TESTING THE VALIDITY OF WAGNER'S LAW IN PAKISTAN: AN APPLICATION OF ARDL COINTEGRATION TECHNIQUE

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Abstract

This study examines the validity of Wagner's law by employing the ARDL cointegration technique for the period 1976 to 2013 in Pakistan.This study also checks the causality between government expenditureand real gross domestic product (RGDP) by applying Engle Granger approach. The results show that the Wagner's law holds in Pakistan. The other main determinants of expenditure are trade openness, exchange rate and financial development. ECM coefficient is negative and statistically significant showing that short run dynamics converge towards equilibrium. The results of causality depict that there is unidirectional causality that runs from growth to expenditure, and not from public expenditure to growth. The policy implications of these results are that the government should be careful about its spending in future because the continuous increase in public expenditure can lead to further worsening of the budget deficit.

Keywords: Real Govt. Expenditure, Real Gross Domestic Product, Trade Openness,Financial Development, Exchange Rate, Pakistan

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Introduction

Adolph Wagner (1883) in his book, Grundlegung der Politischen Okonomie,presented a straightforward model formulated for finding the determinants of public expenditure. Wagner became the first economist who presented a positive correlation between the level of the country's development and size of its public sector. Economists and practitioners of public finance have been giving considerable attention to check the validity of Wagner's Law over 100 years. Since then, and particularly in recent decades, a variety of empirical studies have sought to test the validity of Wagner's law. Wagner's Law gained popularity in academic circles after the publication of the English translation of Wagner's work in 1958. Afterwards, it has been analyzed and tested by many researchers for developing and developed countries, for example, Musgrave (1969), Bird (1971), Mann (1980), Sahni and Singh (1984), Abizadeh and Gray (1985), Ram (1986, 1987),Abizadeh, S. and M. Youse. (1988), Henrekson (**1992**),Henrekson(1993), Murthy (1993), Ansari et al.(1997),Nakane & Resende (1999), Peters (2000),Huang (2006),Narayan et al. (2006), Babatunde (**2008**),Abul, K. M., & Nusrate, A. (2009), Pahlavani et al.(2011), Kesavarajah (2012), Bojanic (2013), Srinivasan (2013) and Santiago (2014).

As far as Pakistan is concerned, Rehman et al. (2007) examined the validity of Wagner's law using the time series data from 1973 to 2004. This study found the long run relationship between real government expenditure, per capita income, trade openness and financial development. Afzal & Abbas (2009) examined the validity of Wagner's law inPakistan using the data from 1960 to 2009. Wagner's law held and there was unidirectional causality from real income to real expenditures.Husnain & Mehmood(2010) examined Wagner's law by using both aggregated and disaggregated data on public expenditure in case of Pakistan for the period 1973 to 2006.Co integration test results showed that there did not exist any long run relationship between per capita real GDP and public expenditure either at aggregated or disaggregated level. Rauf et al. (2012) examined the validity of Wagner's law from 1979 to 2009. The study concluded that there was no long run relationship between public expenditure and national income at the aggregate level.Thus, there are mixed results about the validity of Wagner Law in Pakistan. Furthermore, there is also available fresh data up to 2013. Now this study aims at testing the validity of Wagner's law by using the most recent available annualtime series data in Pakistan from 1976 to 2013.This study also examines other determinants of public expenditure(trade openness, financial development, exchange rate).

The rest of the paper is organized as follows: section II discusses the literature review, while section III explains the data and methodology.The section IV presents the results and discussion, whereas the final section concludes the study.

Literature Review

Empirical evidence regarding the causal relationship between public expenditure and economic growth is mix. A large number of studies have tested the Wagner's hypothesis empirically both for developing and developed countries. Some of them are given below. Henrekson(1993) examined the validity of Wagner's law in Sweden during 1861 to 1990 and there was found no support of Wagner's law by using cointegration analysis. Whereas, Nakane & Resende (1999) examined the validity of Wagner's law from 1948-1993 in Brazil. The results showed that there was no support of Wagner's law in Brazilian economy.

