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Impact of Revenue Gap on Budget Deficit, Debt Burden and Economic Growth: An Evidence from Pakistan

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***Abstract*—**Availability and mobilization of revenue is the main essential with which an economy is managed and run. While planning or while making the budgets nations set revenue targets to be achieved. But later when the accounts are closed the actual collections of revenue through taxes or even the non-tax revenue collection would invariably be different as compared to the initial estimates and targets set to be achieved. This revenue-gap distorts the whole system and the economy disturbing all the major macro-economic indicators. This study is aimed to find out short and long term impact of revenue gap on budget deficit, debt burden and economic growth on the economy of Pakistan. For this purpose the study uses autoregressive distributed lag approach to cointegration and error correction mechanism on three different models for the period 1980 to 2009. The empirical results show that revenue gap has a short and long run relationship with economic growth and budget deficit. However, revenue gap has no impact on debt burden.

***Keywords*—**Revenue Gap, Economic Growth, Budget Deficit, Debt Burden

I. Introduction

TAX is a core instrument in the hands of the government to fulfill expenditures and it helps in acquiring sustained growth targets. The nature of taxes can help predict a growth pattern. Marsden [1] found that the overall tax burden is considered in explaining variations in economic growth. However, Kim [2] elaborated that Solow's [3] existing growth theory had not been encouraging of a government's capability to influence economic growth. In the leading Solow model, in which technical progress was the major determinant of the long-run per-capita income growth rate, tax policy could affect long-run income levels but not long-run growth rates. Endogenous growth models, however, re-opened the theoretical possibility that government tax policy can influence long-run growth rates. Among them are Lucas [4], Jones and Manuelli [5], Rebelo [6], King and Rebelo [7], Yuen [8], Kim [2] and Mankiw *et al*. [9]. These models endogenously determined that growth pace depends on the net rate of return from investment, which depends on tax rates. Therefore tax rates can influence the growth rate. So in this era of modern growth, tax is an important source of revenue for any government.

But for citizens, tax is always an unpleasant phenomenon both in developed and developing countries. People adopt different ways to avoid taxes and the revenue is missed from the pool of the government's revenue. An underground economy is generated. Schneider and Frey [10] focused on the fact that an underground economy would not only be labeled with illegality. Even if many of the activities are legal, taxes are evaded. Such missed revenue is due to poor performance or loopholes in a tax system.

Missing revenue hinders economic growth and ultimately per capita income will remain low especially in developing countries. Whereas, a higher per capita income shows a higher level of growth, indicating a higher capacity to pay taxes as well as a greater capability to charge and accumulate tax revenue [11].

Missing revenue or tax evasion occupies a considerable position in the poor performance of any country. In order to estimate the missing revenue or tax evasion, the difference between what a taxpayer owes as per the statutory tax rates and what the tax administration actually collects in a financial year is determined. This revenue gap is linked with the size of the underground or black economy.

Pyle [12] found that one of the implications of the subsistence of the underground economy was that some income remained untaxed and also definite indirect taxes were evaded. When there is a shortage of revenue and the amount of missing revenue is increased, the government has to adopt different ways to bridge up the budget deficit. Budget deficit and tax revenue are closely related theoretically as the studies of Barro [13] and [14] and Bender [15] showed.

Baffes and Shah [16] found bidirectional causality between budget deficit and revenue of U.S. For developing economies, tax revenue is a main source to cover budget deficit.

The missing revenue forces an economy to depend on debt, especially in developing economies. Pakistan, being a developing economy, has to manage the tax structure and tax revenue in such a way that sustained growth targets can be fulfilled. Pakistan's tax structure has some serious drawbacks which are the cause behind less or missing revenue.

Martinez [17] and Anwar [18] also emphasized the collection of taxes to sustain the economic growth. In Table I

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Pakistan's tax structure is compared with the tax structures of some developing countries by type of main tax as percent of total taxes.

It is evident that Pakistan's tax structure is similar to the other countries representing the average international norm. About 28 percent of Pakistan's tax revenue comes from income taxes, whereas the average value for the sample countries is close to 33 percent. As far as indirect taxes go, excluding taxes on international trade and including 10 percent revenues collected from surcharges on natural gas and petroleum, Pakistan collects 54.7 percent of indirect taxes relying on indirect taxes above the international norm. Income taxes in Pakistan are characterized by numerous exemptions and other special treatments of particular groups of taxpayers.

Tax revenue is far less; there are many reasons for it, like underground economy, tax evasion, smuggling and black market. Yasmin and Rauf [19] found that the underground economy and tax evasion affected Gross Domestic Product (GDP) negatively in Pakistan. Tax evasion or missing revenue creates serious problems and the government has less revenue to fulfill the budget deficit.

The budget deficit slowed down the pace of growth and debt increased rapidly. The Pakistan economy has experienced a turnaround since 2000. Growth has accelerated, and most macroeconomic indicators have improved. Public debt indicators have also shown significant improvement. Modest growth in public debt, coupled with strong growth in nominal GDP, led to a significant fall in public debt-to-GDP ratio, from 81.4 percent in 2001/02 to 56.1 percent in FY 2006. Martinez [17] over the same period, domestic public debt to GDP ratio fell from 40.4 percent to 29.9 percent, while the external public debt-to-GDP ratio fell from 41.0 percent to 26.2 percent. In fact, FY 2005-06 is the fifth successive year that the public debt-to-GDP ratio has improved. This is also the first time in more than two decades that the ratio has fallen below 60 percent [20]. No doubt debt helps in improving the rate of growth but more and more reliance on debt will minimize growth of a country.

