



## Exploring the Empirical Linkages between Economic Growth and Private Consumption: Contextual Evidence from Pakistan

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### ABSTRACT

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The sustainable development of a country is assumed to be a healthy sign for domestic consumers as well as producers. As private consumption is a vital component of real gross domestic product (GDP) and it can influence economic growth. This study explored a dynamic relationship between economic growth represented by real GDP and real private consumption expenditure (PCE). Stationarity of private consumption expenditure and GDP in first differences led to cointegration analysis between these time series data. Cointegration test indicated the existence of co-integrating relationship between these two variables. Vector error correction model (VECM) was employed to test the possibility of long-run adjustment towards equilibrium as well as nature of short-run dynamics. Granger causality test shows plausible role of short run consumption dynamics significantly improve predictive power of the model for real GDP growth.

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## 1. Introduction

Private consumption in developing countries constitute around 75% of Gross Domestic Product (GDP) and its contribution is very significant in GDP growth than production or investment (Mishra; 2011). Consumption being the largest share of GDP is very important for GDP growth. This dominant portion of consumption expenditure in aggregate demand components makes consumption led changes very important for demand led growth as compared to other constituents of aggregate demand.

Consumption has the largest share in GDP expenditures in Pakistan like all other developing countries. So, the very bulky size of this variable in aggregate expenditures indicates changes in consumption may influence GDP significantly for this economy. The interest further magnifies when we have economic underpinnings for consumption-GDP relationship. First instance of consumption-GDP relationship is consumption spending multiplier of Keynesian type that affects GDP in multiple times as compared to first time increase in consumption spending. Furthermore, positive growth of private consumption expenditure that contains consumption of both durable and nondurable goods can provide healthy signal to producers. Production and hence employment can be affected through sustained growth in consumption.

Although theoretical knowledge elaborates this relationship between real GDP and private consumptions. This research problem is need to be validated in context of different economies of world. Hence the determination of GDP growth through consumption has very important implications for economic growth as right policies can maneuver economic growth in

right direction. The specific objective of this study is to test the dynamic relationship between economic growth and private consumption expenditure in perspective of Pakistan economy.

## **2. Literature Review**

Studies on developed as well as few developing countries relating consumption as a major growth driver are evident in past few decades. Guisan (2004) found granger type causal relationship between real GDP and real consumption for US economy but no causal relationship of granger type for Mexican economy. Knetsch (2006) found cointegrating relationship between household consumption and income for Germany, France and Italy. Gabriele, Martelli, and Raitano (2009) evaluated the impact of 2008-09 financial crisis of consumers' confidence for Italian economy. This study showed that despite the fact that consumer confidence shattered all over the developed world, but this didn't happen for Italian economy. This study revealed that self-employed people had shown more confidence than people involved in other categories of employment.

Mishra (2011) indicated long-run relationship between GDP and consumption by employing vector error correction model for India using time series spanning from of 1950 to 2009. On the other hand Amin (2011) showed that consumption in Bangladesh was being determined from GDP growth rather than any other determinant of growth. Raluca-Maria (2014) using two step residual based procedure of cointegration (proposed by Engle and Granger (1987))<sup>1</sup> found no cointegration between consumption and GDP for Romanian economy. Kim (2017) employed factor analysis approach to investigate the linkage of economic growth with consumption and other variables for 52 Asian economies. This study showed presence of significant relationship between these variables for all economies. Al Rasasi, Alzahrani, and Alassaf (2021) explored the interconnection between household consumption with economic growth for Saudi-Arabia using cointegration analysis. This study showed considerable variation in growth is explained by changes in household consumption for this economy.

Chioma (2009) conducted a study in Nigeria to explore the causal relationship between gross domestic product and personal expenditure. The study used the dataset from 1994 to 2007. The regression analysis showed that a coefficient of 0.0514 showed there was no significant impact of personal consumption when there is increase in GDP of Nigeria. The value of coefficient of determination which was only 0.035 that explained that GDP only explained about 3.5% of personal expenditure.

