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An empirical analysis of remittances-growth nexus in Pakistan using bounds testing approach

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This paper empirically examines the impact of remittances, exports, money supply (a broad measure for financial development) on economic growth in the context of Pakistan using bounds testing approach. Data set from 1976-2009 have been used for time series analysis. The result shows that remittances inflow and the lag effect of real output (Y_{t-1}) are significant in short run and long run. Remittances have a positive impact on economic growth of Pakistan in both the long run and short run. The short-run effect of remittances and exports are significant and contributing to about 0.034 and 0.078% to economic growth. However, money supply was found insignificant to contribute to growth. The low coefficient of error correction model implies a slow speed of adjustment after a shock from previous year, that is, approximately 29.0% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year. The results presented in this study reinforce the importance to government, academic, and policy makers.

Key words: Remittances, growth, financial sector, bound test, Pakistan.

INTRODUCTION

Remittances - transfers from international migrants to family members in their country of origin - represent one of the largest sources of financial flows to developing countries. Remittance is different from other external capital inflow like foreign direct investment, foreign loans and aids due to its stable nature, (Kapur and Singer, 2006; Shahbaz and Naveed, 2007). Similarly, remittances tend to go up when the recipient economy suffers an economic recession as result of financial crisis, natural disasters, or political conflicts as migrants send more during hard time for helping their families and friends (Orozco, 2003; World Bank, 2005; Ratha, 2007). On the other hand, other private capital flows, which frequently move pro-cyclically, raising in booms and decreasing in recessions (Ratha, 2003). International Monetary Fund (2005) also finds lower volatility of aggregate output, consumption and investment in nations with larger remittance inflows.

Remittances smooth consumption and contribute to the stability of recipient's economies due to macroeconomic shocks. In 2009, the recorded remittances sent by home migrant (Pakistan) reached to \$316 billion down 6% from \$336 billion in 2008. With improved forecast for the international economy, remittance flows to developing countries are likely to increase by 6.2% in 2010 and 7.1% in 2011 (Ratha, 2010).

Remittances are almost as large as FDI, and more than twice as large as the official aid received by developing countries (Gammeltoft, 2002; Ratha, 2007). Remittances are going to households and individuals. While other external sources such as foreign aid go to public agencies in recipient countries. Hence their effectiveness may therefore be hampered by corruption of government officials (Kapur, 2005). Remittances can improve a nation's creditworthiness and there by enhance its access to international capital markets for financing infrastructure and other development projects (Ratha, 2005; Yang, 2004; Woodruff and Zenteno, 2004).

The remittances of Pakistani migrants has played important role in the development of economy. Foreign exchange reserves has significantly stabilized Pakistan's

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financial sector (Shahbaz et al., 2008). During the oil shocks in the 1970s, the import bill increased and thus worsened the balance of payments problem (Afzal, 2008). On the other hand, the demand for workers from the Gulf countries increased. Therefore, by the end of the 1970s, UAE and Saudi Arabia were contributing over 20% of the total migrant remittances (Vaqaar, 2010). It remained one of the most important components of the balance of payments since late 1970's (Nishat and Bilgrami, 1991). This trend was sustained till 1980s. During 1980s, remittances had positive social and economic effects on household's recipient from Middle East. During this period it was also associated to a rapid decline in poverty levels (Anwar, 2004). During 1982-83, remittances were 10.06% of the GDP, and it financed 84.8 and 96.6% of the current account balance and trade deficit respectively (Burney, 1987).

The boom of 1980's reversed in the beginning of 1990's, partially due to return of the migrants from Iraq and Kuwait, due to the Gulf crisis. By 1990-1991, the inflow of migrants' remittances declined to US \$1848 million which reduced the proportion of Middle East from 86 to 67% in 1983-1984. Although in 1996-1997 the share of Middle East increased to 73% but total remittances decreases to Rs.1409 million (Government of Pakistan, 1998). The remittances again experienced slowdown during 1998 due to sanctions imposed, seizing of foreign accounts caused by nuclear explosions (Asghar and Ashfaq, 2004), and declined in confidence of several Pakistanis migrants on banking system (Haq, 2001).

During the 1990's, decline in remittance inflows is a major contributor in increasing poverty in Pakistan (Siddiqui and Kemal, 2002). Since, after September 11, 2001, remittances have increased very sharply and reached 4 billion dollars due to the additional external support provided by the United States helped increase the cushion of external reserves (World Bank, 2007). During this period the share of remittances increased from 13 to 30% from Pakistani migrant in United States (Azam, 2005). The inflows of remittance during 2000–2010 are started from around \$1 billion in 2000 and reached \$8.9 billion by 2010. The other external flows such as foreign direct investment and portfolio investment from abroad have decreased due to volatile political situation and shortage of energy (State Bank Pakistan, 2010). Pakistan has been reported as a top nation which has shown the highest growth in migrants, remittances in the world in spite of current global financial crisis (Muhammad and Ahmed, 2009). However, there is still inadequate knowledge about the way in which these international transfers affect economy in the migrant sending nations.

High, sustained economic growth is almost universally considered a necessary condition for improving the quality of life and reducing poverty. Pakistan has done considerably well in the past years and should continue

to do as data showing that consumption, partially fuelled by transfers from abroad, drove strong growth from 2002-2007. However, exports and investment, which hold better potential to drive high sustainable growth, lagged far behind the growth of consumption. Pakistan's exports increased more than 100% from \$7.5 billion in 1999 to stand at \$18 billion in the financial year 2007-2008 (Economic Survey of Pakistan, 2009).