TABLE I
PAKISTAN TAX STRUCTURE IN INTERNATIONAL PERSPECTIVE (2000)
(IN PERCENTAGE)

Country	Income and Payroll Taxes	Property Taxes	Indirect Taxes	Taxes on International	Trade Other Taxes
Pakistan	**28.1**	**1.2**	**44.7**	**16.0**	**10.1**
Hungary	36.1	2.6	55.6	4.0	1.7
India	37.3	0.1	37.3	25.1	0.2
Iran, Islamic Rep.	53.0	2.5	19.19	23.3	1.3
Israel	53.2	7.7	37.3	0.9	0.7
Jamaica	41.9	0.6	40.5	8.9	8.1
Kazakhstan	52.7	6.0	36.3	4.1	0.7
Moldova	17.5	6.1	68.9	7.5	0.1
Mongolia	28.4	0.1	56.2	10.1	1.3
Myanmar	34.5	0.0	58.2	7.2	0.0
Nepal	22.4	3.4	41.6	32.6	0.0
Nicaragua	17.1	-0.2	73.6	9.4	0.0
Paraguay	17.9	0.0	59.4	18.2	4.4
Peru	26.8	0.0	67.0	12.4	3.2
Poland	35.5	5.2	55.9	3.5	0.0
Romania	34.5	2.7	54.8	6.2	1.1
Russian Federation	33.2	4.5	44.4	13.0	0.1
Seychelles	26.7	0.1	7.8	63.1	2.3
Singapore	50.2	6.5	31.2	2.5	9.6
Slovak Republic	35.9	2.8	54.3	7.0	0.0
Slovenia	36.3	2.5	57.6	3.6	0.0
South Africa	54.0	5.8	34.8	3.1	0.7
Switzerland	58.1	12.3	28.6	1.1	0.0
Tajikstan	16.0	5.6	63.8	12.6	0.0
Thailand	32.2	2.3	53.1	11.9	0.5

Source: Statistics Division Ministry of Finance, Government of Pakistan (2003).

Hanif [21] and Siddiqui and Malik [22] found that both foreign borrowing and debt burden have negative and positive effect on growth. This study undertakes assessing the extent and degree of this missing revenue, which if duly collected and netted by the tax machinery, allows the government to increase revenue and, ultimately, Pakistan's growth. This, in turn, with greater public spending in areas of both development and non-development, brings about a more equitable distribution of income and allocation of this enlarged pie. It generates greater macroeconomic stability and balance. More sustained economic development is possible by the availability of enhanced and, hitherto, untapped sources of public revenue. This helps the economy to achieve greater self-reliance and avoid large public debts to minimize budget deficits. Without imposing high tariff and tax rates, government tax revenue collection ensures that the tax network is broadened which intern bridges the revenue gap, reduces debt-servicing ratio and puts the economy on the road to progress.

Pakistan has been struggling with falling tax revenues since its independence which caused severe impact on budget deficit, development, non-development expenditures and thereby economic downturn. Therefore, it is necessary to see empirically the impact of revenue gap on key variables of the economy i.e. budget deficit, debt burden and economic growth.

This study is divided into six sections. Section 2 reviews the relevant literature about missing revenue, budget deficit and debt burden. Section 3 explains methodology and empirical framework for the study. The sources of data are also indicated. In section 4, empirical results are given. In last section, the main findings of the study are presented. This section also presents some potential policy implications.

II. LITERATURE REVIEW

Many studies with regard to the subject of missing revenues taxes and tariffs have been considered in the literature review. However, most relevant renowned and important papers were selected for literature review. Many recent and latest and authentic papers and studies are included. The pattern adopted for literature review is that the objectives, methodology and

inferences of the papers under study have been discussed and summarized. Also very brief comments on the inferences of the papers have been added discussing the positive aspects and short comings of the papers, where possible further suggestions have also been made.

Yitzhaki [23] pointed out that income or substitution effect with regard to marginal tax rate depended on the fact whether penalty was imposed on the amount of income evaded or whether it was imposed on the tax-evaded. Mitchel [24] analyzed and compared methods of social control employed by governments and legislators. It was suggested that regulative potential of punitive taxation could simultaneously re-shape human conduct and be a new source of revenue for governments. However punitive taxation had inherent instrumental limits for tax laws could not be openly punitive. For the rich any amount of fine would be too low and would be cheerfully paid and would not be taken seriously as a standard of behaviour, mere tax penalty might be inappropriately mild unlike criminal law which was prohibitory. Not withstanding that minor wrong undeserving of prohibitory criminal penalties can be taxed increasing public revenue might be through coercive cost imposition, in contrast to the futility or destructiveness of prohibition and corporal punishment. This kind of regulatory infraction would be impersonal, and less expensive to administer.

Wang and Yip [25] examined the effect of consumption taxes, taxes on capital and on various factors of out-put. The impact of personal and corporate income taxes on the aggregate economic growth using endogenous growth theory was assessed.

Grossman [26] investigated the history of intermittent and continual increase in taxes on sin taxes. Those policy makers who advocated exorbitant increase in sin taxes to raise more and more revenue ignored the Laffer curve effect and substitution effect because people of different age groups and varied economic strength would react to price hike of sin taxes differently. The study concluded that a plausible feasible tax on cigarettes and alcohol would earn adequate revenue.

Burgess and Stern [27] stated impediments on taxing personal income in developing countries are many including problems of income measurement, administrative capability, low literacy and poor accounting, an economic structure dominated by agriculture and small scale often unregistered enterprises making difficult to tax incomes directly.

Robinson *et al.* [28] analyzed and interpreted the effects of changes in tariffs, direct and indirect taxes on revenue, prices, wages and welfare using general equilibrium models. The study gauged impact of the transformation from direct tax to indirect tax which is good for a developing country for Pakistan where tax-GDP ration is still 8 percent.

