THE DEBT OVERHANG HYPOTHESIS: EVIDENCE FROM PAKISTAN

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Abstract:

This study investigates the debt overhang hypothesis for Pakistan in the period 1960-2007. The study examines empirically the dynamic behaviour of GDP, debt services, the employed labour force and investment using the time series concepts of unit roots, cointegration, error correlation and causality. Our findings suggest that debt-servicing has a negative impact on the productivity of both labour and capital, and that in turn has adversely affected economic growth. By severely constraining the ability of the country to service debt, this lends support to the debt-overhang hypothesis in Pakistan. The long run relation between debt services and economic growth implies that future increases in output will drain away in form of high debt service payments to lender country as external debt acts like a tax on output. More specifically, foreign creditors will benefit more from the rise in productivity than will domestic producers and labour. This suggests that domestic labour and capital are the ultimate losers from this heavy debt burden.

Key words: debt overhang, GDP, ECM, Pakistan

1. Introduction

Pakistan has currently accumulated a considerable amount of foreign debt to augment income and output. This debt has emerged from a deficiency of domestic capital needed to fund higher levels of government spending with inadequate domestic

financial resources, higher import bills and stagnant export revenues. With fiscal and current account deficits remaining common for Pakistan's economy over the last two decades, the government has had several options to fill its implied funding gap. Increasing the money supply, acquiring domestic & foreign resources and running down foreign exchange reserves have all been used as financial supplements. In most cases, however, this gap has been filled by foreign capital with some level of foreign borrowing also used to support income and output stabilization. External borrowing can usefully supplement domestic resources if used efficiently and honestly. In such cases, the debt can be repaid smoothly as the economy grows. In other cases foreign aid can help in economic restoration. However, these benefits can turn negative if accumulated beyond certain limits (Hameed et al 2008).

Most of the aid provided during the initial period of Pakistan's economic history was in the form of grants and soft loans. These were gradually transformed into hard term loans and this has saddled the country with a heavy debt burden (Afazal 1990). The rising magnitude of foreign debt suggests that much of the foreign capital was misallocated, harming the economy in many ways. A high and rising external burden is now seen as constituting a serious constraint on development; a major impediment to macroeconomic stability, economic growth and poverty reduction (GOP 2008).

In extreme cases excessive reliance on foreign debt may result in *Debt-Overhang;* a situation in which the stock of debt becomes large enough to threaten the country's ability to repay its borrowings (GOP 2007). Consequently investors lose confidence, eroding the investment environment. The high taxes imposed to meet the debt servicing obligation then become a heavy burden. This tax on the resources generated by a country (Ruiz-Arranz et al 2005) squeezes the quality and quantity of domestic and foreign investment. Pakistan's external debt figures appear alarming. External debt rose from 101.4 to 5,369 million US dollars between 1981 and 2010 and is now equal to approximately 63 percent of GDP.   Many economists claim that if external debt increases beyond 50 percent of GDP it may leads to *debt-overhang* which will hinder economic growth. Because Pakistan has already reached that stage the objective of this paper is to empirically investigate whether the predictions of the *debt-overhang* hypothesis are present.

Previous studies by Siddiqui and Malik, 2001; Chaudhary and Anwar, 2000, 2001; and Burney, 1988 have examined debt in relation to economic growth but without incorporating the time series properties of the data. This study analyzes the impact of external debt services on economic growth in Pakistan using a method that accounts for non-stationary behavior of the variables. To incorporate the time-series properties of the data it uses unit root, co-integration, and causality analysis and error correction model. The paper continues by providing in Section-II a brief review of literature, section-III examines the econometric methodology and data, section-IV presents the empirical estimation of the model, and section-V presents the conclusions of the study.

2. Literature Review

A series of brief summaries of the many studies conducted on the debt problem in Pakistan are presented below:

Afzal (1988) has analyzed the causes of excessive debt burden in Pakistan for the period 1950-1983 and points to three major reasons for excessive debt in Pakistan. First is the change in the composition of aid from grants and grant type of assistance to hard loans. Second is the poor economic performance and neglect of the agriculture sector in comparison with the industrial sector and third is the tied nature of aid which increases import bills thus contributing to the debt burden.

Afzal (1990) examined the character of foreign aid to Pakistan and its impact on economic development over the period 1950-86 and focused on the change in the composition of aid during those 36 years from aid to hard loans. He attributes these changes to a change in the foreign policy objective of aid donors, notably the USA. Throughout this period aid was used to realize external political interests rather than to stimulate the domestic resources of Pakistan.