It is quite clear from above studies that there are few studies available that explore consumption as a stimulator of GDP growth for developing economies. Other important conclusion that can be derived from above studies is absence of clear-cut relationship between consumption and GDP. Especially from Pakistan's perspective, such study is non-existent. This study is an attempt to fill the gap for developing economy of Pakistan as consumption expenditure has largest share in its GDP.

## **3. Data and Research Methodology**

This part of study presents description of variables that are employed in this study. Sources of data sets employed in this study are also discussed in this portion of this study. Furthermore, research methodology utilized for attainment of results of this study is also discussed in this section.

### **3.1. Description of Variables and Data Sources**

The possible dynamic relationship between consumption expenditure and economic growth in Pakistan is explored for time span from 1973 to 2021. Growth of real GDP at factor cost is taken to represent overall productivity growth whereas real private consumption expenditure (PCE) is taken to represent consumption spending of households on durable and non-durable goods. Unfortunately, data on consumption for economy of Pakistan is a residual from national income accounts identity which is shown below.

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<sup>1</sup>Engle and Granger (1987) proposed two steps approach for testing of co-integration when direction of dependency of variables is straightforward.

$$Y=C+I+G+NX \quad (1)$$

Where, Y stands for the level of national income and C, I G and NX are consumption expenditures (C) by households, investment spending (I) by firms, government spending (G) and spending of foreigners on domestic goods minus domestic spending on foreign goods (NX). Since consumption component is not calculated at official level therefore it is the remainder from national income accounts identity. So, data on consumption can be presented as,

$$Y - G - NX = C \quad (2)$$

A log-linear model is estimated to explore the long-run relationship between real private consumption expenditure and real GDP as proxy for real growth of economy. Data on consumption and GDP is taken from handbook of statistics 2020 issued by the State Bank of Pakistan and various issues of the Pakistan Economic Survey.

### 3.2. Estimation Techniques

Variables that are involved in cointegration must have order of integration greater than zero, i.e., variables in level form must be non-stationary for viable cointegration analysis. So, first step is testing of order of integration. Therefore, details of procedure are discussed below for testing order of integration. Rest of the procedure is about testing of cointegration and estimation of VECM to obtain estimates of long-run and short run parameters so that impact of real consumption expenditure on real economic growth of Pakistan can be determined.

#### 3.2.1 Testing of Stationarity

Perron (1989) showed a clear connection of structural change with unit roots especially when the data are stationary with trend but possesses a structural break. Conventional unit root tests are biased toward a false unit root null. Modern software's that perform econometrical procedures allow different types of modified Dicky-Fuller tests in which levels and trends are allowed to differ across a single break date. Most of these tests compute unit root tests with a single break date in following cases.

- Break occurs gradually or at once.
- Break occurs in intercept or in trend or in both trend and intercept.
- One can have a prior knowledge about break date or it can be estimated from the data.
- Break can be evaluated for trending as well as non-trending data.

Perron (1989) suggested four basic models for which break can be tested. These four models can be described in following manners.

- First model (O) is for non-trending data in which one time change in level is tested.
- Second model (A) is for trending data in which one time change in level is tested.
- Third model (B) is used for testing of a break date for both level and trend for trending data.
- Fourth model (C) is used to test break date in trend for a trending data.

Two distinct approaches are suggested by Perron (1989) that are used to model break dynamics. Modeling and testing procedure in these two approaches are described below.

#### 3.2.2 Innovational Outlier (IO) Tests

General null hypothesis for the IO model can be specified by equation (3).

$$y_t = y_{t-1} + \beta + \varphi(L)(\theta D_t(T_b) + \gamma DU_t(T_b) + \epsilon_t) \dots \dots \dots (3)$$