Peters (2000) examined the application of Wagner's 'law' of expanding state activity to totally diverse countries in United States, Thailand, Barbados, and Haiti for the periods 1948-1995, 1952-1995, 1966-1995 and 1965-1995 respectively. The Engle Granger test supported the existence of Wagner's 'law' for only United States and

Barbados, while the Johansen procedure with an improved model supported the existence of Wagner's 'law' for all countries.

Huang (2006) tested the Wagner's Law for China and Taiwan using annual time series data covering the period 1979-2002. Study found that there did not exist any long-run relationship between government expenditures and output in China and Taiwan by using the Bounds test. Furthermore, Toda and Yamamoto's (1995) Granger causality test results also showed that Wagner's Law did not hold for China and Taiwan over this same period.

Narayan et al. (2006) tested the Wagner's law of increasing state activity using panels of Chinese provinces. Study found the support of Wagner's law for China's central and western provinces, but no support for Wagner's law for the full panel of provinces or for the panel of China's eastern provinces by using cointegration and Granger Causality testing approach.

Rehman et al. (2007) tested the existence of Wagner's Law in Pakistan for 1972-2004. In this connection the Johansen and Juselius (1990) Cointegration approach was used to test the long-run relationship between government expenditures and its determinants for Pakistan. Short-run dynamics were estimated by using the Error Correction Mechanism (ECM). Study found existence of Wagner's law and also found long-run relationship between government expenditures and the determinants like per capita income, openness of Pakistan's economy, and the financial development. There was positive relationship between Per capita income and financial development and negative one between trade openness and public expenditure.

Afzal & Abbas (2009) examined the validity of Wagner's law for Pakistan in 1960 to 2009. There held Wagner's law and unidirectional causality was found from real income to real expenditures. Husnain & Mehmood(2010) examined Wagner's law by using both aggregated and disaggregated data on public expenditure in case of Pakistan for the period 1973 to 2006. Co integration test showed that there did not exist any long run relationship between per capita real GDP and public expenditure either at aggregated or disaggregated level.

Pahlavani et al.(2011) examined the causal relationship between size of the government (measured as the share of total expenditure in GDP) and economic growth in Iran during the period of 1960–2008. Study found that economic growth is co integrated with size of government. So, economic growth is the long-run forcing variable on size of government. Also Granger causality approach showed that a unidirectional causal flowed from economic growth to size of government.

Bojanic (2011) examined Wagner's law by employing annual time-series data in Bolivia for the period 1940 to 2010. Study found by applying the cointegration technique that there existed long run relationship between government expenditures and economic growth. Bidirectional causality was found between income expenditure.

Dada & Adewale (2013) examined the validity of Wagner's Law in Nigeria during the period 1961to 2011. Study also examined the long run relationship and direction of causality between economic growth and government spending. The study found the existence of Wagner's law.

Fawwaz & Al-Sawai (2013) examined the relationship between real gross domestic product and government expenditures in Jordan for the period 1990-2010 by using vector autoregressive model (VAR). Unidirectional effect was found that ran from real government expenditures to real gross domestic product. The results did not support the Wagner's law, but supported the Keynesian's hypothesis, which indicated that expenditure was a part of the effective demand which affects the gross domestic product.

Srinivasan(2013) investigated the causal nexus between public expenditure and economic growth in India using cointegration approach and error correction model. The analysis was carried out over the period 1973 to 2012. The Cointegration test result confirmed the existence of long-run equilibrium relationship between public expenditure and economic growth in India. The empirical results based on the error-correction model estimate indicated one-way causality running from economic growth to public expenditure in the short-run and long-run supporting the Wagner's law of public expenditure. Santiago (2014) investigated Wagner's Law of a long-run tendency for government expenditure to expand at a faster rate than the pace of growth of national output in Chile, Colombia, Honduras, Panama, and Paraguay during the period 1980-2012. Study found evidence of a long-run relationship between gross domestic product and government expenditure in these countries. According to this study in all of countries there was existence of Wagner's law. Moreover, Granger pair wise causality tests showed causal relationship running from gross domestic product to government spending.