Aslam and Anwer (2000) note the dependency on foreign aid of Asian countries and examine its impact on economic growth. However, their study focuses particularly on the problem of rising foreign debt in South Asia. They conclude that the debt servicing to GDP ratio for South Asian countries is alarming, suggesting that these countries are on verge of economic insolvency. If the present trend of borrowing were allowed the debt servicing of South Asian countries will increase up to 14% in 2014-15. Such high levels increase dependency on foreign economic assistance and in long run will lead South Asian countries to collapse.

Aslam (2000) examines the debt position of Pakistan and its retirement. That study points to a change in the composition and utilization of foreign aid across different eras. During 1950 to 1960, 70 percent of aid was in the form of non-returnable grants and only 30 percent were in the form of loans and credit. From that aid, 80 percent was spent on development while 20 percent were towards non-development expenditures. In 1980-1990 the situation was reversed: 80 percent of the aid package was now allocated to defense while the remaining 20 percent was allocated to development expenditure. To the extent that defense expenditures add little to the country's ability to repay its debt, the accumulation of foreign debt in that period may have been a burden rather than blessing.

Anwar (2000) discusses the poverty and unsustainability of the debt burden in Pakistan. He highlights the increase poverty that has arisen in response to the inability to repay external debt. By requiring adjustment in return for future assistance, the IMF and World Bank adjustment programs have played a major role in the massive increase of the poverty level. The IMF's demand to devalue the domestic currency against dollar in order to enhance exports has not been successful, with exports remaining stagnant due to weak commodity prices. The unavailability of this export surplus meant that devaluation only increased the value of existing debt obligations.

Further liberalization in such circumstances is seen as unfavorable and would likely lead to more macroeconomic instability and recession.

Idress and Saleem (2006) investigate the link between fiscal imbalance and inflation in Pakistan. Their study suggests that fiscal imbalance is soon converted into monetary mismanagement and inflation. Government has several domestic and external sources to finance fiscal deficits. Nevertheless, if government expenditures exceed its revenues, the financing of deficits through either external or internal sources will cause inflation. Their findings suggest a long relationship between inflation and deficits.

Fan (2007) also has investigated the public debt situation in Pakistan and concludes that debt has been an important source of government funding. The use of debt to achieve domestic economic targets however has relied on foreign debt for too long, creating a risky macroeconomic environment that has impeded economic growth. For example, public demand for debt increases the domestic interest rate and thereby crowding out domestic investment. Similarly the long period of dependency on foreign capital enlarged the volume of foreign debt, increasing the probability of default which, in turn, harms the country's international reputation.

Hameed (2008) examines the impact of external debt on Pakistan's economic growth for the period 1970-2003. He analyzed both the short and long run impacts of debt on economic growth. His findings suggest that there is long run relationship between economic growth and debt services, with the higher debt burden stemming from the misallocation of economic resources, the generation of macroeconomic imbalances, and through the loss of competitiveness in international market. Overall excessive debt affects adversely the economic development.

Chawla (2008) has noted the relationship between "Pakistan' and high defense spend". The purpose of her study was to analyze Pakistan's high defense expenditures from being an ally of USA. With Pakistan receiving enormous funds by playing a new role in US war against terrorism, Pakistan's economy received an artificial economic boom reflected in higher growth rates from 2003 to 2007. Despite these higher growth rates, the volume of defense expenditures increased more than growth rates which enlarged the volume of public debt as it reached 56 per cent of the GDP in 2008.

3. Econometric Methodology And Data

Following Cunningham (1993), we use neoclassical production function as given under:

$$LNGDP = \beta_0 + \beta_1 LNDS + \beta_2 LNK + \beta_3 LNL + e_t \ ... \ (1)$$

Where LNGDP = log of real gross domestic production (nominal GDP/P)
LNDS = log of debt services, the annual payment on external debt comprises the interest rate and principal amount of accumulated.
LNK = log of real gross investment (capital)

LNL = log of employed labour force

et = error term that satisfies the classical regression assumptions

The debt services is included in neoclassical production function, due the fact the debt service payment is collect on accumulated debt, which finances the domestic project; efficient utilization of the external debt will positively contribute to economic growth and DS will appear with positive sign. Alternatively misallocation of external resources will not improve economic growth and impede economic growth by debt servicing obligation hence the coefficient of the sign of DS would be negative. Empirical literature suggests that high debt services payments (above the 50 percent of GDP) will hinder economic growth. Since this study is analyzing the existence of debt overhang in Pakistan the expected sign of DS will be negative in our case.