The financial market witnessed excessive liquidity that was diverted towards boosting consumption through consumer financing. There was hardly any concerted effort to divert a major chunk of remittances towards manufacturing, agriculture or agro-based industries either by the government or by commercial banks. It resulted in developing inflationary pressures that was further aggravated because of expansionary fiscal policy of the government, soon after coming out of the IMF bailout package by end of 2004. In 2008, prices of essential commodities and food items hit new peaks. The cumulative effect of all these factors pushed the inflation to a record high of 25.4% in August 2008 (Qazi, 2010).

The objective of this study is to examine the impact of remittance, exports and broad money supply on economic growth of Pakistan. More specifically to:

Estimate whether there is a long-run relationship between economic growth and remittances in Pakistan. Estimate the dynamic short-run parameters (obtained by error correction model) in Pakistan.

LITERATURE REVIEW

Remittances are global phenomenon and there has been considerable debate on the development impact of remittances on economic growth, financial sector development, saving, consumption inequality, poverty reduction and human capital development. However, there are concerns whether remittances could have significant and positive impact on economic growth. Existing evidence of the impact of remittances on economic growth is limited and provides mixed results. A large number of studies have been carried out to show how remittances affect economic growth. Some suggested remittances affect economic growth via exports or financial development process of the country. Ledesma and Piracha (2001) conclude that migrants' remittances have positive effects on productivity and employment through its effects on investment and consumption for Central and East European (CEE) countries.

Glytsos (2002, 2005) estimated a dynamic, simultaneous Keynesian type model for investigating the impact of remittances on consumption, investment, imports and output for eight countries including Algeria, Egypt, Greece, Jordan, Morocco, Portugal, Syria and Tunisia for the period of 1969-1993 and then further extended in the other study that is, 1969-1998. The same findings of both the study point out that the effect of

Table 1. Economic growth during first five decades.

| Decades/ Year | Economic growth (%) |
|---------------|---------------------|
| 1960s | 6.8 |
| 1970s | 4.8 |
| 1980s | 6.5 |
| 1990s | 4.6 |
| 2000s | 4.8 |

Source: Economic Survey of Pakistan, 2009-2010.

remittances on growth is partial and in several years negative impact of remittances to growth is observed.

Chami and Jahjah (2003) found that migrants' remittances have negative impact on growth in per capita incomes. The study reported three stylized facts: first, that a "significant proportion, and often the majority," of remittances are spent on consumption; secondly, that a smaller part of remittance funds goes into saving or investment; and thirdly, the ways in which remittances are typically saved or invested - in housing, land and jewelry - are "not necessarily productive" to the economy as a whole. Guilano and Arranz (2005) criticized Chami et al. study, for not taking into account endogeneity problem. The study found that remittances improve credit constraints on the poor, improve the allocation of capital, substitute for the lack of financial development and thus accelerate economic growth. Iqbal and Sattar (2005) found that in the absence of worker remittances, it was likely that exchange rate, monetary and fiscal policies will come under pressure.

Quarthey (2005) found that remittances positively impact economic growth and reduced poverty in Ghana. Cattaneo (2005) found that remittances are typically spent on investment in physical assets as well as investment on human capital such as education and health, which promotes growth. Natalia et al. (2006) investigated the impacts of remittances and economic growth by using the Dynamic Panel Data analysis. They found positive impact of remittances on economic growth. They also concluded that a sound institutional environment can affect the volume and efficiency of investment.

Jongwanich (2007) examined the impact of workers' remittances on growth and poverty reduction in developing Asia-Pacific. The results suggested that, while workers' remittances have a significant impact on poverty reduction through increasing income, smoothing consumption and easing capital constraints of the poor, but they have marginal impact on growth working through domestic investment and human capital development. Fayissa and Nsiah (2008) have investigated the impact of remittances on economic growth for 37 African countries. The study showed that migrant' remittances as well as institutional variable have positive impacts on economic growth.

Rukshana and Nadeem (2008), has investigated the relationship between poverty and workers' remittances

for the period of 1973-2006. Their study found that remittances bring a decline in poverty for the said period. Barajas et al. (2009) examined the effect of remittances and economic growth; they conclude that migrants' remittances have contributed slightly to economic growth in remittance recipients nations. Rao and Hassan (2009) explain the effects of remittances on growth by using the Solow growth model. The study finds that migrant remittances have positive but marginal effect on growth. Kumar (2010) investigate the relationship between remittance inflow and economic growth of the Philippines by using the Bounds test analysis. They find that remittances have positively affected economic growth.

Studies conducted by Habib and Nourin (2006) for analyzing the relationship between remittance and economic growth in the context of South and South East Asian economies by using simultaneous equations model under the concept of panel data least-squares dummy variable regression model. Their results shows an inverse relationship between remittances and real GDP in the perspective of Thailand, Sri Lanka, India and Indonesia, while found positive impact of remittances on real investment for Bangladesh, Pakistan and Philippine. One reason for the similarity in results is the use of different research techniques in both papers, as we used time series cointegration technique in individual country case assessments in which country shocks are absorbed and data are refined accordingly.

Both remittances and growth have been a focal point in Pakistan, hence there is a pressing need to evaluate and analyze the remittances-growth nexus and to find out the inter-relationship. In the subsequent sections an effort has been made to empirically find out the long-run relationship between remittances and growth in the context of Pakistan over a period of 1976-2009.