Data and Methodological Framework

Data

This study is using time series data for the period of 1976 to 2013 to test an applicability of Wagner's law in Pakistan. It is taken from Hand Book of State Bank of Pakistan 2013, Economic Survey of Pakistan, International Financial Statistics (IFS), Penn Word table and Federal Bureau of Statistics. The descriptiv statistics are given below:

Table 3.1.1:

Descriptive Statistics

	Real govt. expenditure	Real GDP	Financial development	Trade openness	Exchange rate
Mean	3.510063	3.812916	2.889149	10.96012	1.488274
Median	3.334710	3.675882	2.944415	11.13237	1.507603
Maximum	4.919443	4.860357	3.947378	13.04028	1.946010
Minimum	2.530834	2.965805	1.756332	8.573026	0.996074
Std. Dev.	0.661942	0.493969	0.659117	1.288164	0.325585
Skewness	0.460096	0.426170	-0.059156	-0.148008	-0.221858
Jarque-Bera	2.495277	2.278053	2.409557	2.150410	3.350640
Probability	0.287182	0.320131	0.299758	0.341228	0.187248
Sum	133.3824	144.8908	109.7877	416.4845	56.55442
Sum Sq. Dev.	16.21218	9.028207	16.07410	61.39653	3.922196
Observations	38	38	38	38	38

Methodological Framework

In Econometrics a variety of models have been employed and several proxies have been utilized for the Wagnerian variables (Bird, 1971; Gandhi, 1971; Michas, 1975; Abizadeh& Youse, 1988). Wagnerian argument suggests that government expenditures as a percentage of GDP is a function of real per capita GDP (Michas, 1975). Quantitatively, it has been postulated that

$$\frac{GE}{GDP} = F\left(\frac{RGDP}{POP}\right) \ldots\ldots\ldots..(I)$$

Where GE represents the nominal government expenditure, POP denotes total population, and GDP and RGDP are nominal and real national output, respectively. However, some other studies in testing Wagner's law utilized the following formulation (Goffman and Mahar, 1971; Musgrave, 1969).

$$RGE = F(RGDP) \ldots\ldots\ldots.(II)$$

GE and GDP are either real or nominal. As per the relationship the elasticity value of GE with respect to GDP is being expected to exceed unity to validate Wagner's law, postulating a faster rate of increase of government expenditure than national output. Another formulation is, for example, by Gupta (1967).

$$\frac{RGE}{POP} = F\left(\frac{RGDP}{POP}\right) \ldots\ldots\ldots\ldots..(III)$$

GE and GDP are in constant prices. Two more formulations have been suggested and empirically tested by Mann (1980):

$$RGE = F\left(\frac{RGDP}{POP}\right) \ldots\ldots\ldots (IV)$$

$$\frac{RGE}{POP} = F(RGDP) \ldots\ldots\ldots (V)$$

Wagner's Law is valid if the elasticity of public expenditure with respect to real gdp exceeds unity. Our model is the modified version of the (Goffman and Mahar, 1971; Musgrave, 1969) that is given as under:

$$LRGE = \beta_0 + \beta_1 LRGDP + \beta_2 LFD + \beta_3 LTO + \beta_4 LERT + \varepsilon_t$$

Where L shows variables are in log form.
RGE= Real government expenditures
RGDP= Real GDP
TO=Trade openness
ERT=Exchange rate
FD=Financial development

Before testing the Wagner's law, it is necessary to check the properties of time series step by step. If the data is non stationary, it gives spurious results.

Properties of Time Series Data

A data where the variables consist of two or more observations over the time is called time series data. There are different types of time series data, e.g., monthly, qannually, etc.uallytechniques, e.g.lots of techniques, e.g.Engel Granger, Johansen& Juselius and ARDL to find the short run and long runrelationship among variables.

Thus, it is very necessary to find the order of integration of the variables. Mostly time series data is non-stationary and non-stationary data give spurious results. There are different unit root tests to check whether data is stationary or non-stationary.