Where,  $D_t(T_b)$  is a onetime variable with break which opts the value 1 for the break date only and assume the value of zero otherwise.  $DU_t(T_b)$  is a variable with intercept break and assumes the value of zero before the break date and 1 thereafter.  $\epsilon_t$  are identically and independently distributed (i.i.d) innovations, and  $\varphi(L)$  shows a lag polynomial representing the dynamics of the stationary and invertible autoregressive moving average (ARMA) error process. Break variable in the above model follows dynamics same as the innovations ( $\epsilon_t$ ). Trend stationary model is assumed with break and intercept for alternative hypothesis. So, model with alternative hypothesis can be written as,

$$y_t = \mu + \beta t + \varphi(L)(\theta DU_t(T_b) + \gamma DT_t(T_b) + \epsilon_t) \quad (4)$$

Where,  $DT_t(T_b)$  is a variable with trend break assumes the value of 0 before the break and takes a break date re-based trend for all subsequent dates. In the model for alternative hypothesis, breaks are again assumed to follow dynamics of innovations. Following modified Dicky-Fuller test, equation can be constructed that nests these hypotheses,

$$y_t = \mu + \beta t + \theta DU_t(T_b) + \gamma DT_t(T_b) + \omega D_t(T_b) + \alpha y_{t-1} + \sum_{i=1}^k c_i \Delta y_{t-i} + u_t \dots \dots \dots (5)$$

Null hypothesis is evaluated by the t-statistic for comparison of  $\hat{\alpha}$  to 1 ( $t_{\hat{\alpha}}$ ). k lags are included to remove the effect of potential autocorrelation structure on asymptotic distribution of the test statistic.

Four Different models can be specified for null and alternative hypothesis by imposing zero constraints for one or more parameters such as  $\beta$ ,  $\theta$ ,  $\gamma$  and  $\omega$ . Following specific assumptions yield four specifications for Dicky-Fuller regression that conform to the assumptions that entail behavior regarding trend and break which can be tested in modified version (Perron, 1989; Perron & Vogelsang, 1992a, 1992b; Vogelsang & Perron, 1998).

**3.2.3. Additive Outlier (AO) Tests**

General null hypothesis for the AO model can be specified by following equation.

$$y_t = y_{t-1} + \beta + \theta D_t(T_b) + \gamma DU_t(T_b) + \varphi(L)\epsilon_t \dots \dots \dots (6)$$

Where  $\epsilon_t$  are identically and independently distributed (i.i.d) innovations, and  $\varphi(L)$  shows a lag polynomial representing dynamics of the stationary and invertible autoregressive moving average (ARMA) error process.  $\beta$  is a shift parameter and full impact of the break variable occurs immediately.

Trend stationary model is assumed with potential breaks in intercept and trend for alternative hypothesis. So, model with alternative hypothesis can be written in following manner.

$$y_t = \mu + \beta t + \theta DU_t(T_b) + \gamma DT_t(T_b) + \varphi(L)\epsilon_t \dots \dots \dots (7)$$

Two steps procedure is required for testing of unit root in AO framework. In the first step intercept, trend and breaking variables are used to detrend the series by the method of ordinary least squares (OLS). In the second step detrended series is used for testing of unit root using Dicky-Fuller regression.

**3.2.4. Selection of Lag-Length**

Selection of appropriate lag-length is necessary for modified Dicky-Fuller equation in order to eliminate effects of autocorrelation of errors from the asymptotic distribution of test statistic. Once a proper lag-length is selected only then theoretical properties are assumed to hold. So, t-test or F-test can be used for appropriate lag-length selection whereas information criterion such as the Akaike information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quinn information criterion (HQ), Modified Akaike information criterion, Modified Schwarz information criterion and Modified Hannan-Quinn criterion can also be used for this purpose.