OVERVIEW OF ECONOMIC GROWTH, REMITTANCES, EXPORTS AND MONEY SUPPLY IN PAKISTAN (1976-2009)

Economic growth

The long-run path of economic growth is one of the central questions of economics. An increase in GDP of a country is generally taken as an increase in the standard of living of its inhabitants. Pakistan's economy has gone through a various stages of decline and high economic growth over the first six decades (1960-2010). Table 1 shows economic performance over the last five decades in Pakistan.

Pakistan's average economic growth rate since independence has been higher than the average growth rate of the world economy during the period. Average annual real GDP growth rates were 6.8% in the 1960s, 4.8% in the 1970s, and 6.5% in the 1980s. Average annual growth fell to 4.6% in the 1990s with significantly lower growth in the second half of that decade (Economic

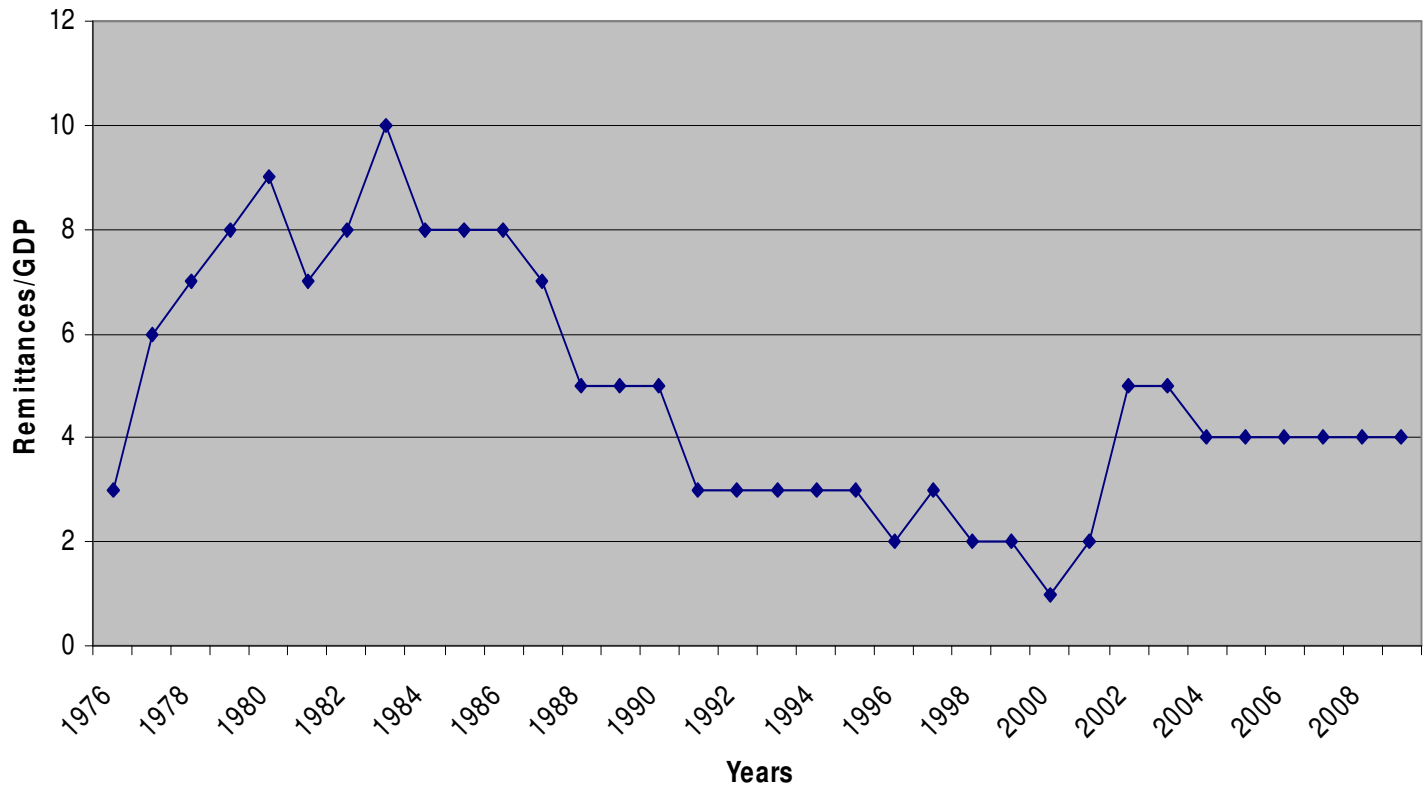


Figure 1. Trend analysis of remittances in Pakistan (1976-2009). Source: WDI (2009).

Survey of Pakistan, 2010).

Remittances

The remittances of Pakistanis living abroad has played important role in Pakistan's economy and foreign exchange reserves. The Pakistanis settled in Western Europe and North America is important sources of remittances to Pakistan. Since 1973 the Pakistani workers in the oil rich Arab states have been sources of billions dollars of remittances. The remittance inflows during the period of 2000- 2010 are around \$1 billion in 2000 and had reached more than \$9 billion by 2010. In 2005–2006, official remittances reached \$4.6 billion, an increase of 10% over the previous year (State Bank of Pakistan, 2006). In 2006-2007 Pakistan received \$ 5.493 billion as remittances. In 2007-2008 the remittances were estimated \$6.5 billion (State Bank of Pakistan, 2008). In FY10 the remittances were estimated at record of \$8.906 billion, an increase of 14% compared to the FY 2009. The trend continued to show a rising amount of \$791.19 million was received in the first month (July 2010) of the current fiscal year 2010-2011 (FY11), showing rise 6.22% over the similar period of the previous fiscal year. Figure 1 shows a tendency of remittances as percentage of GDP over a period of 1976-2009 in the specific context of

Pakistan.

