the Kingdom of Saudi Arabia**

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**Abstract.** This study examines the causal relationship between real private consumption and real government consumption in the Kingdom of Saudi Arabia using Granger causality techniques, Cointegration, and Error Correction Models in order to determine the long run equilibrium and the direction of the causal relationship, in both the long and the short runs. The Cointegration test indicates the existence of a long run equilibrium between real private consumption and real government consumption variables. The causality test indicates that there is a causal relationship which runs from real government consumption to real private consumption in the long but not the opposite. However, the causality test indicates that there is no short run causality. This result suggests that real government consumption has a positive effect on private consumption which is consistent with the Keynesians proposition. Therefore, government expenditure is considered an important policy instrument to affect the real variables in Saudi Arabia.

### **I. Introduction**

Private consumption is an important element in the Keynesian Model in which an increase in government expenditure would be transmitted through the multiplier process to the entire economic activities. Therefore, the stability of the consumption function is a core element in the Keynesian model; particularly, to the effectiveness of fiscal policy. The theoretical debate over the impact of public expenditure on private spending either on investment or consumption has been going on for decades.

There are three major distinct schools of thought dealing with the impact of government expenditure on private spending: Keynesians believe that an increase in government expenditure or a reduction in taxes have a positive effect on private consumption. Neoclassicals, on the other hand, argue that increasing government expenditure crowds out private spending. Lastly, the Ricardian Equivalence Hypothesis

(REH) holds that increasing government expenditure financed by government debt has no effect on private spending. Therefore, the effect of government expenditure on private consumption has come to be an empirical issue.

The purpose of this paper is to investigate the kind of relationship that exists between government consumption and private consumption in the Kingdom of Saudi Arabia, given the fact that government consumption composes a large component of aggregate demand, for example, in 1999, real government consumption accounted for 25% of the real gross domestic product. The rest of the paper is organized as follows: Section II will be devoted to theoretical arguments and some previous empirical works regarding the effect of government expenditure on private spending. Section III discusses the methodology used to test the relationship between government and private consumption. Section IV presents the empirical results. Section V concludes the paper.

## **II. Theoretical Background and Previous Empirical Works**

The role of government expenditure in the economic activities of an economy was not recognized until Keynes published *The General Theory of Employment, Interest, and Money* in 1936. Under less than full employment level of output, expansionary fiscal policy (either by increasing government expenditure or by reducing taxes) has a positive effect on output through the multiplier process, Keynes [1].

Keynesians, then, believe that fiscal policy is the core tool to stabilize the economy given the deficiency of aggregate demand accompanied with rigid wages and prices and inelastic investment function with respect to interest rates, Modigliani [2], Peacock and Shaw [3], and Bailey [4]. Governments in the western Hemisphere have engaged in different programs which led to the expanding of the government role in the economy and contributed largely to accumulating national debt. The Keynesian argument was advanced further by the balanced budget multiplier in which an equal increase in government expenditure and taxes would increase national income by the same amount. Moreover, any budget deficit would disappear due to the economic growth caused by the expansionary fiscal policy, Kyer, Mixon, and Uri, [5]. Neoclassicals, on the other hand, maintain that an expansionary fiscal policy would be offset either partially under less than full employment, or totally under full employment by a decline in private investment or consumption expenditure. In particular, government consumption has an adverse effect on economic growth in the short run and on capital accumulation in the long run.

The crowding out effect is due primarily to the rising interest rates as a result of increasing government borrowing to finance the deficit which in turn would reduce the private investment. Furthermore, interest rates would rise more as individuals demand more money to finance the increasing economic transactions which would further reduce private expenditure and may reverse the initial increase in national income. In case of complete crowding out fiscal policy determines only the substitutability between the

public and private sector. Bailey [4] concludes that there exists a substitutability between public and private consumption. Bailey's work has been followed by a series of empirical works including Barro [6], Kormendi [7], Aschauer [8], Ahmed [9], Baxter and King [10], and Monadjemi [11]. However, some studies found that government expenditure does not affect private consumption, Olekalans [12]. Moreover, Karras [13] and Erenburg and Wohar [14] found that public and private consumption are complementary. Karras [13] argued that the relationship depends on government size. As government size increases, government consumption turns to be substitutable to the private consumption rather than complementary. Erenburg and Wohar [14] found that private consumption tends to rise as government consumption increases. Therefore, government consumption has a positive effect on private consumption and does not crowd-out private consumption. In the context of the Kingdom of Saudi Arabia (KSA), Barry [15] found that public consumption and investment crowd-out private investment.