Stationary and Non-Stationary

In stationary time series shocks will be temporary and over the time their effect will be eliminated as the series revert to their long run mean values (Asteriou & Hall, 2006).
A stationary time series have three properties.

$$E(Y_t) = constant for all t$$

$$Var(Y_t) = constant for all t$$

$$Cov(Y_t, Y_{t+k}) = constant for all t \& k \neq 0$$

If time series data has constant mean, variance & covariance, then it is said to be stationary. It is very necessary to make sure that data is stationary; otherwise it will give spurious results. Mean and variance of non-stationary time series are not constant and depend upon time. Non stationary time series will give spurious results (meaning; signs of coefficient are not reliable and very high "t" ratio).Granger and New bold (1974) suggested following rule of thumb for detecting spurious regression. If $R^2 > DW$ then the regression must be spurious.

Unit Root Test

Mostly time series data is non-stationary at level. Non stationary data give spurious results. So the first and important step in time series analysis is to check unit roots. The other step is to check and detect the order of integration of each variable in the model. There are different methods for testing unit root for example: DF, ADF & PP test etc. This study used Augmented Dicky Fuller and Philip Perron test.

Augmented Dicky-Fuller (ADF) Test for Unit Roots

Augmented Dicky-Fuller (ADF) test is used to check the stationarity of each variable. ADF is an extension of DF test; it contains an extra lagged difference term of the dependent variable in order to eliminate autocorrelation among residuals. Lag length of extra term is either determined by Schwartz Bayesian Criterion (SBC) or by Akaike Information Criterion (AIC). The three forms of Augmented Dicky-Fuller (ADF) unit root test are provided in the followinglines.

Model 1 without intercept and trend

$$\Delta X_t = \gamma X_{t-1} + \sum_{i=1}^{p} \beta_i \Delta X_{t-i} + \mu_t$$

Model 2 with intercept but without trend

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \sum_{i=1}^{p} \beta_i \Delta X_{t-i} + \mu_t$$

Model 3 with intercept and trend

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + \alpha_2 t + \sum_{i=1}^{p} \beta_i \Delta X_{t-i} + \mu_t$$

Where

Δ =First difference operator

p = Lag operator

t =Time subscript

μ =The error term

This test is performed ata level and 1st difference. The null hypothesis is that the variable under estimation has unit root and alternative hypothesis is that there is no unit root. Decision rule for testing these hypotheses is:If t-statistics> ADF critical value, then the null hypothesis (H0: γ =0) is not rejected. It depicts that series is non stationary.If t-statistics< ADF critical value, then the null hypothesis is rejected. It shows that series is stationary.

The Phillip-Perron Test

The Philip-Perron test is a generalization of Augmented Dicky-Fuller (ADF) test which was developed by Phillips and Perron (1988). Phillip Perron (PP) test equation is given as under

$$\Delta X_t = \alpha_0 + \gamma X_{t-1} + e_t$$

PP test makes amendment to the t-statistics of coefficient γ in order to remove serial correlation in e_t(error term). PP test is a modification of ADF test that takes into account less restrictive nature of the error process.

Cointegration

The cointegration concept was first introduced by Granger (1981) and it was further explained by Engle Granger (1987), Engle & Yoo (1987), Stock & Watson (1988) etc. The main objective of cointegration is to discover the long run relationship among variables in the study. If there are two variable, then Engle Granger technique is the relevant technique. If series of the variable Y_t and X_t are stationary at first difference I (1) and error term from the cointegration regression is stationary at the level I (0), then the series and are co integrated of order I(1,0) (Hanson & Juselius(1995)).

$Y_t = \alpha + \beta X_t + e_t$ Where

$$e_t = Y_t - \hat{\alpha} - \hat{\beta} X_t$$

If there are more than two variable, then there are different techniques (Johanson Juselious Approach and ARDL Approach). If the integration of order is same for all variables, then Johanson Juselious cointegration technique is used. But if order of integration of all variables is not same, then ARDL is applied. In this study order of integration is I(0), & I(1), so this study applies ARDL technique.