Exports

Pakistan's exports increased more than 100% from \$7.5 billion in 1999 to stand at \$18 billion in the financial year 2007-2008. Pakistan's exports as percentage of GDP rising from 12.4% in 1980s to 16.1% in 1990s. In the decade 2000, there is a decline up to 1.2% from last decades (2000s-14.8%). Figure 2 shows exports performance as percentage of GDP over a 34 years period.

Money supply (M2)

The oldest and most extensively used sign of financial development is the ratio of liquid financial liabilities to GDP, for instance, the ratio of M2 to GDP or the relative amount of domestic money banks' assets to GDP (King and Levine 1992, 1993). Figure 3 shows the trend analysis of money supply (a broad measure for financial development) as percentage of GDP for Pakistan over a period of 1976-2009. The trend clearly shows increasing money supply in the Pakistan economy from 37% in 1970s to 39% in 1980s and further increase in 41% in

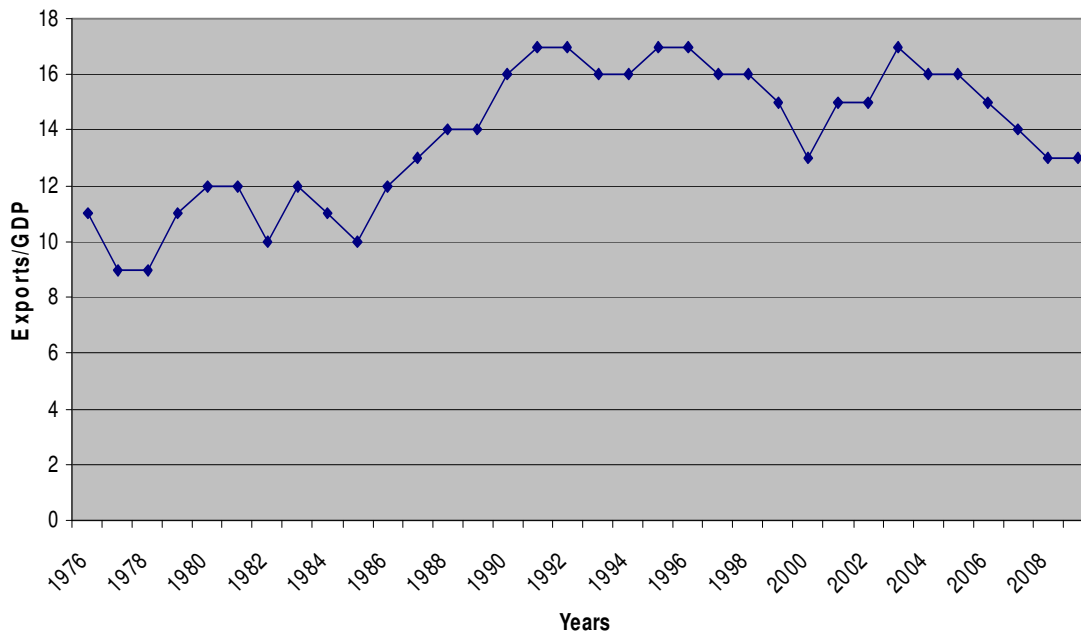


Figure 2. Trend analysis of exports of performance in Pakistan (1976-2009). Source: WDI (2009)

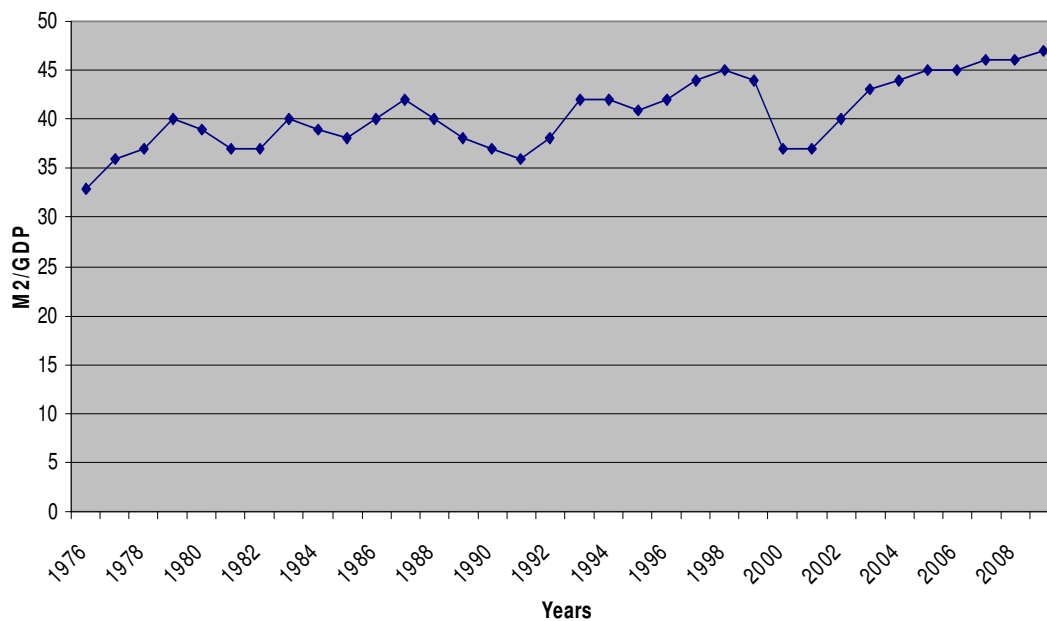


Figure 3. Money supply in Pakistan (1976-2009). Source: WDI (2009).