**3.2.5. Testing of Cointegration**

Once it is established that some of the variables of interest are nonstationary then Testing of cointegration is done to examine whether a long-run equilibrium relationship exists among variables of interest. In this way one can refute possibility of any kind of spurious correlation that may arise among trended variables. Once cointegration between variables is established then its exclusion from the functional form of a model would lead to model misspecification. Consider a finite order vector autoregressive (VAR) model with finite lags up to p,

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \epsilon_t \dots \dots \dots (8)$$

Where  $y_t$  is a vector of endogenous variables in period  $t$  which depends on its lagged values. If this  $y_t$  vector contains non-stationarity variables, then this model is estimated in first difference.  $A_i$  are matrices of coefficients which are to be estimated where  $i = 1, \dots, p$ .  $\epsilon_t$  is a vector of innovations that are assumed to be uncorrelated with their own lags and endogenous and exogenous variables involved in a VAR model. A VAR model for a first differenced stationary time series involving co-integrating relation can be written as,

$$\Delta y_t = \pi \Delta y_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta y_{t-i} + \epsilon_t \dots\dots\dots (9)$$

Where,  $\pi = \sum_{i=1}^p A_i - I$  and  $\phi_i = -\sum_{j=i+1}^p A_j$ . In the presence of identified cointegration among variables then a VAR model should include vector of residuals from lagged one series. This dynamic model that incorporate vector of lag-one residuals in a VAR model is called vector error correction model suggested by Johansen (1988)<sup>2</sup>. Cointegration is tested by Johansen's cointegration test that identifies co-integrating relationship among variables. In nonstationary time series Johansen's method applies maximum likelihood procedure to estimate parameter(s) of co-integrating vector(s).

It can be shown through Granger's representation theorem that if  $\pi$  matrix of coefficients has reduced rank  $r < k$  then  $r \times k$  matrices of  $\alpha$  and  $\beta$  contain each with rank  $r$  such that  $\pi = \alpha\beta'$  and  $\beta'y$  is  $I(0)$ .  $R$  shows number of co-integrating relations and  $\beta$  is a co-integrating vector. Matrix  $\alpha$  contains error correction parameters measuring speed of adjustment towards equilibrium in  $\Delta y_t$ . Johansen's approach to cointegration relies on two test statistics, for testing of cointegration, called the trace test statistic and the maximum eigenvalue test statistic. Where these statistics are calculated in following ways.

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \dots\dots\dots (10)$$

$$\lambda_{\text{max}}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \dots\dots\dots (11)$$

Where,  $\hat{\lambda}_i$ s are characteristic roots for estimated values and these are also known as eigenvalues obtained from the  $\pi$  matrix and  $T$  shows total number of observations. Null hypothesis in trace test is that the number of cointegrating vector(s) is less than or equal to number of cointegrating relations ( $r$ ). The null hypothesis in maximum eigenvalue value test is tested for exactly cointegrating relations against  $r+1$  cointegrating relations (Enders, 2010).

### 3.3. Modelling Economic Growth

Existence of cointegration leads to construction of a model that encompasses long-run relationship along with short-run dynamics among variables. Vector error correction model (VECM) provides a suitable framework to model such kind of relationship. Through vector error correction model one can obtain parameters for speed of adjustment as well as long-run cointegrating vector. So, long-run and short-run relationship can be explored in VECM. Representation of error correction model<sup>3</sup> is used to study long-run relationship between economic growth and consumption expenditure. The model can be specified in following equation.

$$\Delta \text{GDP}_t = \text{Constant} + \delta_1 D + \lambda \text{EC}_{t-1} + \beta_1 \sum_{i=1}^n \Delta \text{GDP}_{t-i} + \beta_2 \sum_{i=1}^n \Delta \text{PCE}_{t-i} + \epsilon_t \dots\dots\dots (12)$$

Where,  $\Delta$  shows first difference of a variable and GDP and private consumption expenditure (PCE) are variables of interest. EC is error correction term and its coefficient  $\lambda$  if significant and negative shows error correction or movement towards equilibrium.  $\epsilon_t$  are identically and individually distributed innovations.  $\delta_1$  is coefficient of dummy variable "D" for any possible structural break during the time span of a sample.

### 3.4. Testing of Granger Causality

There is plethora of correlation coefficients in econometric literature to study correlation analysis with their own defects. Granger causality analysis proposed by Granger (1969)

<sup>2</sup> Johansen (1988) introduced multiple equation approach to cointegration. Since then this approach has been used extensively in applied work.