Winters [29] analyzed whether trade liberalization had positive or negative impact on poverty. It was stated that trade liberalization basically was aimed at improvement of the economy generally and poverty particularly was not the target. Ebrill and Grapp [30] stated that developed countries kept imposing trade restrictions like high tariffs and non-tariff barriers. Progressive elimination of non-tariff and tariff reduction would allow developing countries to amalgamate in international trade system.

Razeen [31] stated that less developed countries still have wide scope in further liberalization of tariffs as low tariff would reduce bias against tradable goods and shift productive resources in export sectors which in tern provide impetus to the economy. Kemal [32] analyzed that in the global village no economy or country can succeed by following isolationist policies and by being remaining a completely closed economy. Chaudhary and Anwar [33] tested the hypothesis that inflow of foreign capital would generally had been an accelerating force to economic growth the additional resources complementing local savings and increasing overall productivity involving real transfer of resources so that the borrowing country could gather momentum for improved economic growth and welfare.

Maingot and Mitchell [34] stated that international tax havens help depositors steal taxes and get away with black money. Tax havens support parallel black economies providing safe havens for the black money. Maingot further propounded that punitive measures against safe havens like Switzerland, Monaco, Guernsey-Gibraltar may be put in place internationally.

Beckmann [35] through a simple graphic presentation assessed the extent and impact of tax evasion utilizing the neoclassical pattern of theory of tax evasion.. The paper concluded that risk-neutral tax payer agent would only under-take risky evasion if expected return to evading an additional dollar of tax, was less than the expected return.

Kemal [36] tried to estimate, the underground economy and tax evasion in Pakistan. He used the monetary, fiscal and labour market approaches to measure the hidden economy. He took year 1973 as the bench mark and data on money supply upto 2002 using monetary approach. The study showed that for the 29 years each year underground economy and tax evasion increased 1.83 percent as percentage of GDP.

Slaughter [37] while discussing gradual tariff elimination for Industrial Goods stated that the gains in tax revenue flow and in competing internationally by going into areas of comparative advantage in trade will far out-weight the initial losses in trade taxes and tariff revenues when dependence on trade taxes and tariffs is reduced, in the long run.

Baunsgaard and Keen [38] stated in their paper that most developing countries and emerging markets heavily depended on trade tax revenues for generation of public finances, for budgeting the economy annually. Further trade liberalization by lowering the tariff rates and by bringing more openness in the economy immediately reduced the total amount of revenue collected. Unless alternative sources of revenue were developed like imposition of VAT and Sales Tax, and commodity taxes LDCs would not be able to bridge revenue gap.

Sandmo [39] in the paper analyzed the main themes of the theory of tax evasion. Whenever a tax would be levied there would be tax evasion. The paper very subtly encompassed the

themes related to public economics, the economics of uncertainty i.e. economics of tax evasion. Efforts were made to evolve an optimal tax design and the analysis of tax administration.

Nguyen *et al.* [40] analyzed public debt stabilization, how through a strategic dynamic interaction between monetary and fiscal policies the stability could be managed. How shortfall in budgetary collection because of tax corruption and tax gap impinge upon the economic performance of developing countries.

In conclusion the main results were that a developing country which had prevalent tax corruption and a weak tax related infrastructure would face a higher level of Public debt, lower level of public spending at the steady state and the speed of adjustment of public debt would be much slower than of an economy which did not have tax corruption and had an honest tax administration costing less.

This study is an addition to the above literature review which shed light on different aspects related to the relationship between revenue gap, budget deficit and debt burden. The present study is an attempt to examine the above relationships in case of Pakistani economy i.e. pioneer in this field.

III. Methodology

A. Unit Root Tests

The study is aimed to find out short and long run impact of revenue gap on economic growth, budget deficit and debt burden. For this purpose cointegration tests between these sets of variables are analyzed. Before starting the Cointegration tests, it is essential to check each time series for stationarity. If a time series in non-stationarity, the regression analysis done in a conventional way will produce spurious results. Therefore, in order to examine this property of time series, the unit root test is conducted.

A time series is considered to be stationary if its mean and variance are independent of time. If the time series is non-stationary, it is said to have a unit root. Therefore, the stationarity of a time series is examined by conducting the unit root test. Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) test methods are commonly used to examine the stationarity of a time series (for detail see Dickey and Fuller [41], Nelson and Plosser [42], Perron [43], Maddala and Kim [44] and Enders [45]).

Research by Hall [46] and Ng and Perron [47] and [48] show that the DF/ADF and PP unit root tests have low power to accept or reject the null hypothesis in small sample size. Ng and Perron [48] proposed four unit root test statistics that are calculated using generalized least squares (GLS) de-trended data for a time series variable to overcome the drawbacks of ADF and PP unit root tests. This test is suitable when dealing with small sample of size. Ng-Perron unit root test statistics have good power and size properties as compare to the widely used DF/ADF and Phillips-Perron (PP) unit root tests. For robustness DF/ADF and PP along with Ng-Perron unit root tests are utilized in the present study.

B. Cointegration

As stated earlier, the main objective of the study is to analyze the impact of revenue gap on various aspects of Pakistan's economy. For this purpose, the study of the relationships among relevant time series is essential in portraying the true picture of this impact. This section is dedicated to briefly explaining the methodological framework that investigates the short and long-term relationships among various time series related to this study. This section discusses the concept of cointegration and the reasons for employing the Autoregressive Distributed Lag (ARDL) modeling approach to cointegration as is used in this study.