1990s to 43.6% in 2000s.

Remittances in crises

International remittances have played a significant role in livelihoods in the wake of the earthquake that hit northern Pakistan in October 2005. A large number of people from

the earthquake-affected areas of the Khyber Pakhtunkhwa (KPK) province and Kashmir live abroad and, although remittance flows were severely disrupted by the earthquake, they recovered relatively quickly. The widespread destruction and damage inflicted on the economy means that external sources of income such as remittances will be vital to recovery, both for individual households and for the country as a whole. In 2005–2006

(the year of the earthquake), official remittances reached some \$430 million, an increase of over 10% over the previous year (State Bank of Pakistan, 2006). It is important to stress that estimating remittance flows accurately is fraught with difficulties, and the data needs to be treated with great caution. The main sources of overseas remittances are Saudi Arabia, the United Arab Emirates (UAE), the UK and the US.

DATA SOURCE AND METHODOLOGICAL FRAMEWORK

All aggregate annual data are sourced from World Development Indicators published by the World Bank (2009). Since the number of observations is not large enough for estimating a long-run remittance and output model, we resort to the autoregressive distributed lag (ARDL) procedure, developed by Pesaran et al. (2001).

The hypothesized model specification is as follows:

$$LY_t = f(LREM_t, LEXP_t, LM2_t, D_{05}) \quad (1)$$

Where:

LY_t = GDP in million of US Dollars in constant prices;

$LREM_t$ = Remittances as percentage of GDP;

$LM2_t$ = M2 as percentage of GDP (a proxy for financial development);

$LEXP_t$ = Exports of goods and services as percentage of GDP;

D_{2005} = Dummy variable for natural calamity (earth quake) in Pakistan. D_{2005} assigning one for 1976-2004 and zero for 2005-2009.

Analytical framework

We use the Cobb Douglas production function specification to formulate the following output equation for Pakistan for the period of 1976-2009.

$$Y_t = C_t REM_t^\alpha EXP_t^\beta M2_t^\theta D_{2005}^\pi \quad (2)$$

Where α , β , and θ are elasticity coefficients with respect to REM (remittances), EXP (exports of goods and services), and M2 (money and quasi money), as a percentage of GDP respectively. From equation (2), an explicit estimable function is specified after taking the natural logarithms on both sides, hence as follows:

$$\ln Y_t = c + \alpha \ln REM_t + \beta \ln EXP_t + \theta \ln M2_t + \pi D_{2005} + \varepsilon_t \quad (3)$$

Where all coefficients and variables are defined, c as a constant parameter and ε_t is the white noise error term. The signs of all the coefficients are expected to be positive in (3) except π , which has a negative effect. Because we assume that the earth quake dummy is going to negatively impact on growth only in the short-run, we therefore do not explicitly specify it in Equation (2). However, we

include the dummy in the short-run dynamic specification later on. Equation (3) represents the long-run equilibrium relationship and may form a cointegration set provided all the variables are integrated of order 1, that is, $I(1)$.

ARDL model specification

This section summarizes the autoregressive distributed lag (ARDL) model, or bounds testing approach (Pesaran et al., 2001), which we take up to check the existence of short and long-run relationships between growth, remittances, export and money supply in the specific context of Pakistan. Econometric theory designate a set of variables is cointegrated if there is a linear combination among them without stochastic trend. In this case, a long-run relationship subsists between these variables. However, this implication is only valid if the obligation of the same order of integration has been met. Assume an explanatory variable, which is stationary at level is regressed with another variable, which is non-stationary at level but is first-difference stationary, then this will capitulate a spurious regression and thereby give a deceptive and erratic conclusion.

The use of the bounds technique is based on three validations. First, Pesaran et al. (2001) advocated the use of the ARDL model for the estimation of level relationships because the model suggests that once the order of the ARDL has been recognized, the relationship can be estimated by OLS. Secondly, the bounds test allows a mixture of $I(1)$ and $I(0)$ variables as regressors, that is, the order of integration of appropriate variables may not necessarily be the same. Therefore, the ARDL technique has the advantage of not requiring a specific identification of the order of the underlying data. Thirdly, this technique is suitable for small or finite sample size (Pesaran et al., 2001).

Following Pesaran et al. (2001), we assemble the vector autoregression (VAR) of order p , denoted VAR (p), for the following growth function:

$$Z_t = \mu + \sum_{i=1}^p \beta_i z_{t-i} + \varepsilon_t \quad (4)$$

where z_t is the vector of both x_t and y_t , where y_t is the dependent variable defined as economic growth (Y), x_t is the vector matrix which represents a set of explanatory variables that is, Remittances (REM), Export (EXP), Broad Money Supply (M2) and t is a time or trend variable. According to Pesaran et al. (2001), y_t

must be $I(1)$ variable, but the regressor x_t can be either $I(0)$ or $I(1)$. We further developed a vector error correction model (VECM) as follows:

$$\Delta z_t = \mu + \alpha t + \lambda z_{t-1} + \sum_{i=1}^{p-i} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{p-1} \gamma_i \Delta x_{t-i} + \varepsilon_t \quad (5)$$

Where:

Δ is the first-difference operator. The long-run multiplier matrix λ as:

$$\lambda = \begin{bmatrix} \lambda_{YY} & \lambda_{YX} \\ \lambda_{XY} & \lambda_{XX} \end{bmatrix}$$

The diagonal elements of the matrix are unrestricted, so the selected series can be either I(0) or I(1). If $\lambda_{YY} = 0$, then Y is I(1). In contrast, if $\lambda_{YY} < 0$, then Y is I(0).