An Autoregressive Distributed Lag (ARDL)

Two steps are taken to apply the ARDL approach in a stepwise style. In first step F-test which is highly sensitive to lag length for all first differenced variables is conducted [bahmani-Oskooee Goswami, (2003), bahmani-Oskooee and Nasir, (2004), naryan and naryan, (2007)]. In the second step F-test is applied to all of the models to determine the existence or nonexistence of cointegration among the variables being considered. Considering each of the variable as regressand, the unrestricted error correction regressions can be estimated. F-test is applied to find the presence of cointegration. The null hypothesis is that there is no existence of cointegrating relationship among the variables being considered. The alternative hypothesis is that there is a long run relationship among the variables.

$$\Delta LRGE_t = \alpha_0 + \sum_{i=1}^{\rho} \beta_i \Delta LRGE_{t-i} + \sum_{i=1}^{\rho} \delta_i \Delta LRGDP_{t-i} + \sum_{i=1}^{\rho} \varphi_i \Delta LTO_{t-i} + \sum_{i=1}^{\rho} \sigma_i \Delta LER_{t-i} + \sum_{i=1}^{\rho} \psi_i \Delta LFD_{t-i}$$
$$+ \lambda_1 LRGE_{t-1} + \lambda_2 LRGDP_{t-1} + \lambda_3 LTO_{t-1} + \lambda_4 LER_{t-1} + \lambda_5 LFD_{t-1} + \mu_t$$

Here Δ is the first difference operator.

The coefficients of first part such as: β, δ, φ, σ, and ψ represent the short run dynamics.The coefficients, λs represent the long run relationships between the variables.And μ_t is used for white noise error term in the model.

$$H_0 : \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$$
$$H_1 : \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$$

The non-standard F-test distribution relies on (i) whether incorporated variables have different order of integration, i.e., I (0) or I (1) in ARDL model; (ii) the number of regressors; (iii) whether, ARDL contains intercept and/ or a trend; and (iv) the sample size.

In ARDL approach, Pesaran *et al.* (2001) provides a pair of critical bounds values in which each pair shows different values at different level of significance. For instance, a set of one critical values (say, upper critical bound) assumes that all variables are integrated of order one. Another set of critical values (say, lower critical bound) supposes that all variables are integrated of order zero. In addition, these critical values are suitable for larger sample. On the other hand, Narayan (2005) and Turner (2006) have also provided the critical bounds values for a small number of observations ranging from thirty to eighty observations. This research study uses both critical bounds values of Pesaran *et al*., (2001) and Narayan (2005).If the computed F-statistic value is higher than the upper critical bound value, then a definite result of cointegration is possible, without knowing that underlying variables are integrated of order zero or one. On the contrary, the non-existence of cointegration is developed if computed F-statistic value is found smaller relative to lower critical bound value. Moreover, if the computed value of the F - statisticlies is lie within the range of upper and lower critical bounds, then the decision of cointegration is inconclusive.

Long Run Coefficients

When there is a long run relationship among the variable, then following equation are estimated following the ARDL model

$$\mathrm{LRGE_t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 LRGE_{t-i} + \sum_{i=0}^{n} \alpha_2 lRGDP_{t-i} + \sum_{i=0}^{n} \alpha_3 TO_{t-i} + \sum_{i=0}^{n} \alpha_4 LER_{t-i} + \sum_{i=0}^{n} \alpha_5 FD_{t-i} + \varepsilon_t$$

The lag length of the models underlying ARDL is selected using four different criteria such as Schwarz Bayesian criterion, Hannan and Quinn criterion, R-square criterion, and Akaike Information criterion. The estimation process is accomplished in Microfit software that selects the optimal lag length of the variables under inbuilt algorithm.

Error Correction Model

Error Correction Model approach is used to identify short run cointegration. First time this technique was applied by Sargan in 1964. Basically it is used to check the correctness of disequilibrium proportion from one period to the next period in an economic system (Engel & Granger, 1987).