The concept of cointegration is associated with the long-run equilibrium relationship between two or more variables. The economic interpretation of cointegration is that if two or more variables are linked to form an equilibrium relationship spanning the long run, even though the series themselves in the short run may deviate from the equilibrium, they will move closer together in the long-run equilibrium [49].

There are several methods available for conducting the cointegration test. The most widely used methods include the residual-based Engle-Granger [50], maximum likelihood-based Johansen [51] and Johansen-Juselius [52] tests. Due to the low power and other problems associated with these test methods, the OLS-based ARDL approach to cointegration has become popular.

The ARDL modeling approach pioneered by Charemza and Deaman [53], Pesaran and Pesaran [54], Pesaran *et al.* [55] and Pesaran and Shin [56] has numerous advantages. The main advantage of this approach lies in the fact that it can be applied irrespective of whether the regressors are I(0) or I(1) [54]. Another advantage of this approach is that the model takes a sufficient number of lags to capture the data-generating process in a general-to-specific modeling framework [57]. Moreover, a dynamic Error Correction Model (ECM) can be derived from ARDL through a simple linear transformation [58]. The ECM integrates short-run dynamics with the long-run equilibrium without losing long-run information. It is also argued that ARDL approach avoids problems resulting from non-stationary time series data [57]. As mentioned by Pesaran and Pesaran [54] that ARDL bounds cointegration can be applied irrespective of whether the are I(0) or I(1), however, in case of I(2) integration order of regressors, this approach is silent. Therefore, testing of unit root in time series variables is important to know the level of integration.

C. Data Sources and Empirical Framework

The data for the study are time series data covering the time period 1980-2008. They were gathered from the State Bank's Annual Report (1980-2008), Statistical Year Book of Federal Bureau of Statistics (1980-2008) and Economic Survey of Pakistan (2005-2009).

Following Romero-Avila and Strauch [59], Florio and

Colautti [60] most of the fiscal variables are measured as shares of GDP. Budgetary aggregates are classified according to an economic criterion rather than functionally.

To see the impact of revenue gap as a ratio of GDP on economic growth, budget deficit-to-GDP ratio and debt burden to GDP ratio, the following models are developed:

$$PGDP_t = \alpha_0 + \alpha_1\left(\frac{RG}{GDP}\right)_t + \alpha_2\left(\frac{FDI}{GDP}\right)_t + e_{1t} \ldots (1)$$

$$\left(\frac{BD}{GDP}\right)_t = \beta_0 + \beta_1\left(\frac{RG}{GDP}\right)_t + \beta_2\left(\frac{GE}{GDP}\right)_t + e_{2t} \ldots (2)$$

$$\left(\frac{DB}{GDP}\right)_t = \gamma_0 + \gamma_1\left(\frac{RG}{GDP}\right)_t + \gamma_2\left(\frac{GE}{GDP}\right)_t + e_{3t} \ldots (3)$$

where

t is time period

GDP_t is Gross Domestic Product

$PGDP_t$ is per capita GDP and taken as growth variable

RG_t is revenue gap

BD_t is Budget Deficit

FDI_t is foreign direct investment

GE_t is Government Expenditure

DB_t is Debt Burden

α's, β's and γ's are intercepts and coefficients in above models e_{1t}, e_{2t} and e_{3t} are usual error terms and independent from all independent variables.

FDI_t and GE_t to GDP_t ratio are included as explanatory variables in equations (1), (2) and (3) respectively, to avoid specification bias.

The ARDL specification of the above equations is as under to find empirical evidence of long-run equilibrium:

$$(1-L)PGDP_t = \alpha_{10} + \sum_{i=1}^{p}\alpha_{1i}(1-L)PGDP_t + \sum_{i=0}^{p}\alpha_{2i}(1-L)\left(\frac{RG}{GDP}\right)_{t-i} + \sum_{i=0}^{p}\alpha_{3i}(1-L)\left(\frac{FDI}{GDP}\right)_{t-i} + \lambda_{10}PGDP_{t-1} + \lambda_{11}\left(\frac{RG}{GDP}\right)_{t-1} + \lambda_{12}\left(\frac{FDI}{GDP}\right)_{t-1} + e_{4t} \ldots (4)$$

$$(1-L)\left(\frac{DB}{GDP}\right)_t = \beta_{10} + \sum_{i=1}^{p}\beta_{1i}(1-L)\left(\frac{DB}{GDP}\right)_{t-i} + \sum_{i=0}^{p}\beta_{2i}(1-L)\left(\frac{RG}{GDP}\right)_{t-i} + \sum_{i=0}^{p}\beta_{3i}(1-L)\left(\frac{GE}{GDP}\right)_{t-i} + \lambda_{20}\left(\frac{DB}{GDP}\right)_{t-1} + \lambda_{21}\left(\frac{RG}{GDP}\right)_{t-1} + \lambda_{22}\left(\frac{GE}{GDP}\right)_{t-1} + e_{5t} \ldots (5)$$

$$(1-L)\left(\frac{BD}{GDP}\right)_t = \gamma_{10} + \sum_{i=1}^{p}\gamma_{1i}(1-L)\left(\frac{BD}{GDP}\right)_{t-i} + \sum_{i=0}^{p}\gamma_{2i}(1-L)\left(\frac{RG}{GDP}\right)_{t-i} + \sum_{i=0}^{p}\gamma_{3i}(1-L)\left(\frac{GE}{GDP}\right)_{t-i} + \lambda_{30}\left(\frac{BD}{GDP}\right)_{t-1} + \lambda_{31}\left(\frac{RG}{GDP}\right)_{t-1} + \lambda_{32}\left(\frac{GE}{GDP}\right)_{t-1} + e_{6t} \ldots (6)$$