<sup>3</sup> Davidson, Hendry, Srba and Yeo (1978), known in economic literature as DHSY, proposed error correction model between income and consumption on assumption of long-run relationship between these variables.

provides a useful way to test predicting power of a variable for another variable  $y$  in this case  $x$  is growth of private consumption expenditure and  $y$  is real GDP growth. A granger causality test is conducted by estimating a following vector autoregressive model.

$$x_t = \sum_{i=1}^n \alpha_i y_{t-i} + \sum_{j=1}^n \beta_j x_{t-j} + \epsilon_{1t} \dots\dots\dots (13)$$

$$y_t = \sum_{i=1}^n \lambda_i y_{t-i} + \sum_{j=1}^n \sigma_j x_{t-j} + \epsilon_{2t} \dots\dots\dots (14)$$

Where,  $\epsilon_{1t}$  and  $\epsilon_{2t}$  are disturbances and uncorrelated with each other. Null hypothesis of first equation is that  $y$  does not granger cause  $x$  and null hypothesis for second equation is  $x$  does not granger cause  $y$ .

#### 4. Results and Discussion

This portion contains results regarding co-integrating relationship between GDP growth as economic growth and growth of consumption expenditure. First step in this process is testing of stationarity for GDP and consumption for economy of Pakistan. Table 1 shows modified ADF unit root test with break point testing for GDP and consumption in their levels and first differences.

**Table 1: Results from breakpoint Unit Root Test**

<b>ADF Test with Break for GDP in Level</b>		<b>ADF Test with Break for Private Consumption Expenditure in Level</b>	
Augmented Dickey-Fuller test statistic	t-Statistic -4.778635	Augmented Dickey-Fuller test statistic	t-Statistic -4.243852
Test critical values: 1% level	-5.719131	Test critical values: 1% level	-5.719131
5% level	-5.175710	5% level	-5.175710
<b>ADF Test with Break for GDP in First Difference</b>		<b>ADF Test with Break for Private Consumption Expenditure in First Difference</b>	
Augmented Dickey-Fuller test statistic	t-Statistic -8.450697	Augmented Dickey-Fuller test statistic	t-Statistic -7.531267
Test critical values: 1% level	-4.949133	Test critical values: 1% level	-4.949133
5% level	-4.443649	5% level	-4.443649

Source: Authors' data analysis estimation, 2022

Table 2 shows results of cointegration test for real GDP and real private consumption expenditure. Trace statistic and maximum eigenvalue statistic are greater than critical values at 5% significance level for null hypothesis of no co-integration. Results clearly indicate that null hypothesis of no cointegration can be rejected between real GDP and real private consumption expenditure. On the other hand, null hypothesis of cointegrating vector ( $r \leq 1$ ) cannot be rejected at 5% significance level. So there exists only one co-integrating relationship between real GDP and real private consumption expenditure.

**Table 2: Results from cointegration test**

None *	0.312176	17.21300	15.49471	14.59468	14.26460
At most 1	0.064932	2.618316	3.84166	2.618316	3.841466

Trace test and Max-Eigen test indicate 1 cointegrating(s) at the 0.05 level

Selection of appropriate lag-length is essential for correct model specification in vector error correction model. Model selection is done on basis of information criteria to study dynamics of real GDP and real private consumption expenditure. Information criteria of FPE, AIC select four lags whereas SC and HQ criterion select one lags from a VAR model. So, four lags are chosen as appropriate to study error correction mechanism between these two variables<sup>4</sup>.

Estimates from vector error correction model are shown in Table 3. It is very clear from these estimation results that there exists adjustment towards equilibrium. The negative sign for lag of error correction term ( $EC_{t-1}$ ) shows this movement in the direction of equilibrium. Magnitude of this term indicates the speed with which adjustment occurs towards equilibrium. It seems that 16 percent of error is corrected in each period.

<sup>4</sup> I have given preference to FPE and AIC over Schwarz information criterion (SC) and Hannan-Quinn (HQ) criterion. For further detail see Liew (2004) and Ivanov & Kilian (2005).