Real GDP is obtained by deflating the nominal GDP by consumer price index, instead of using the labour force we have used the employed labour force in order to avert overestimation owing to unemployment. Because of non-availability of accurate data on capital stock, real gross investment has been used to represent the capital stock. Above equation assumes the existence of a possible long-run relationship between economic growth and the three inputs. Except for DS, the expected sign of the coefficients is positive.

We have employed multiple regression analysis for empirical assessment. Since this study is using long period time series data, therefore we must examine long run relationship amongst the included variables and cointegration techniques are normally used in literature. However before going to perform the cointegration test, we first check the stationary property of the data in order to overcome the problem of spurious regression and augmented Dickey–Fuller (ADF) unit root test has been used in this regard. The presence of unit root can be tested via using the following three different auto-regressive models.

$$\Delta Y = \gamma Y_{t-1} + \varepsilon_t \ldots \ldots \ldots (2)$$

$$\Delta Y = \beta_0 + \gamma Y_{t-1} + \varepsilon_t \ldots \ldots \ldots (3)$$

$$\Delta Y = \beta_0 + \beta_1 i + \gamma Y_{t-1} + \varepsilon_t \ldots \ldots (4)$$

Dickey Fuller (1979) test is mainly estimated to test the coefficient of Y_{t-1}. Instead of using usual t-test for coefficient he follows τ (tau) statistics which is known as Dickey Fuller test. This test suggest that if ($\gamma = 0$) Yt has a unit root indicating that time series is nonstationary, alternatively if ($\gamma < 0$) which imply that time series is stationary. This test is based on the assumption that error term (ε_t) is not correlated. However later they developed a new test in order to avert the problem of serial correlation which is known as Augmented Dickey Fuller (1981), ADF test. He included the lagged difference term of dependant (ΔY_t) , the above mention equation became

$$\Delta Y_t = \beta_0 + \beta_1 i + \gamma Y_{t-1} + \Sigma \beta_i Y_{t-\rho} + \varepsilon_t \ldots (5)$$

If the computed τ value is less than DF value or Mackinnon critical (τ) value than we will not reject the hypothesis H0: $\gamma = 0$, and the series has unit root indicating

nonstationary alternatively if τ > DF or Mackinnon critical τ value than one may reject the hypothesis of H0: γ = 0, which implies that series has no unit root or stationary.

Cointegration technique shows the long run relationship between variables. However there may be short run deviation from long run equilibrium therefore Error Correction Model (ECM) may be an appropriate tool to estimate such deviation. If cointegration exists then ECM will combine the long run relationship with short dynamic. I am using cointegration methodology suggested by Johansen (1991, 1995). Johansen's test is preferred from Engle & Granger (1987) due many statistical reasons notably identification of number of vectors. Johansen's methodology is estimated in VAR framework as follow

$$\Delta X = \mu + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + \Pi X_{t-1} + \varepsilon_t \ ... \ (6)$$

The residuals in Johansen methods are used to compute two likelihood ratios (LR) test statistics, which is used to determine the cointegrating vectors of X_t. Fist test which is based on hypothesis that the rank Π is less than or equal to cointegrating vector (r) and tested through trace statistics as follow

$$\lambda \ trace = - T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \ ... \ (7)$$

The second test is maximal eigen value, which testes the null hypothesis that there are exactly r cointegration vectors as follow

$$\lambda \ max = - T \ln(1 - \lambda_r) \ ... \ (8)$$

If the series are not cointegrated one may use Granger Causality. In bivicariate case the variable Y is in Granger Causality, if we take lag of X and lag of Y as independent gains, if it significantly improves the predication of Y, than one can say that X (Granger) Causes Y. A similar definition applies if Y (Granger) causes X. Bi-variate can be extended to multivariate causality in vector autoregressive (VAR) framework. (See Gujarathi, 2003 for detail), this shows that Granger Causality test is based on forecasting the value of Y on past value Y under ceteris paribus assumption. As following the equations

$$\Delta y_t = \alpha_0 + \alpha_1 \Delta y_{t-1} + ... + \alpha_n \Delta y_{t-i} + \beta_1 \Delta x_{t-1} + ... + \beta_m x_{t-j} + + \varepsilon_t \ ... \ (9)$$
$$\Delta x_t = \lambda_0 + \lambda_1 \Delta x_{t-1} + ... + \lambda_i \Delta x_{t-1} + \gamma_1 \Delta y_{t-1} + ... + \gamma_m y_{t-j} + \mu_t \ ... \ (10)$$

Causality can be determined via testing null hypothesis ($\beta_i = \gamma = 0$) of relevant coefficients of X_{t-1} and Y_{t-1}, There is bidirectional, unidirectional and no causality if β_i and Y_i are statistically significant, β_i and Y_i is statistically significant and both are

insignificant respectively(see Afzal 2007). Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Final Prediction Error (FPE) are used for lag selection criteria while F-statistic is Wald statistics used for joint hypotheses.