The VECM procedures described previously are imperative in the testing of at most one cointegrating vector between dependent variable y_t and a set of regressors x_t . To derive model, we followed the postulations made by Pesaran et al. (2001) in Case III, that is, unrestricted intercepts and no trends. After imposing the restrictions $\lambda_{YY} = 0, \mu \neq 0$ and $\alpha = 0$, the remittances-growth nexus can be stated as the following unrestricted error correction model (UECM):

$$\Delta(\ln Y)_t = \beta_0 + \beta_1(\ln Y)_{t-1} + \beta_2(\ln REM)_{t-1} + \beta_3(\ln EX)_{t-1} + \sum_{i=1}^p \beta_5 \Delta(\ln Y)_{t-i} + \sum_{i=0}^q \beta_6 \Delta(\ln REM)_{t-i} + \sum_{i=0}^r \beta_7 \Delta(\ln EX)_{t-i} + u_t \dots \dots \dots (6)$$

Where Δ is the first-difference operator and u_t is a white-noise disturbance term. Equation (6) also can be viewed as an ARDL of order (p, q, r, s). Equation (6) indicates that economic growth tends to be influenced and explained by its past values. The structural lags are established by using minimum Akaike's information criteria (AIC). After regression of Equation (6), the Wald test (F-statistic) was computed to differentiate the long-run relationship between the concerned variables. The Wald test can be carry out by imposing restrictions on the estimated long-run coefficients of economic growth, remittances, exports and money supply. The null and alternative hypotheses are as follows:

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \text{ (No long-run relationship)}$$

Against the alternative hypothesis

$$H_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0 \text{ (A long-run relationship exists)}$$

The computed F-statistic value will be evaluated with the critical values tabulated in Table C1 (iii) of Pesaran et al. (2001). According to Pesaran et al. (2001), the lower bound critical values assumed that the explanatory variables x_t are integrated of order zero, or

I(0), while the upper bound critical values assumed that x_t are integrated of order one, or I(1). Therefore, if the computed F-statistic is smaller than the lower bound value, then the null hypothesis is not rejected and we conclude that there is no long-run relationship between remittances and growth variables. Conversely, if the computed F-statistic is greater than the upper bound value, then growth-remittances nexus has a long-run level relationship. On the other hand, if the computed F-statistic falls between the lower and upper bound values, then the results are inconclusive.

In the second step, once cointegration is established the conditional ARDL (p1, q1, q2, q3) long-run model for Y_t can be estimated as:

$$\ln Y_t = \beta_0 + \beta_1 \sum_{i=1}^{p1} \ln Y_{t-i} + \beta_2 \sum_{i=0}^{q1} \ln REM_{t-i} + \beta_3 \sum_{i=0}^{q2} \ln EXP_{t-i} \dots \dots \dots (7)$$

Before we start with the long-run specification, we need to determine the lag order of VAR. This can be done using the hypothesis testing of lag order of VAR, Here we include the

D_{2005} in this specification so that it can be specified in the short-run specification. This involves selecting the orders of the ARDL (p1, q1, q2, q3) model in the four variables using either Akaike information criteria (AIC) or Schwarz Bayesian criteria (SBC). We will use the former.

In the third step, the short-run dynamic parameters are obtained by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta \ln Y_t = \beta_0 + \gamma_1 \sum_{i=1}^p \Delta \ln Y_{t-i} + \nu_j \sum_{j=1}^q \ln REM_{t-j} + \sigma_k \sum_{k=1}^q \Delta \ln EXP_{t-k} + \kappa_l \sum_{l=1}^q \Delta \ln M2_{t-l} + \omega_m \sum_{m=1}^q D_{2005} + \vartheta ECM + \varepsilon_t \dots \dots \dots (8)$$

Where $\gamma, \nu, \sigma,$ and κ are the short-run dynamic coefficient model's convergence to the equilibrium and ϑ , which is expected to have a negative coefficient, is the speed of adjustment to equilibrium.

RESULTS AND DISCUSSION

For unit root test, the standard Augmented Dickey-Fuller (ADF) and DF-GLS unit root test was exercised to check the order of integration of these variables. The DF-GLS test is a simple modification of the conventional augmented Dickey-Fuller (ADF) t-test as it applies to generalized least squares (GLS) de-trending prior to running the ADF test regression. We used intercept without trend option with automatic AIC lag selection criteria. The results obtained are reported in Table 2. Based on the ADF and DF-GLS test statistic, it was found that all variables have a unit root that is, All variables are non-stationary at level but stationary at their first difference, therefore, the order of integration of the variables are I(1).