L is lag operator, α's, β's, γ's and λ's are intercepts and coefficients. e_{4t}, e_{5t} and e_{6t} are usual error terms and independent from all independent variables in above models. The first step in the ARDL based cointegration approach is to estimate equations (4), (5) and (6) using Ordinary Least Squares (OLS). The second step is to trace the presence of cointegration by restricting all estimated coefficients of lagged level variables equal to zero. The following hypotheses are tested for cointegration in the above equations by the means of F test with an asymptotic non-standard distribution:

For equation (4)
H_0: $\lambda_{10} = \lambda_{11} = \lambda_{12} = 0$ (no cointegration)
Ha: $\lambda_{10} \neq \lambda_{11} \neq \lambda_{12} \neq 0$ (cointegration)

For equation (5)
H0: $\lambda_{20} = \lambda_{21} = \lambda_{22} = 0$ (no cointegration)
Ha: $\lambda_{20} \neq \lambda_{21} \neq \lambda_{22} \neq 0$ (cointegration)

For equation (6)
H0: $\lambda_{30} = \lambda_{31} = \lambda_{32} = 0$ (no cointegration)
Ha: $\lambda_{30} \neq \lambda_{31} \neq \lambda_{32} \neq 0$ (cointegration)

Two asymptotic critical value bounds provide a test for cointegration, when the independent variables are I(d) with $0 \leq$ ḍ ≤ 1. The lower bound assumes that all the regressors are I(0) and the upper bound assumes that they are I(1). If the computed F-statistic lies above the upper level of the bound, the null hypothesis is rejected, indicating cointegration. If the computed F-statistic lies below the lower level band, the null cannot be rejected, supporting the absence of cointegration. If the statistics fall within the bound, inference would be inconclusive. After confirmation of the existence of a long-run relationship between the variables in the model, the long-run and short-run models can be derived using information criteria such as the Schwartz Bayesian or the Akaike Information Criteria.

IV. Empirical Results

A. Level of Integration

The study used annual time series data in empirical analysis covering the period 1980-2008. The annual variables are consolidated GDP per capita (as a proxy for economic growth), revenue gap, foreign direct investment, government expenditures, budget deficit and debt burden. The first step of the time series analysis is to investigate the properties of the series individually. The DF/ADF, PP and Ng-Perron unit root tests are applied to check the stationarity of each variable (discussed in previous section).

The results of unit root tests of time series are given in Table II, Table III, Table IV, Table V at level and first difference. The unit root tests indicate that $PGDP_t$, $(GE/GDP)_t$, $(BD/GDP)_t$, $(DB/GDP)_t$ and $(FDI/GDP)_t$ are non-stationary except $(RG/GDP)_t$ at level. However, $PGDP_t$, $(GE/GDP)_t$, $(BD/GDP)_t$, $(BD/GDP)_t$ and $(FDI/GDP)_t$ are

stationary at 1st difference or I(1). In each empirical model $(RG/GDP)_t$ is an explanatory variable which is stationary at level or I(0) and all other variables are stationary at first difference or I(1). In this situation ARDL or bounds testing approach proposed by Pesaran *et al.* [55] is more suitable as discussed in previous section. The total number of regressions estimated in each empirical model (4), (5) and (6) are $(4+1)^3 = 125$. The ARDL model for equations (4), (5) and (6) selected are (1,0,1), (1,2,0) and (4,0,3) respectively.

TABLE II
UNIT ROOT TEST AT LEVEL

Variables	DF/ADF Test		PP Test	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
$PGDP_t$	0.105(5)	0.675(5)	-0.015(1)	-0.086(1)
$(RG/GDP)_t$	-5.482[a](0)	-5.353[a](0)	-5.803[a](0)	-6.050[a](0)
$(GE/GDP)_t$	-0.509(0)	-1.888(0)	-0.537(1)	-1.816(2)
$(BD/GDP)_t$	-1.717(0)	-2.142(0)	-1.783(3)	-2.249(3)
$(DB/GDP)_t$	-0.705(0)	-0.484(0)	-0.864(2)	0.244(7)
$(FDI/GDP)_t$	-1.040(0)	-2.919(1)	-1.084(2)	-2.210(2)

Note: lag length of DF/ADF test and bandwidth of PP test are in parenthesis, a, b and c indicate 1%, 5% and 10% level of significance

TABLE III
UNIT ROOT TEST AT FIRST DIFFERENCE

Variables	DF/ADF Test		PP Test	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
$\Delta PGDP_t$	-5.038[a](0)	-5.008[a](0)	-6.047[a](1)	-6.121[a](1)
$\Delta(RG/GDP)_t$	-9.696[a](0)	-9.517[a](0)	-26.18[a](26)	-28.053[a](26)
$\Delta(GE/GDP)_t$	-4.869[a](0)	-4.911[a](1)	-4.862[a](6)	- 5.008[a](8)
$\Delta(BD/GDP)_t$	-5.939[a](0)	-5.814[a](0)	-5.947[a](1)	-5.820[a](1)
$\Delta(DB/GDP)_t$	-4.833[a](0)	-6.612[a](0)	-4.896 [a](2)	-6.686[a](2)
$\Delta(FDI/GDP)_t$	-4.396[a](0)	-4.337[b](0)	-4.184[a](3)	-3.936[b](4)

Note: lag length of DF/ADF test and bandwidth of PP test is in parenthesis, a and b indicate 1% and 5% level of significance