I have used the time series data for empirical estimation for period 1964 to 2007. All data on relevant variables were collected from Government of Pakistan (GOP), Economic Survey (various issues).

4. Estimation of results

The secondary data has been used for the empiric al estimation, which is easily available in Pakistan economic survey; for the period 1960 to 2007. Tabl-1 consist the OLS results:

Table. 1
Ordinary Least Squares Estimation

Dependent variable: LNGDP

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	3.52	0.52	6.69 [.000]
LNDS	-0.06	0.03	-1.57 [0.123]
LNINV	0.17	0.07	2.38 [1.021]
LN LF	1.38	0.38	3.57 [0.0009]

R-square = 0.98		Adjusted R = 0.96
F- statistics = 751.85		
Durbin-Watson stat = 1.80		Prob (F-statistics) = 0.00
Unit root test for residuals:		
Test statistics critical value		
-2.4200 -4.3681		

The table 1 shows regression results, which shows that GDP is negatively related with debt services, and positively related with investment and employed labor force, negative association of debt services postulates the fact that most of foreign economic resources were not properly utilized and wasted, the results indicate that each percent of US dollar debt service reduce the GDP by 0.06 percent, while on other hand each percent of investment increase the GDP by 0.17 percent and one percent employed labor force contribute to increase the GDP by 1.38 percent. Further investment and labor force are statistically significant, but debt services are statistically insignificant. R-square has high value indicating that there is strong relation between GDP and other variables like investment and labor force. However high R-square value does not sign of good fit, In time series data we always got high R-square which is the sign indicating robust relationship between variable may have strong tendency towards spurious regression dependency on the value of Durbin Watson (DW) value.

Since the estimated Durbin Watson d-test is used to investigate the autocorrelation and no autocorrelation has been found by comparing computed values

with lower and upper Durban value and thus concluded no auto correlation (either positive or negative) in the model. The unit root test for residuals show that computed values do not exceed the critical values which shows cointegration amongst the variables. However before computing cointegration test we first determine the order of integration via ADF unit root technique and later we reinvestigate the cointegraion test in Johansen framework. OLS estimation results show that the variables under consideration have corrected and expected signs, increasing debt servicing has adverse impact on GDP economic growth, though it is not significant, while investment and labor both has positive impact on economic growth.

Table 2.
ADF unit root test

	Level With Trend	First Difference With Trend
LNGDP	-3.15	-6.64
	(0.10)	(.000)
LNDS	-2.27	-2.59
	(0.43)	(.001)
LNINV	-1.05	-9.28
	(0.92)	(.000)
LN LF	-2.59	-6.78
	(0.28)	(.000)

1% = -4.19
5% = -3.52
10 % = -3.19

The first step in cointegration analysis is to test the stationary properties of variables under the consideration; Augmented Dickey Fuller (ADF) unit root test has used to detect the stationary properties of the included variables. Table -2 contains ADF test results, which show that all variables are stationary at first difference and got different results at 10% level from ADF. However the hypothesis that the variables are stationary at level is rejected by both level of significance and MacKinnon (1999) p-values. Therefore all the variables are indicated of order 1 and that they are nonstationary. Since the long period data it is likely to have trend stationarity so that only the deviation from the trend would be stationary.

Now we apply, Johansen (1991, 1995) test. Before applying the test we determined the lag order of the VAR by AIC, FPE and SC criteria. The former criteria supported log order 3 from VAR and cointegration results are shown in Table 3 and 4.

Table 3.
Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.561547	56.94768	47.85613	0.0056
At most 1	0.325319	22.31853	29.79707	0.2811
At most 2	0.091084	5.790889	15.49471	0.7201
At most 3	0.041491	1.779789	3.841466	0.1822

*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Trace test indicates 1 cointegrating equation at the 0.05 level of significance.

Table 4.
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
None *	0.561547	34.62915	27.58434	0.0053
At most 1	0.325319	16.52764	21.13162	0.1955
At most 2	0.091084	4.011099	14.26460	0.8582
At most 3	0.041491	1.779789	3.841466	0.1822

*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Max-eigenvalue test indicates 1 cointegrating vector at the 0.05 level.