Bound tests for cointegration

In the first step of the ARDL, we tested for the presence of long-run relationship in Equation (5), using (6). We used a Hendry's general-to-specific modeling approach and selected the maximum lag order of 4 for the conditional ARDL-VECM. Following the procedure in Pesaran et al. (2001), we first estimated an OLS regression for the first differences part of Equation (6) and then tested for the joint significance of the parameters of the lagged level variables when added to the first regression. The OLS regression in the first differences is of no direct interest to bounds cointegration test. The F-statistics test the joint significance of the null hypothesis of the lagged level variables which are equal to zero that shows no long-run relationship exists between the variables. Table 3 reports the results with F-statistics when each variable is considered as a dependent variable (normalized) in ARDL-OLS regressions. Based on the Pesaran et al. (2001) and Narayan (2005), all four model specification that is,

Table 2. Unit root test.

| Variable | ADF | | DF-GLS | |
|----------|---------------|-------------------|---------------|-------------------|
| | Level | First difference | Level | First difference |
| LY | -2.192845 (1) | -3.720932 (0) *** | -0.319057 (1) | -3.589773 (0) *** |
| LREM | -1.826427 (0) | -6.019842 (0) *** | -1.663766 (0) | -4.036881 (0) *** |
| LM2 | -1.637434 (2) | -5.301807 (0) *** | -0.551243 (2) | -3.966512 (0) *** |
| LEXP | -1.719479 (0) | -6.321565 (0) *** | -1.499933 (0) | -2.693528 (1) *** |

Notes: The ADF critical values are based on McKinnon (1996). The optimal lag is chosen on the basis of the Akaike information criterion (AIC). The null hypothesis for both ADF and DF-GLS is that a series has a unit root (non-stationary). The asterisk ** and *** denotes the rejection of the null hypothesis at 5 and 1% level of significance respectively.

Table 3. Results of bounds test.

| Dependent variable ^a | Computed F-statistics | | Outcome | |
|---------------------------------|---|--------------------------|------------------------------------|--------------------------|
| $F_Y (LY, LREM, LEXP, LM2)$ | 38.636*** | | Cointegration | |
| $F_{M2} (LM2, LREM, LEXP, LY)$ | 18.316*** | | Cointegration | |
| $F_{REM} (LREM, LM2, LEXP, LY)$ | 10.060*** | | Cointegration | |
| $F_{EXP} (LEXP, LREM, LM2, LY)$ | 13.347*** | | Cointegration | |
| | Pesaran et al. (2001) ^b | | Narayan (2005) ^c | |
| Critical value | Lower bound value | Upper bound value | Lower bound value | Upper bound value |
| 1% | 4.29 | 5.61 | 4.614 | 5.966 |
| 5% | 3.23 | 4.35 | 3.272 | 4.306 |
| 10% | 2.72 | 3.77 | 2.676 | 3.586 |

Critical value bounds with $k=3$; ^b Critical values are obtained from Pesaran et al. (2001), Table CI (iii) Case III: Unrestricted intercept and no trend, p. 300. Critical values are obtained from Narayan (2005), Table case III: unrestricted intercept and no trend, p. 10. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively.

F_Y, F_{REM}, F_{EXP} and F_{M2} are significant at 1% level. Thus the null hypothesis of no cointegration is rejected, implying long-run cointegration relationships between them.

Once a long-run cointegration relationship was identified, we used unrestricted VAR option to determine the order of VAR for the cointegration analysis. We started with the initial order as 4 and specified the dynamic equation with intercept only. The results showed, from the highest AIC, SBC and significant adjusted LR test, the order of VAR as 0 (Table 4). We also tested for lag test including D_{2005} (not reported here) and found similar results with order of VAR as 0.

The long-run Equation (7) was estimated with ARDL (0,0,0,2) specification. The result obtained by GDP (Y_t) in the long run are reported in Table 5. The result shows that remittances inflow and the lag effect of real output (Y_{t-1}) are significant at 1% level. Therefore, a 1% rise in remittances is expected to contribute about 0.02% to

GDP.

The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the ECM Equation (8) are given in Table 6. The results in Table 5 shows that the lagged effect of real output is statistically significant at 1% level, indicating the effectiveness of previous year's pro-growth policy in the current year. The short-run effect of remittances and exports are significant at 1 and 5% level, contributing to about 0.034 and 0.078% to economic growth. The error correction coefficient (ECM_{t-1}), estimated at -0.29 is statistically significant at 1% and has the correct sign. However, the low coefficient implies a slow speed of adjustment after a shock from previous year, that is, approximately 29% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year. Further, we find coefficient of D_{2005} , the proxy for natural calamity (earth quake) to be negative and small, however, not statistically significant. This could plausibly be due to remittances acting as an insurance or

Table 4. Lag length selection criterion.

| Lag selection | | | | | |
|---|----------|------------|------------|----------|-----------|
| Test statistics and choice criteria for selecting the order of the VAR Model : | | | | | |
| Based on 29 observations from 1976 to 2009. Order of VAR = 4 | | | | | |
| List of variables included in the unrestricted VAR: Δ LY Δ LREM Δ LEXP Δ M2 | | | | | |
| List of deterministic and/or exogenous variables: C | | | | | |
| Order | LL | AIC | SBC | LR | FPE |
| 0 | 145.7271 | -9.774285* | -9.585693* | NA* | 6.69e-10* |
| 1 | 159.7863 | -9.640435 | -8.697473 | 23.27035 | 7.75e-10 |
| 2 | 173.3434 | -9.471958 | -7.774625 | 18.69942 | 9.85e-10 |
| 3 | 181.8984 | -8.958511 | -6.506808 | 9.440024 | 1.99e-09 |
| 4 | 202.5834 | -9.281614 | -6.075541 | 17.11861 | 2.17e-09 |

* Indicates lag order selected by the criterion, LR: Sequential modified LR test statistic (each test at 5% level). Final prediction error (FPE); Akaike information criterion (AIC) and Schwarz information criterion (SBC).