However, under less than full employment, partial crowding out may occur, hence fiscal policy will have different effects such as rising interest rates, changing the composition of wealth, and inflation. An implicit assumption to the crowding out argument is that monetary authority holds money stock constant in order to have a rising interest rates. Nerile [16] found no evidence relating the variations in government deficit to changes in short-term interest rates in Australia.

A strong criticism to active fiscal policy came in the 1980's from the Ricardian Equivalence Hypothesis (REH) proponents. Barro [17-19] argued that when government expenditure is financed through debt, private sector will increase their current saving in order to pay their tax liabilities in the future. Government expenditures and revenues are thus related through the budget constraint. Therefore, a decrease in public saving (deficit financing) will be offset by an increase in private saving. Thus, national saving and consumption stay unchanged as government increases its consumption which is financed through the budget deficit. Therefore the fiscal policy will have no impact on aggregate demand. This result is somewhat similar to the monetary policy ineffective proposition which argues that monetary policy has no effect on real variables. Empirical works have shown mixed results regarding the REH. Kormendi [7] provided the strongest support of the REH. Seater [20] argued that although; most of the assumptions of REH are restrictive and realistic, considerable empirical works are supportive of the REH, except for those studies that lack econometric precision. In contrast with Kormendi's result, Feldstein [21], Feldstein and Elmeadrof [22], Modigliani and Sterling [23], and Monadjemi [24] provided evidence against the REH. In the context of KSA, Al-Batil [25] found that financing government budget deficit through borrowing leads to crowding out of private investment.

### III. Methodology

The causal relationship between two variables ( $X_t, Y_t$ ) in time series analysis, known as Granger causality, is concerned with the relevance of past information in a

variable in predicting the value of the other, Granger [26], [27].

Since most of time series have unit roots as many studies indicated including, Nelson and Plosser [28], and as proved by Stock and Watson [29] that most of the time series are non-stationary, conventional regression techniques based on non-stationary time series produce spurious regression, Granger and Newbold, [30].

The Augmented Dickey-Fuller (ADF) unit root test, Dickey-Fuller [31], [32] is one of the most widely used test for determining the order of integration of time series. The test involves estimating the following regression:

$$\Delta X_t = \alpha + \beta X_{t-1} + \sum_{j=1}^k \delta_j \Delta X_{t-j} + U_t \quad (1)$$

Alternatively, Phillips [33] and Phillips and Perron [34] PP have proposed a nonparametric method to correct a wide variety of serial correlation and heteroskedasticity situations. Phillips-Perron and Dickey-Fuller tests have the same asymptotic distributions. The PP test detects the presence of a unit root in a series by estimating the following equation:

$$\Delta X_t = \alpha + \gamma X_{t-1} + \varepsilon_t \quad (2)$$

Where  $Y_t$  is the series being tested,  $\Delta$  is the first difference of the time series  $U_t, \varepsilon_t$  are white noise terms.

Both of the ADF and PP tests are based on the t-statistics of  $\beta$  and  $\gamma$ . If either  $\beta$  or  $\gamma$  is negative and significantly different from zero, the null hypothesis is rejected and the alternative is accepted that  $X_t$  has no unit root, hence it is stationary.

The unit root test and the order of the integration would be performed on both the original series and the differences of the series using both the ADF and PP tests.

### Cointegration Test

The two non-stationary series with the same order of integration may be cointegrated if there exist some linear combination of the series that can be tested for stationarity i.e. (I(0)). Cointegration is a test of long run equilibrium of non-stationary series that do not have equilibrium in the short run, Granger and Newbold, [30]. Engle and Granger [35] propose a two-step procedure to test Cointegration between two time series. First, Cointegration regression:

$$X_t = \alpha + \beta Y_t + U_t \quad (3)$$

is estimated by OLS, then the residuals from the regression are tested for stationarity. If the test indicates that the residuals are stationary, i.e.  $I(0)$ , then there is a Cointegration between  $X_t$  and  $Y_t$  i.e. they have a long run equilibrium. However, Johansen [36] Johansen and Juselius [37] 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  $\Pi$ . Cointegration between two non-stationary series requires that the matrix  $\Pi$  does not have full rank ( $0 < r(\Pi) = r < n$ ) where ( $r$ ) is the number of Cointegration vectors.

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

The trace test ( $\lambda_{\text{trace}}$ ) is defined as:

$$\text{Trace} = -T \sum_{i=r+1}^n \log(\hat{\lambda}_i) \quad (4)$$

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 ( $\lambda_{\text{max}}$ ) is defined as:

$$\lambda_{\text{max}} = -T \log(1 - \hat{\lambda}_i) \quad (5)$$

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

### Short run adjustments

Once the variables in a VAR system are cointegrated, following (Johansen – Juselius, [37]), 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 private and government consumption.