Table 3 and Table 4 shows the results of unrestricted cointegration Rank test (trace) and unrestricted cointegration rank test (Maximum Eigenvalue). The hypothesis of no-cointegration (r = 0) is rejected by both trace and Eigenvalue. Therefore all the variables are cointegrated. The LNGDP and other included variables, PEF and AIC at lag-3 also suggests that two series are cointegrated. Since there is one-cointegrating, so there will be only one ROW.

Table 5
Vector Error Correction Model (VECM)

Error Correction	D(LNGDP)	Error Correction	D(LNGDP)
Coint equ: 1	0.18	D(LNINV(-1))	-0.29
	[- 2.82]*		[-3.47]
D(LNGDP(-1))	0.29	D(LNINV(-2))	0.017
	[1.28]		[0.20]
D(LNGDP(-2))	- 0.45	D(LNINV(-3))	0.05
	[-3.06]*		[0.64]
D(LNGDP(-3))	0.10	D(LNLF(-1))	-0.62
	[0.75]		[-2.93]
D(LNDS(-1))	-0.01	D(LNLF(-2))	0.34
	[-0.40]		[1.30]
D(LNDS(-2))	-0.05	D(LNLF(-3))	0.01
	[-1.84]		[0.04]
D(LNDS(-3))	0.05		
	[1.64]		

Note : Figures in parentheses with small brackets are t-statistics, * shows significance at 5 percent
Ericsson and MacKinnon (2002) critical values

1 % =	−5.9099
5% =	−5.2992
10% =	−4.9707

The error correlation term has correlated negatively and is significant at 5% level of significance. Beside the lagged times all also significant, indicating the directional causality between GDP and other included variable like employed labor and investment, which is also supported by Wald test in table 6.

Table 6.
Wald Test: For Variable GDP

Test Statistics	Value	df	Probability
Chi-squar	28.0212	3	0.0000

To summarize the short run coefficients seem significant at 5 percent level except DS probably due to significance at 10% level. Unit root analysis shows that all variables are integrated at first difference and cointegration results verify the existence of long run relationship between the included variables. Vector Error correlation indicated the causality between economic growth and debt services, investment and labor force although most of coefficients are insignificant. Wald statistics also pointed that all the explanatory variables (LNDS, LNLF, LNK) jointly affect economic growth significantly. Overall the empirical results indicated negative relationship between economic growth and debt services both in short run and long. This implies that debt

services have negative impact on the economic growth for the long run, which confirmed debt –overhang in Pakistan and the negative relation of debt services with GDP postulate the fact of misallocation of foreign economic resources.

5. Conclusion

The study has examined the debt-overhang hypothesis in Pakistan using the assumption that debt servicing forms part of the neo-classical production function on annual data for the period 1960-2007. The study has empirically analyzed the dynamic behaviour of GDP, debt services, employed labour force and investment using time series techniques of unit roots, cointegration, error correlation and causality. Both theoretical and empirical literature supports that if the debt services payment exceeds form 50 percent of GDP a country may face *debt overhang* situation. Since debt service payment of Pakistan also increase form 50 percent of GDP and the empirical findings of the study also suggest that the debt-servicing has negative impact on the productivity of labour and investment that in turn has adversely affected the economic growth that severely constrains the ability of the country to service debt and thus lending support to debt-overhang hypothesis in Pakistan. Johansen (1991, 1995) cointegration technique supported the existence of long-run relationship between debt services and economic growth, which implies that future increase in output will drain away in form of high debt service payments to lender country because debt services will act like a tax on output. More specifically, in persistence of such situation, foreign creditor will gain more benefits from the rise in productivity than domestic producers and labour. This suggests that domestic labour and capital will be the ultimate losers and foreign debt become a burden rather than blessing.

There is need to minimize fiscal imbalances and current account deficits, since a high debt burden is stemmed from both fiscal and current deficits. A necessary competitiveness should promote in order to mobilizing the domestic resources. There must be a proper check and balance of governmental project which might be helpful to prevent misallocation of foreign economic resource.

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Data Appendix

Variables	Descriptions
GDP	Real Gross Domestic production = real GDP is obtained by dividing nominal GDP_n on base year prices (GDP_n/P).
K	Capital or Investment = gross capital formation is used as a proxy for investment which is a net additions to the (physical) capital stock of a country.
L	Employed labor force = The share of the total labor force that is engaged in work.
DS	Debt services = The amount of money required to pay principal amount plus interest rate on accumulated external debt.
Data Source	All the relevant data used in the analysis are obtained form "*Pakistan Economic Survey* (various issues), Economic Advisor Wing, Finance Division, Islamabad, Pakistan.