The general form of ECM is as: $\Delta Y_t = \alpha_0 + \beta_1 \Delta X_t - \pi \hat{\mu}_{t-1} + v_t$

β_1= impact multiplier (short run effect)

π =feedback or adjustment effect

Impact multiplier measures the instant impact that change in X_t will have on change in Y_t & feedback shows how much of disequilibrium is being corrected.Where $\hat{\mu}_{t-1} = Y_{t-1} - \hat{\alpha} - \hat{\beta} X_{t-1}$ and this equation has $\hat{\beta}$ showing a long run response.Moreover, it is estimated by equation i.e,($\Delta Y_t = a_1 + a_2 \Delta X_t + u_t$).

The ARDL design of the short run dynamic can be resulted by building an error correction model of following form

$$\Delta \mathrm{LRGE}_t = \omega_0 + \sum_{i=1}^{n} \omega_1 \Delta LRGE_{t-i} + \sum_{i=0}^{n} \omega_2 \Delta lRGDP_{t-i} + \sum_{i=0}^{n} \omega_3 \Delta TO_{t-i} + \sum_{i=0}^{n} \omega_4 \Delta LER_{t-i} + \sum_{i=0}^{n} \omega_5 \Delta FD_{t-i} + \psi ECM_{t-1} + \varepsilon_t$$

Where ECM= Error correction term and it is defined as follows:

$$ECM_t = \mathrm{LRGE}_t - \alpha_0 - \sum_{i=1}^{n} \alpha_1 LRGE_{t-i} - \sum_{i=0}^{n} \alpha_2 lRGDP_{t-i} - \sum_{i=0}^{n} \alpha_3 TO_{t-i} - \sum_{i=0}^{n} \alpha_4 LER_{t-i} - \sum_{i=0}^{n} \alpha_5 FD_{t-i}$$

Where:

ΨECM_{t-1} Indicates the error correction term and Ψ shows speed of adjustment that is related to cointegration equation.

Engle Granger Causality Model

To investigate the causality pattern between government expenditure and real per capita GDP study consider the following system of equations.

$$\Delta LRGE_t = \sum_{i=1}^{m} \beta_i \Delta LRGE_{t-i} + \sum_{i=1}^{n} \alpha_j \Delta LRGDP_{t-i} + \mu_{1t} \; \ldots\ldots (1)$$

$$\Delta LRGDP_t = \sum_{i=1}^{p} \delta_i \Delta LRGE_{t-i} + \sum_{i=1}^{q} \lambda_j \Delta LRGDP_{t-i} + \mu_{2t} \; \ldots\ldots (2)$$

Where Δ is the first difference operator,

and β_i, α_j, δ_i and λ_j are parameters.

Unidirectional causality from RGDP (real gross domestic product) to RGE (real government expenditure) is run, if the estimated coefficients on lagged RGDP (equ.=1) are statistically different from zero as a group ($\sum_{i=1}^{n} \alpha_j \neq 0$) and the set of estimated coefficients on the lagged LRGE (equ.=2) is not statistically different from zero ($\sum_{i=1}^{p} \delta_i = 0$). Conversely, unidirectional causality from public expenditure to GDP is indicated, if the estimated coefficients on lagged RGDP (eq=1) are statistically not different from zero as a group ($\sum_{i=1}^{n} \alpha_j = 0$) and the set of estimated coefficients on the lagged LRGE (equ.=2) is statistically different from zero($\sum_{i=1}^{p} \delta_i \neq 0$). There is bidirectional causality when the sets of LRGDP and LRGE coefficients arestatistically significantly different from zero in both regressions.

Results and Discussion

Mostly time series data is non-stationary in level. Non stationary data give spurious results. So the first and important step in time series analysis is to check unit roots. The results are given in the table 4.1.