TABLE IV
NG-PERRON UNIT ROOT TEST AT LEVEL

Variables	Intercept			
	MZa	MZt	MSB	MPT
$PGDP_t$	5.12595	8.6052	2.67875	340.121
$(RG/GDP)_t$	-13.7579[a]	-2.62127[a]	0.19053[b]	1.7865[b]
$(GE/GDP)_t$	-1.12447	-0.54216	0.48214	14.616
$(BD/GDP)_t$	-5.17801	-1.01590	0.34650	5.0189
$(DB/GDP)_t$	-1.51994	-0.06913	0.45480	12.644
$(FDI/GDP)_t$	-1.8264	-1.27533	0.283747	4.5984
	Trend and Intercept			
$PGDP_t$	0.62433	0.21710	0.34773	38.1512
$(RG/GDP)_t$	-13.720[b]	-2.6016[a]	0.18962[b]	6.73972
$(GE/GDP)_t$	-3.9123	-1.3866	0.35442	23.1329
$(BD/GDP)_t$	-1.1745	-1.2902	0.29496	8.51239
$(DB/GDP)_t$	-1.3638	-0.5573	0.40864	38.0561
$(FDI/GDP)_t$	-1.2855	-1.0508	0.32715	5.23687

Note: a, b and c indicate 1%, 5% and 10% level of significance

TABLE V
NG-PERRON UNIT ROOT TEST AT FIRST DIFFERENCE

Variables	Intercept			
	MZa	MZt	MSB	MPT
$\Delta PGDP_t$	-14.4641[c]	-2.87652[a]	0.17075[a]	3.1056[b]
$\Delta(RG/GDP)_t$	-10.5254[b]	-2.29273[a]	0.21783[b]	2.3328[b]
$\Delta(GE/GDP)_t$	-25.0483[a]	-3.51967[a]	0.14052[a]	1.0408[a]
$\Delta(BD/GDP)_t$	-12.0640[b]	-2.54922[a]	0.18644[b]	2.7921[b]
$\Delta(DB/GDP)_t$	-12.7766[b]	-2.68431[a]	0.19444[b]	2.0814[b]
$\Delta(FDI/GDP)_t$	-14.4592[a]	-2.83311[a]	0.16592[a]	3.0970[b]
	Time trend and Intercept			
$\Delta PGDP_t$	-20.091[a]	-3.9634[a]	0.1605[b]	4.0563[c]
$\Delta(RG/GDP)_t$	-9.2087[b]	-2.1416[b]	0.2325[c]	4.0111[c]
$\Delta(GE/GDP)_t$	-28.237[a]	-3.7505[a]	0.1328[a]	3.2672[c]
$\Delta(BD/GDP)_t$	-28.896[a]	-3.7352[a]	0.1292[a]	3.5253[c]
$\Delta(DB/GDP)_t$	-12.065[b]	-2.4173[b]	0.2003[b]	3.7540[c]
$\Delta(FDI/GDP)_t$	-13.488[b]	-2.2103[b]	0.1638[a]	8.74714

Note: a, b and c indicate 1%, 5% and 10% level of significance

B. Revenue Gap and Economic Growth

The long run relationship or equilibrium can be examined using standard F statistic. The calculated F statistics are reported in Table VI alongwith 90% and 95% significance level. The sample size in this study is relative small. Therefore this study uses critical values given by Narayan and Smith [61] which are suitable for low sample size. If the computed F statistic is higher than upper bounds then the null hypothesis of no cointegration or long run equilibrium can not be accepted. If F statistic is lower than the lower bound then null hypothesis of no Cointegration or no long run equilibrium can not be rejected. If F statistic falls between lower and upper bounds then it can not be concluded. In our case calculated F-statistics (3.8603) is higher than upper bound (3.585) at 90% level of significance in 2nd case. This implies that long run equilibrium exists between $PGDP_t$, $(RG/GDP)_t$ and $(FDI/GDP)_t$.

The test statistics in Table VII indicate that the coefficient of control variable $(FDI/GDP)_t$ is negative when $PGDP_t$ is dependent variable but statistically not significant even at 10% level. This implies that there is no significant long run impact of $(FDI/GDP)_t$ on economic growth. The coefficient of revenue gap $(RG/GDP)_t$ is statistically significant at 10% level and there is a negative association between $PGDP_t$ and $(RG/GDP)_t$. This implies that a decrease in average revenue gap to GDP ratio leads to an increase in the economic growth. The underlying rational is that when government achieves targeted revenue and does not rely on internal and external sources to meet the revenue deficit the average economic growth increases.

TABLE VI
ARDL BOUNDS COINTEGRATION FOR EQUATION (4)
ARDL(1,0,1) MODEL SELECTED BASED ON SCHWARZ BAYESIAN CRITERION

F – Statistics	90% critical value bounds		95% critical value bounds	
	I(0)	I(1)	I(0)	I(1)
$F(PGDP)_t = 2.2306$	2.835	3.585	3.435	4.260
$F(RG/GDP)_t = 3.8603$				
$F(FDI/GDP)_t = 1.8632$				

TABLE VII
ESTIMATED LONG RUN COEFFICIENTS
ARDL(1,0,1) MODEL SELECTED BASED ON SCHWARZ BAYESIAN CRITERION

Dependent variable is $PGDP_t$			
Regressor	Coefficient	Standard Error	t-statistic
$(RG/GDP)_t$	-0.188	0.103	-1.821 (0.084)
$(FDI/GDP)_t$	-0.851	-0.506	-1.682 (0.108)
Constant	3405.6	2711.3	1.256 (0.224)
Diagnostic Tests			
χ^2 Serial Correlation = 0.56711 (0.451)			
χ^2 Functional Form = 2.6986 (0.100)			
χ^2 Normality = 1.3538 (0.508)			
χ^2 Heteroscedasticity = 0.98187 (0.322)			

Note: Probability values are in [ ]

The diagnostic tests are conducted and reported in table VII to determine the robustness of ARDL model. The diagnostic tests show that the ARDL model specification of (4) associated with revenue gap and economic growth model has robust results and it doest not violate the assumption of serial correlation, functional form biasedness, normality and heteroskedasticity.