Table 5. Estimated long-run coefficient.

| Estimated long run coefficients using the ARDL approach ARDL(0,0,0,2) selected based on Akaike information criterion | | | | | |
|--|-------------|------------|-------------|--------|--|
| Dependent variable is LY | | | | | |
| 34 observations used for estimation from 1976-2009 | | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. | |
| C | 0.157620 | 0.183214 | 0.860306 | 0.3972 | |
| L(Y(-1)) | 0.977231 | 0.016709 | 58.48399 | 0.0000 | |
| L(REM(-1)) | 0.022033 | 0.008021 | 2.746969 | 0.0106 | |
| L(EXP(-1)) | 0.040132 | 0.027793 | 1.443981 | 0.1602 | |
| L(M2(-1)) | 0.002937 | 0.058094 | 0.050549 | 0.9601 | |
| D_{2005} | -0.010021 | 0.012756 | -0.785584 | 0.4390 | |

11. Model criteria / Goodness of fit:

R-square = 0.845; Adjusted R-square = 0.791

111. Diagnostic checking:

JB = 0.440 [0.802]; LM-1 = 2.205 [0.149]; ARCH (1) = 0.148 [0.702]; White Heteroscedasticity = 0.812 [0.585]; Ramsey RESET = 2.009 [0.155]

*, ** and *** indicate significance at 0.01, 0.05 and 0.10 level respectively. Probability values are quoted in square brackets. MA and ARCH denote LM-type Breusch-Godfrey serial correlation LM and ARCH test, respectively, to test for the presence of serial correlation and ARCH effect. JB and RESET stand for Jarque-Bera Normality Test and Ramsey Regression Specification Error Test, respectively.

shock absorber in the short run, thereby weakening the impact of calamity on economic growth, on or perhaps the negative effect passing through export and financial sector industry thereby indirectly impacting growth. However, taking account of earth quake calamity has improved our results.

Further in Table 6, the goodness of fit of the specification, that is, *R*-squared and adjusted *R*-squared, is 0.645 and 0.512 respectively. The robustness of the model has been definite by several diagnostic tests such as Breusch- Godfrey serial correlation LM test, ARCH test, Jacque-Bera normality test and Ramsey RESET specification test. All the tests disclosed that the model has the aspiration econometric properties, it has a correct functional form and the model's residuals are serially uncorrelated, normally distributed and homoskedastic.

Therefore, the outcomes reported are serially uncorrelated, normally distributed and homoskedastic. Hence, the results reported are valid for reliable interpretation.

CONCLUSION

This paper has estimated the impact of remittances, exports, money supply on economic growth of Pakistan, using time series data from 1976-2009 by employing Bounds testing approach. Bounds test suggested that the remittances have both the long and short-run relationship with economic growth of Pakistan. Remittances in the short and long-run stand out to be statistically significant and cointegrated to economic growth, however with low elasticities that is, 0.02 and 0.03 respectively.

Table 6. Estimated error correction model.

Error correction representation for the selected ARDL model
 ARDL(0,0,0,2) selected based on Akaike information criterion
 Dependent variable is ΔLY
 34 observations used for estimation from 1976-2009

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---------------------|-------------|------------|-------------|--------|
| C | -0.023082 | 0.020524 | -1.124631 | 0.2719 |
| $\Delta L(Y(-1))$ | 1.434845 | 0.379537 | 3.780510 | 0.0009 |
| $\Delta L(REM(-1))$ | 0.034307 | 0.009739 | 3.522763 | 0.0018 |
| $\Delta L(EXP(-1))$ | 0.078869 | 0.037807 | 2.086078 | 0.0478 |
| $\Delta L(M2(-1))$ | -0.049767 | 0.079014 | -0.629849 | 0.5347 |
| ΔD_{2005} | -0.001192 | 0.009163 | -0.130135 | 0.8975 |
| ECM_{t-1} | -0.298629 | 0.416927 | -3.114761 | 0.0047 |

11. Model criteria / Goodness of Fit:

R-square = 0.645; Adjusted R-square = 0.512

11.1. Diagnostic Checking:

JB = 1.277 [0.739]; LM-1 = 0.084 [0.774]; ARCH (1) = 0.002 [0.958]; White Heteroscedasticity = 1.621 [0.171]; Ramsey RESET = 0.114 [0.739]

*, ** and *** indicate significance at 0.01, 0.05 and 0.10 level respectively. Probability values are quoted in square brackets. MA and ARCH denote LM-type Breusch-Godfrey Serial Correlation LM and ARCH test, respectively, to test for the presence of serial correlation and ARCH effect. JB and RESET stand for Jarque-Bera normality test and Ramsey regression specification error test, respectively.

The short-run effect of exports is significant at 0.05% level, contributing to about 0.078% to economic growth. However, money supply was found insignificant to contribute to economic growth. In the long-run, both exports and money supply were found insignificant to contribute economic growth in Pakistan. Further, growth policy (proxied by a lag of change in output) is statistically significant both in the long and short-run which indicating the effectiveness of previous year's pro-growth policy in the current year. As far as natural calamity (earth quake, D_{2005}) dummy variable is concerned, it is found to be negative and small, however not statistically significant, both in the short and long-run. The ECM results indicate that the convergence of the model and implying that about 29% adjustment takes place every year Therefore, the government should realize effective macro-economic policies along with momentous improvements in the structure and functioning systems of governance for stabilizing economic growth along their determinants.

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