Table 4.1:
Unit Root Tests

Variables	Level				1st difference			
	ADF		PP		ADF		PP	
	Intercept With trend	Intercept Without trend	Intercept With trend	Intercept Without trend	Intercept With trend	Intercept Without trend	Intercept With trend	Intercept Without trend
FD	-1.03	-1.09	-2.58	-3.54**	3.69*	3.46**	4.19*	-3.83*
RGDP	-2.54	-2.12	-2.82**	-2.19	-3.01**	-3.22**	-5.84	-6.24
TO	-1.89	-2.11	-2.12	-1.09	-3.23**	-3.62**	-5.07*	-5.52*
RPGE	-1.71	-1.94	-3.33**	-2.82	-2.85**	-3.42**	-3.47**	-4.71*
ER	-1.31	-0.98	-1.12	-1.004	-2.82**	-3.24**	-4.99*	-5.13*

FD=Financial Development,RGDP=Real Gross Domestic Product, TO=Trade Openness,RPGE=Real Public Expenditure, ER=Exchange Rate

Note: without * values not significant at any level, * significant at 1% level of significance , **significant at 5% level of significance and * shows 10% level of significance**

The results of ADF and PP show that some variables are stationary at level, while the other variables are stationary at first difference. Thus integration of order is not same. So the ARDL technique is the relevant one for this data.

Bounds Test for Co-integration Model

Bounds test is applied for checking the cointegration among the variables. If F- statistics is greater than F- critical value of upper bound, then cointegration exists. The results are presented in table 4.2.

Table 4.2:
Bounds Test for Co-integration Model.

Variables	F- critical values		F-estimated value	Conclusion
	I(0)	I(1)		
F(LRGE/LTO, LFD, LERT, LRGDP)	3.21	4.16	6.88(0.01)	Co-integration

Results of bounds test illustrate that the long run relationships exist between the variables because the estimated value of F-statistics (6.88) lies above the upper bond (4.16).

Cointegration

The main objective of co-integration is to discover the long run relationship among variables in the study.Results are presented in table 4.3.

Table 4.3
Long run relationships using the ARDL approach
The Dependent variable is LRGE

Regressor	Coefficient	Standard Error	T-Ratio [Probe]
REAL GROSS DOMESTIC PRODUCT	1.39	0.11	12.62[.00]
FINANCIAL DEVELOPMENT	0.33	0.14	2.36[.03]
EXCHANGE RATE	1.24	0.44	2.78[.01]
TRADE OPPENES	-0.30	-0.09	-3.37[.00]
Int.	-0.41	0.43	-0.96[.35]

Note: All variables are in log form

The results show that the signs of all coefficients are according to theory. Elasticity ofpublic expenditure with respect to real GDP is greater than one that is 1.39%. It gives evidence of Wagner's law.Financial development and Exchange rate have significantly positiveeffect on government expenditures.Trade openness has significantly negative effect on real government expenditures. The results of this study are in line with those of Haung(2006), Rehman et al. (2007), Kappeler (2008), and Pahlavani et al.(2011), Dada &

Adewale(2013). When Trade openness increases by 1%, the public spending will decrease 0.30 %. The public spending increases by is 1.24 %, when there is one percent increase in Exchange rate. These expenditures increase by 0.33 %, when there is one percent increase in financial development. The public expenditures rise by 1.39 %, as gross domestic product increases by one percent.

Error Correction Model

Error Correction Model approach is used to identify short run co-integration. Basically it is used to check the correctness of disequilibrium proportion from one period to the next period in an economic system. (Engel & Granger, 1987). The results of error correction model are given in the following table 4.4.

Table 4.4:
Error Correction Representations for the Selected ARDL Model

The dependent variable is dLRGE **ARDL (1,0,0,1,0)**

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
Δ Real Gross Domestic Product	0.47	0.08	6.00 (0.00)
Δ Financial Development	0.18	0.05	3.28(0.00)
Δ Exchange Rate	0.34	0.07	4.51(0.00)
Δ TRADE OPENNES	-0.16	0.03	-6.33(0.00)
Δ inpt	-0.22	0.22	-0.95(0.35)
Ecm(-1)	-0.53	0.13	-3.95

Akaike Information Criterion = 94.14	R-Squared = 0.82
Schwarz Bayesian Criterion = 88.60	R-Bar-Square = 0.78
Durbin-Watson Statistic = 2.13	F-statistic = 26.61 [0.000]

The results show that the coefficient of error correction is negative and statistically significant at less than five percent. Value of ECM (-0.53) shows that the fifty three percent of disequilibrium from the previous year shock is converged to the equilibrium in the current year.