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

$$\Delta X_t = \alpha_0 + \alpha_1 e_{t-1} + \sum_{i=1}^m \alpha_i \Delta X_{t-i} + \sum_{j=1}^n \alpha_j \Delta Y_{t-j} + \varepsilon_t \quad (6)$$

$$\Delta Y_t = \beta_0 + \beta_1 u_{t-1} + \sum_{i=1}^m \beta_i \Delta Y_{t-i} + \sum_{j=1}^n \beta_j \Delta X_{t-j} + u_t \quad (7)$$

Where  $e_{t-1}$  and  $u_{t-1}$  represent the error-correction term lagged residual from the Cointegration relations. The error correction terms ( $e_{t-1}$ ,  $u_{t-1}$ ) will capture the speed of the short run adjustments towards the long run equilibrium.

### Causality tests

The inclusion of the error terms ( $e_{t-1}$ ,  $u_{t-1}$ ) in equations (6) and (7) will be used to track the long run causality between the time series derived from VECM. The significant value of the coefficients of the error terms is based on a standard t-test. Negative and statistically significant values of the coefficients indicate the existence of a long run causality.

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 the ir first differences. The test is based on estimating the following equations:

$$\Delta X_t = \alpha_0 + \sum_{i=1}^m \alpha_i \Delta X_{t-i} + \sum_{j=1}^n \alpha_j \Delta Y_{t-j} + \varepsilon_t \quad (8)$$

$$\Delta Y_t = \beta_1 + \sum_{i=1}^m \beta_i \Delta Y_{t-i} + \sum_{j=1}^n \beta_j \Delta X_{t-j} + U_t \quad (9)$$

## IV. Data and Empirical Findings

The variables of the model are real private consumption (RPC) and real government consumption (RGC) for Saudi Arabia. The annual data employed in this study cover the period from 1970-1999 obtained from the thirty-seventh annual report of Saudi Arabian Monetary Agency SAMA, [38].

### Properties of the time series

As has been mentioned, the stationarity of the series is required in order to carry out the cointegration and causality tests. The analysis of the time series variables used in the

study (RPC and RGC) to test the stationarity of the series over time and to determine the degree of integration is based on the well-known Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) unit root tests (equation 1). The results of the two tests are shown in Tables 1 and 2 indicate clearly that the null hypothesis can not be rejected for the levels of the two series since their ADF and PP values are less than McKinnon's critical values at the (1%) level of significance. Therefore, real government consumption and real private consumption are non-stationary in their levels. However, the results indicate that the null hypothesis is rejected for the first differences since their ADF values exceeds McKinnon's critical values at the (5%) level of significance. The result shows that the two time series are integrated of degree one (I (1)). The number of lags is determined according to Akaike Information Criterion (AIC), Akaike, [39]. The results of ADF and PP unit root tests are presented in Tables 1 and 2 respectively:

**Table 1. Augmented Dickey-Fuller unit root test**

Variable	Level with intercept and trend	Level with intercept	First difference with intercept and trend	First difference with intercept
RGC	-1.34 (2)	-2.253 (2)	-4.833 (0)	-4.285 (1)
RPC	-2.051 (2)	-1.481 (2)	-4.203 (0)	-2.994 (1)

**Table 2. The Phillips – Perron unit root test**

Variable	Level with intercept and trend	Level with intercept	First difference with intercept and trend	First difference with intercept
RGC	-1.31	-1.67	-4.92	-4.56
RPC	-1.88	-0.88	-4.23	-4.21

Critical values:	Intercept and Trend		Intercept
At (1%) level of Significance	-4.355	-3.696	
At (5%) level of significance		-3.594	-2.975
At (10) level of significance		-3.232	-2.626

### Cointegration test

Having established the stationarity of the two time series under consideration, the next step is to test for cointegration. Although, the individual time series tends to deviate from equilibrium in the short run, they may be cointegrated i.e. have long run equilibrium. As has been mentioned, cointegration is a test for stationarity of a linear combination of non-stationary variables. In doing so, we apply Engle and Granger two-step method which involves estimating equations (2) by the Ordinary Least Squares (OLS) and testing for stationarity of residuals.

**Table 3. Engle and Granger two-step cointegration test**

	RPC	RGC
C	-0.03 (-0.12)	-0.41 (1.73)
RPC		0.86 (17.40)
RGC	1.06 (17.40)	
R <sup>2</sup>	0.91	0.91
DW	0.81	0.84
SE	0.20	0.19
ADF statistics for residuals	-2.65	-3.23

99% critical value for the Dickey-Fuller statistics = -2.648.