Table VIII shows the results of Error Correction Model (ECM) with ARDL (1,0,1) model. The coefficient of ECT_{t-1} is statistically significant at 1% level having correct negative sign. This significance also confirms the short run cointegration relationship between variables. The coefficient of ECM_{t-1} is -0.10406, which indicates a speed of adjustment to the long run equilibrium after a short run shock. About 10.41% adjustment is taken place within one year if there is a shock.

Cumulative sum of recursive residual (CUSUM) and cumulative sum of squares of recursive residual (CUSUMSQ) stability tests results are plotted against 5 percent level of significance in figures 1 and 2 to ensure the stability of model. The plots of stability tests indicate that the model in general is stable over time.

TABLE VIII
ERROR CORRECTION REPRESENTATION
ARDL(1,0,1) MODEL SELECTED BASED ON SCHWARZ BAYESIAN CRITERION

Dependent variable is ΔPGDPt			
Regressor	Coefficient	Standard Error	t-statistic
Δ $(RG/GDP)_t$	19605.50	8761.800	2.2376 [0.036]
Δ $(FDI/GDP)_t$	-7422.50	32489.30	-0.2285 [0.821]
Constant	-354.374	314.7532	-1.1259 [0.273]
ECM_{t-1}	-0.10406	-0.023553	-4.4179 [0.000]
Adjusted R^2 = 0.86379			
F-statistics (3, 21)= 52.0672 [0.000]			

Note: Probability values are in [ ]

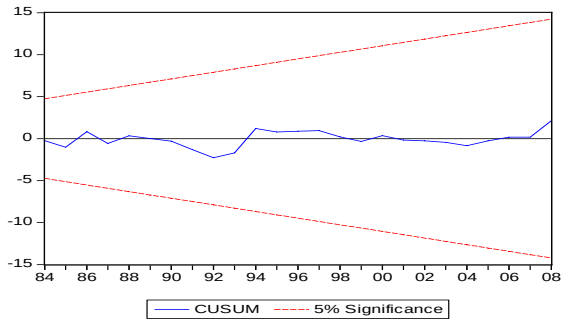

Fig. 1 Cumulative Sum of Recursive Residual on (4)

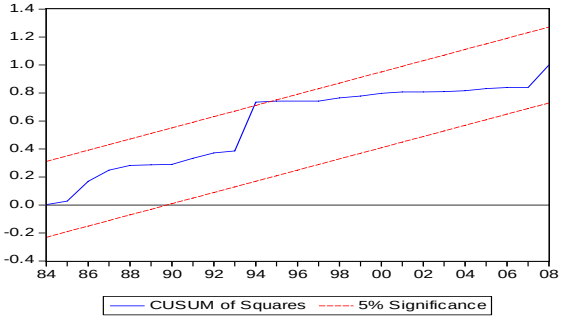

Fig. 2 Cumulative Sum of Squares of Recursive Residual on (4)

C. Revenue Gap and Debt Burden

The results of long run co-movement between debt burden and revenue gap are reported in Table IX The calculated *F*-statistic, when $(RG/GDP)_t$, $(DB/GDP)_t$ and $(GE/GDP)_t$ are dependent variables, are lower than critical values of lower bound at 5% and 10% level of significance. This indicates that null hypotheses of no cointegration between revenue gap and debt burden cannot be rejected. In other words there is no long run equilibrium or relationship between revenue gap and debt burden. Consequently, the short run equilibrium or relationship cannot be determined between these variables. However, in the long run the larger the debt burden the larger will be revenue gap and the debt servicing.

TABLE IX
ARDL BOUNDS COINTEGRATION FOR EQUATION (5)

F – Statistics	90% critical value bounds		95% critical value bounds	
	I(0)	I(1)	I(0)	I(1)
F $(DB/GDP)_t$ = 2.0669	2.835	3.585	3.435	4.260
F$(RG/GDP)_t$ = 0.9041				
F$(GE/GDP)_t$ = 0.7223				

D. Revenue Gap and Budget Deficit

One of the main objectives of this study is to see the impact of revenue gap on budget deficit. For this purpose empirical test based on ARDL bounds cointegration has also been conducted on equation (6) when budget deficit is explained variable and revenue gap and government expenditures are explanatory variables. The results of calculated and critical F-statistics are shown in Table X. The calculated F-statistic is greater than upper bounds at 10% level of significance and there is only one long run cointegrating vector when $(GE/GDP)_t$ is dependent variable. This indicates that null hypotheses of no cointegration between revenue gap and budget deficit cannot be accepted and there is long run equilibrium or relationship between revenue gap and budget deficit.

TABLE X
ARDL BOUNDS COINTEGRATION FOR EQUATION (6)
ARDL(4,0,3) MODEL SELECTED BASED ON AKAIKE INFORMATION CRITERION

F – Statistics	CV at 90%		CV at 95%	
	I(0)	I(1)	I(0)	I(1)
F $(BD/GDP)_t$ =2.6508	2.835	3.585	3.435	4.260
F $(RG/GDP)_t$ =1.8050				
F $(GE/GDP)_t$ =3.9241				

The long run coefficients are given in Table XI. The test statistics indicate that the coefficient of control variable $(GE/GDP)_t$ is positive and significant when $(BD/GDP)_t$ dependent variable is. This implies that there is a significant long run impact of $(GE/GDP)_t$, on $(BD/GDP)_t$. The coefficient of revenue gap $(RG/GDP)_t$ is statistically significant at 10% level and there is a positive association between $(BD/GDP)_t$ and $(RG/GDP)_t$. This implies that one unit increase in $(RG/GDP)_t$ leads to an increase in $(BD/GDP)_t$ on average by 0.1844 unit. This involves that when government achieves targeted revenue, the budget deficit reduces when government does not achieve targeted revenue budget deficit increases.