Engle Granger Causality test

The study also investigates the causality pattern between government expenditure and real GDP. Results are presented in table 4.5.

Table 4.5:
Engle Granger Results

Null Hypothesis:	F-Statistic	Prob.	Conclusion
LRGE does not Granger Cause LRGDP	0.28	0.60	Do not reject
LRGDP does not Granger Cause LRGE	6.54	0.01	Reject

Engle Granger results showthat there is unidirectional causality between government expenditure and real GDP. Real government expenditure does notgranger cause RGDP toincrease, butRGDP granger cause government expenditure to increase. These results are consistent with those of Huang 2006, Santiago 2014. Most part of the public spending is spent on non development expenditure that cannot increase RGDP but when growth increases it causes government expenditures to increase.

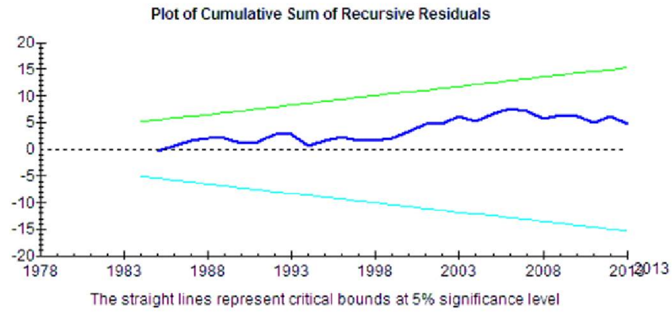
Model Diagnostics and Parameter Stability Tests

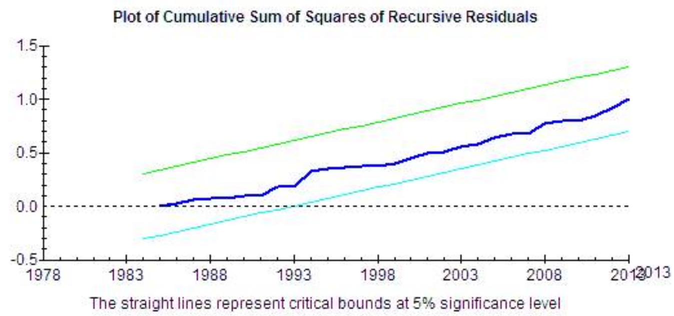
Diagnostic tests are applied on the estimated parameters underlying ARDL approach. The results of these tests are given in the following table.

Table 4.6
The results of Diagnostic Tests

	LM Version		F-Version	
Diagnostics	Statistic'sValue	P-Value	Statistic'sValue	P-Value
Serial Correlation	0.39	0.53	0.31	0.58
Normality	1.17	0.57	notapplicable	
Heteroscedasticity	0.06	0.81	0.05	0.81

The results show that there is no indication of any problem of autocorrelation or heteroscedasticity. The model passes the normality providing that the errors are normally distributed. To find the parameters stability the study applies CUSUM AND CUSUMSQ tests whose graphs are given below.





There are two upward sloping straight lines in the above both diagrams showing the critical lower and upper bounds at the 5 % significance level. The parameters stability is supported by these both diagrams because both CUSUM and CUSUMSQ residuals are moving within the critical bounds.

Conclusion

The results show that the elasticity of public expenditure with respect to real gross domestic product is more than one showing the existence of Wagner's law in Pakistan. The Study also concludes thatExchange rate, Trade openness and financial developments are other major determinants of the government expenditures in Pakistan. Exchange rate, real gross domestic product and financial development affect public expenditures positively, whereas the trade openness affects these expenditures negatively. Engle Granger results show that government expenditure does not cause real GDP to increase, but GDP causes public expenditure to increase. Negative value (-0.53) of ECM shows that about fifty three percent disequilibrium from the previous year is corrected in the current year.The policy implications of these results are that the government should be careful about its spending in future because the continuous increase in public expenditure can lead to further worsening of the budget deficit.

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