Table 3 shows that the residuals obtained from regressing RPC on constant and RGC and regressing RGC on constant and RPC are stationary. This result implies that there exist a long run relationship between real private consumption and real government consumption in Saudi Arabia.

Johansen [36] and Johansen–Juselius [37] procedure is used to further confirm the existence of cointegration between RGC and RPC. Table (4) presents the results of Johansen’s trace test ( $\lambda_{\text{trace}}$ ) and the maximum eigenvalues test ( $\lambda_{\text{max}}$ ) statistics for the existence of a long run equilibrium between the two time series.

**Table 4. Cointegration with restricted intercept and no trend**

Null hypothesis	( $\lambda_{\text{max}}$ )	( $\lambda_{\text{trace}}$ )	95% critical value for maximum eigenvalue test	95% critical value for trace test
$r = 0$	16.437	22.920	15.870	20.180
$r \leq 1$	6.483	6.483	9.160	9.160

The null hypothesis of no Cointegration between RGC and RPC (i.e.  $r=0$ ) based on both the maximum eigenvalue test and the trace test is rejected at the (5%) level of significance. However, the null hypothesis that ( $r \leq 1$ ) could not be rejected. Which indicates the existence of only one cointegration equation between the two time series.

Having established the existence of a stable long run relationship between RPC and RGC based on Engle-Granger two steps and Johansen procedure, short run relationship between the two time series is investigated using the Vector Error Correction Model (VECM):



### 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 determined according to Akaike Information Criterion (AIC) [39]. The lag length that minimizes the AIC is one lag. But, two lags are chosen in order to ensure the absence of any serial correlation in the residuals. Too short a lag in VECM model may not capture the dynamic behavior of the variables appropriately, consequently, a second period lag is considered to be appropriate here. The additional lag is merely added to produce the required asymptotic distributional result.

**Table 5. Estimates for VECM Regression**

Regresses	$\Delta \ln \text{RPC}$	$\Delta \ln \text{RGC}$
Constant	0.068 (2.082)	0.072 (1.631)
$e_{t-1}$	-0.893 (-3.131)	
$\mu_{t-1}$		-0.036 (-0.093)
$\Delta \ln \text{RPC}_{.1}$	0.143 (0.221)	0.285 (0.953)
$\Delta \ln \text{RPC}_{.2}$	-0.036 (0.180)	-0.230 (-0.953)
$\Delta \ln \text{RGC}_{.1}$	-0.121 (-0.244)	0.157 (0.048)
$\Delta \ln \text{RGC}_{.2}$	-0.020 (-0.094)	-0.265 (-0.934)
$R^2$	0.47	0.16
S.E.	0.14	0.19
log likelihood	17.48	9.56

(terms in brackets are t – ratios).

Table 5 presents the error correction models estimations. The lagged error term coefficient ( $e_{t-1}$ ) is statistically significant, while the coefficient of ( $\mu_{t-1}$ ) though negative, is not significant. The value of ( $e_{t-1}$ ) indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium. Eighty nine percent of the disequilibrium in RPC is corrected each year. That may be attributed largely to the fact that a large percentage of government consumption consists of wages and salaries paid to households. In addition, the significant error term in the RPC equation support the existence of a long run equilibrium relationship between RPC and RGC. Furthermore, the estimates of the VECM indicate the existence of unidirectional causality running from the RGC to the RPC.

### Direction of causality

The existence of Cointegration implies, as Granger [27] indicated, the existence of Granger causality at least in one direction.

The long run causality test from the VECM indicates that causality runs from RGC to RPC since the coefficient of the error term in RPC equation (7) is statistically significant and negative based on standard t-test which means that the error term ( $e_{t-1}$ ) contributes in explaining the changes in RPC. However, the coefficient of the error term in the RGC equation (8) is statistically insignificant which means that the error term ( $\mu_{t-1}$ ) does not contribute in explaining the changes in real government consumption. Therefore, there is unidirectional causality running from real government consumption (RGC) to real private consumption (RPC) variable.

The coefficients of the first difference of RPC and RGC lagged two periods in Table 5 are statistically insignificant which indicate the absence of short run causality based on VECM estimates.

In order to confirm the result of the short-run causality between the RGC and the RPC based on VECM estimates, a standard Granger causality test is run based on F-statistics.