TABLE XI
ESTIMATED LONG RUN COEFFICIENTS
ARDL(4,0,3) MODEL SELECTED BASED ON AKAIKE INFORMATION CRITERION

Dependent variable is $\left(\frac{BD}{GDP}\right)_t$			
Regressor	Coefficient	Standard Error	t-statistic
$(RG/GDP)_t$	0.184	0.978	1.885 [0.084]
$(GE/GDP)_t$	0.629	0.047	13.467 [0.000]
Constant	-0.071	0.012	-6.101 [0.000]
Diagnostic Tests			
χ^2 Serial Correlation = 1.8211 [0.251]			
χ^2 Functional Form = 0.9455E-4 [0.992]			
χ^2 Normality = 0.63669 [0.727]			
χ^2 Heteroscedasticity = 1.9118 [0.208]			

TABLE XII
ERROR CORRECTION REPRESENTATION

ARDL (4,0,3) Model selected based on Akaike Information Criterion			
Dependent variable is ΔBDt			
Regressor	Coefficient	Standard Error	t-statistic
$\Delta(BD/GDP)_{t-1}$	0.915	0.329	2.780 [0.013]
$\Delta(BD/GDP)_{t-2}$	0.877	0.269	3.251 [0.005]
$\Delta(BD/GDP)_{t-3}$	0.715	0.213	3.368 [0.004]
$\Delta(RG/GDP)_t$	0.137	0.150	0.9140 [0.374]
$\Delta(GE/GDP)_t$	0.350	0.224	1.564 [0.137]
$\Delta(GE/GDP)_{t-1}$	-0.485	0.241	-2.015 [0.061]
$\Delta(GE/GDP)_{t-2}$	-0.339	0.239	-1.421 [0.174]
C	-0.118	0.037	-3.192 [0.006]
ECM_{t-1}	-0.166	0.038	-4.351 [0.000]
Adjusted R^2 = 0.70129			
F-Statistic (8, 16) = 3.2209 [0.022]			

Note: Probability values are in [ ]

Table XII shows the results of ECM with ARDL (4,0,3) model. The coefficient of ECT_{t-1} is statistically significant at 1% level and has correct negative sign which also confirms the short run cointegration relationship. The coefficient of ECM_{t-1} is -0.16619. About 16.619% adjustment is taken place within one year if there is a shock.

The diagnostic tests associated with ARDL model of revenue gap and budget deficit (6) are reported in table XI. The results indicate that the model is robust against the assumptions of serial correlation, functional form biasedness, normality and heteroskedasticity. Moreover, the stability tests (CUSUM and CUSUMQ) plotted in figures 3 and 4 which indicate that ARDL model (6) is stable and there is no structural break.

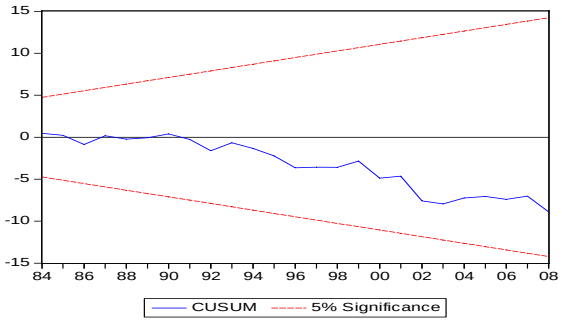

Fig. 3 Cumulative Sum of Recursive Residual on (6)

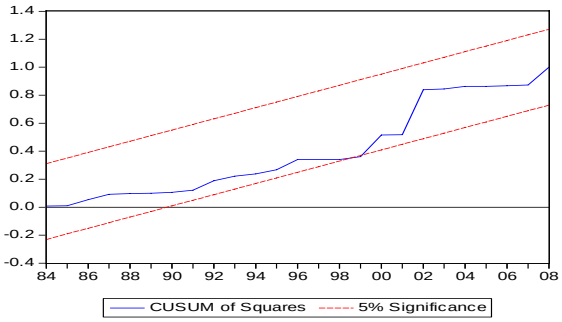

Fig. 4 Cumulative Sum of Squares of Recursive Residual (6)

V. CONCLUSIONS

The study is aimed to find out short and long term impact of revenue gap on budget deficit and debt burden. For this purpose short and long run cointegration tests between the variables have been analyzed such as ARDL and ECM for the period 1980 to 2008 on the economy of Pakistan. The annual variables are consolidated GDP per capita (as a proxy for economic growth), revenue gap, foreign direct investment, government expenditures, budget deficit and debt burden. The short and long run equilibrium found between revenue, economic growth and budget deficit. However, revenue gap has no impact on debt burden. The empirical results show that a decrease in average revenue gap to GDP ratio leads to an increase in the economic growth. In conclusion it is determined that if the missing revenue and the tax evasion is tapped efficiently by eliminating the exemptions relaxations and laxities in the system then most of the economic distortions can be eliminated without resorting to foreign and domestic borrowing and printing more and more currency notes which generate further distortions in the economy enmeshing the nations into heavy debt-trap ever yawning

budgetary and current account deficits and vicious circle of economic downturn, besides the cuts in development expenditure would not be made. Also to enforce the tax code and to implement the tax-reforms strong political backing is imperative and above all an honest effort to improve the economic plight must be there.

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