**Table 3: Estimation results from VECM**

Regressor	Estimated Coefficient	t-value
<b>ECT-1</b>	-0.16	-3.68
<b><math>\Delta</math>GDP<sub>t-1</sub></b>	-0.21	-0.93
<b><math>\Delta</math>GDP<sub>t-2</sub></b>	0.10	0.44
<b><math>\Delta</math>GDP<sub>t-3</sub></b>	-0.19	-0.88
<b><math>\Delta</math>PCE<sub>t-1</sub></b>	-0.07	-0.33
<b><math>\Delta</math>PCE<sub>t-2</sub></b>	-0.52	-2.56
<b><math>\Delta</math>PCE<sub>t-3</sub></b>	-0.19	-0.89
<b>C</b>	0.09	6.15
<b>D1</b>	0.07	4.28

Source: Authors' data analysis estimation, 2022

The t-statistics for the coefficients of short-run multipliers except private consumption expenditure (PCE) for second lag are below the absolute value of 2. Coefficients for short run impact multipliers except second lag of PCE appear to be insignificant. This result can further be cross-checked by testing of granger causality. The coefficient of dummy variable for military regime for decade 1999-2008 appears to be significant with positive impact on economic growth.

Table 4 showed the results from granger causality test. This test is conducted to test validation of results from VECM. It can be seen that probability of GDP growth not being a Granger cause of private consumption expenditure is sufficiently high. So we cannot reject this null hypothesis at such a high probability.

**Table 4: Results from Granger Causality Test**

Null Hypothesis	Number of Observations	F-Statistics	Probability
<b>GDP does not Granger cause PCE</b>	48	0.9874	0.3245
<b>PCE does not Granger cause GDP</b>		2.4781	0.0874

Source: Authors' data analysis estimation, 2022

On the other hand, probability of private consumption expenditure not being a granger cause of GDP and validated at 10% significance level. GDP and private consumption expenditure are involved in long-run equilibrium relationship then accepting this null hypothesis does not make much sense. As a stable long-run relationship requires some dynamics moving towards it. One can accept alternative hypothesis of changes in personal consumption expenditure enhances predicting power of the model. Real GDP growth responds positively to changes in private consumption expenditure after two periods and this might be the reason of above 10 percent probability of no granger causality of this variable for real GDP growth.

## 5. Conclusion and Policy Implications

This study was carried out to estimate the effect of real private consumption expenditure for real GDP growth as proxy for real economic activity for economy of Pakistan. Consumption is a main drive for this study that was tested this plausibility through modelling potential cointegrating nexus between these two variables. Testing stationarity of a time series without inclusion of break point in a time series could result in biased conclusion. Hence both variables are integrated of order one for economy of Pakistan. This result led to testing of cointegration and results from this test validated the plausibility of cointegration between these two variables for this economy. Results from vector error correction model for real GDP equation are representative for error correction mechanism for this variable. Sign and magnitude of lagged error correction term indicates presence of significant convergence towards long-run equilibrium. Short-run impact multipliers of private consumption expenditure can be assumed to enhance predictive power of the model for real GDP as depicted by cointegration results and test for Granger Causality.

The study concluded that real private consumption expenditure and GDP constituted a long-run equilibrium relationship. Short-run dynamics of consumption can be informative for economic growth modeling when GDP is taken as proxy for this growth. Targeting consumption can have significant lasting effect on real GDP, but after lags of 2 periods. Short-run impact of

consumption expenditure appears to affect GDP growth negatively after 2 lags for economy of Pakistan. This information is valuable as when monetary and fiscal policies aim to influence demand side of the economy.

Based on the findings of study, it may be suggested that consumption expenditure on GDP growth might be consequential reduction in the supply of loanable funds. Reduction of the supply of loanable funds can cause increase the cost of borrowing for these funds which might result in reduction for the demand of loanable funds by firms. Firms are often in need of private credit and any rise in its cost can be detrimental for economic growth. Future study should analyze the relationship between supply of loanable funds and consumption for economy of Pakistan.

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