**Table 6. Results of Pairwise Granger causality test**

Null hypothesis	F-statistics	Probability
$\Delta \ln(\text{RGC})$ does Granger cause $\Delta \ln(\text{RPC})$	2.656	0.0926
$\Delta \ln(\text{RPC})$ does not Granger cause(RGC)	1.087	0.355

(number of lags = 2)

The result in Table 6 indicates that real government consumption does not Granger

cause the real private consumption at the (5%) level of significance. This result supports the previous result obtained from VAR/ VECM that there is no short run causality at the (5%) level of significance. Based on causality tests, changes in the real government consumption cause changes in the real private consumption in the long-run, but not in the short run.

### V. Conclusion and Policy Implication

The goal of this paper is to investigate the relationship between real private consumption (RPC) and real government consumption (RGC) in the Kingdom of Saudi Arabia using Granger causality techniques, cointegration, and Error Correction Models in order to determine the long run equilibrium as well as the direction of the causal relationship in both long and short runs. Data properties were analyzed to determine their stationarity using the ADF and PP unit root tests which indicated that the two series are I(1). The results of the cointegration tests based on both Engle - Granger and Johansen-Juselius techniques indicate the existence of the cointegration between (RPC) and (RGC) . Therefore, the two variables have a long run equilibrium relationship although they may be in disequilibrium in the short run. VECM based on VAR indicates that (89%) of disequilibrium in RPC is corrected each period. That may be attributed largely to the fact that a large percentage of government consumption consists of wages and salaries paid to households. In addition, the significant error term in RPC equation support the existence of a long run equilibrium relationship between RPC and RGC. Furthermore, the estimates of the VECM indicate the existence of a unidirectional causality running from RGC to RPC. The causality test indicates that there is a causal relationship running from RGC to the RPC in the long run but not in the short run.

This result suggests RGC is exogenous to RPC which is consistent with the Keynesians proposition and in contrast with the Ricardian Equivalence Hypothesis. However, RGC has a positive effect on private consumption in the Kingdom and does crowd in not crowd-out private consumption. This dependence of private consumption on the government consumption highlight the need for further research concerning the decisions underlying public spending This result may be attributed, largely, to the fact that the government in the Kingdom finances most of its expenditures through its revenues from oil exports which are independent of private consumption. Moreover, government budget deficit through borrowing does not seem to be crowding-out private consumption. This result indicates that government expenditure may be a promising means of raising gross domestic product in Saudi Arabia through its effect on private consumption. Therefore, the government expenditure is considered an important policy instrument to affect the real variables in the Kingdom economy.

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## العلاقة بين الاستهلاك الحقيقي الخاص والاستهلاك الحقيقي الحكومي في المملكة العربية السعودية:

خالد بن حمد بن عبدالله القدير

قسم الاقتصاد، كلية العلوم الإدارية، جامعة الملك سعود، الرياض

(قدم للنشر في ١٤٢٤/١/٢ هـ ؛ قبل للنشر في ١٤٢٤/٧/٢٧ هـ)

**ملخص البحث.** يهدف البحث إلى دراسة العلاقة السببية بين الاستهلاك الحقيقي الخاص والاستهلاك الحقيقي الحكومي في المملكة العربية السعودية باستخدام منهجية قرينجر واختبار التكامل المشترك ونموذج تصحيح الخطأ وذلك لتحديد اتجاه العلاقة بين المتغيرين في الأجل الطويل والقصير. وقد دل اختبار التكامل المشترك على وجود علاقة توازنية طويلة الأجل بين الاستهلاك الحقيقي الخاص والحكومي. كما وضح اختبار السببية أن هناك علاقة سببية ذات اتجاه واحد في الأجل القصير والطويل تتجه من الاستهلاك الحقيقي الحكومي إلى الاستهلاك الحقيقي الخاص وليس العكس، وتوضح اختبارات السببية أن التغيرات في الاستهلاك الحقيقي الحكومي تساعد في تفسير التغيرات في الاستهلاك الحقيقي الخاص، بينما لا تساعد التغيرات في الاستهلاك الحقيقي الخاص في تفسير التغيرات في الاستهلاك الحقيقي الحكومي في الأجل الطويل. كما وضحت النتائج أن التغيرات في الاستهلاك الحقيقي الحكومي لا تساعد على تفسير التغيرات في الاستهلاك الحقيقي الخاص في الأجل القصير. وهذه النتيجة تتوافق مع النظرية الكينزية التي تؤكد على دور الإنفاق الحكومي في التأثير على المتغيرات الاقتصادية خاصة الإنفاق الاستهلاكي الخاص. وعليه فإنه يمكن استمرار استخدام سياسة الإنفاق الحكومي بفعالية في المملكة للتأثير على المتغيرات الاقتصادية الحقيقية.