Blessing or Curse: The Stabilizing Role of Remittances, Foreign Aid and FDI to Pakistan

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Abstract

Inflows of remittances to Pakistan are being increasingly viewed as a relatively attractive source of external finance, one that can help to foster development and manage economic shocks. Remittances have become a major source of revenue, surpassing the volume of FDI and official development assistance that the country receives. This study focuses primarily on the stability, cyclicality and stabilization impacts of migrant remittances to Pakistan. It is evident that foreign inflows exhibit different types of volatility; remittances are found to be a less volatile source of external finance than FDI and ODA that are counter-cyclical and stabilizing, thus serving to steady the recipient economy in times of economic downturns. ODA appears to be acyclical and stabilizing, whereas FDI emerges as pro-cyclical and destabilizing. Furthermore, remittances are insensitive to cyclical fluctuation in source countries. We also proceed with SVAR-based identification in order to examine the responses of financial flows to innovation in receiving and source economies. We confirm the counter-cyclical mechanism of remittances with Pakistani output. In particular, our results indicate that remittance flows to Pakistan are mainly due to the economic conditions in the receiving economy.

Keywords: *Remittances, FDI, ODA, Business Cycle, Pakistan*.

JEL Codes: *E32, F15, F21, F22, F35*

1. Introduction

During the last decade the inflow of remittances has increased rapidly and now constitutes one of the largest sources of external development finance for developing countries. Recorded remittance flows to developing countries are estimated to have reached $406 billion in 2012, a 6.5 percent increase from $381 billion in the preceding year (World Bank, 2012). Remittances are the second largest source of foreign exchange earnings for developing countries after Foreign Direct Investment (FDI). These remittances have proved remarkably resilient during economic downturns compared to other capital inflows, namely foreign direct investment and official development assistance (Gupta et al., 2000; Ratha, 2003; Buch and Kuckulenz, 2004; and IMF, 2005). For instance, remittances dropped by only 5.5 percent in 2009 after the global financial crises, but rapidly recovered in 2010. By contrast, FDI declined by 40 percent and private debt and portfolio equity flows dropped by 46 percent in 2009 (see Table 1).

The authors gratefully acknowledged the comments by Prof. Stephan Klasen, Dr. Felicitas Nowak-Lehmann D. and Dr. Mazhar Mughal.

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Table 1 Remittances and other resource flows into developing countries (US$ billions)

Resource flows	1995	2005	2006	2007	2008	**2009**	2010	2011
Migrant Remittances	54	198	232	286	331	**316**	341	381
Foreign Direct Investment	95	307	398	559	637	**428**	583	644
Private debt and Portfolio Equity	59	193	277	429	186	**180**	284	201
Official Development Assistance	57	108	107	108	127	**126**	130	-

Source: World Development Indicator, and World Bank Development Prospects 18.

Similarly, remittances tend to rise during recessive phases in the economic cycle, as migrants send more money home to support their families in the receiving country (Orozco, 2003; World Bank, 2005; Ratha, 2007). Remittances may therefore smooth consumption and contribute to the stability of recipient economies (World Bank, 2006). In contrast, other private financial flows frequently move pro-cyclically, raising income in good times and decreasing it in bad times (Ratha, 2003). There are different motives for which remittances may be sent. On the one hand, Lucas and Stark (1985) suggested the pure altruism approach according to which remittances are expected to smooth household consumption and contribute to the stabilization of receiving countries following macroeconomic shocks. The hypothesis of remittances being countercyclical is based on the evidence that a large portion of remittance transfers are intended for altruistic purposes (e.g. Agarwal and Horowitz, 2002). The fact that remittances rose sharply after the economic crises in countries like Indonesia (1997), Ecuador (1999) and Argentina (2001) seems to support this view (Spatafora, 2005). The World Bank (2006) points out that remittances increased after natural disasters in Bangladesh, Haiti, Honduras and the Dominican Republic, as well as in response to conflicts in Albania and in Sierra Leone. Ahmed (2012) reported that remittances to Pakistan display a counter-cyclical tendency to both real output and household consumption and have helped households cope with natural catastrophes (Suleri and Savage, 2006).

What is more, remittances can also be destined for investment in recipient countries (Woodruff and Zenteno, 2001), which has been generally called the portfolio approach. According to this approach, remittances are supposed to increase when the expected returns of these transfers rise in receiving countries (El-Sakka and McNabb, 1999; Hysenbegasi and Pozo, 2002). Ratha (2003) mentioned that remittance receipts in Turkey and the Philippines declined after the financial crises in the late 1990s, although the decline was marginal compared to other capital inflows. In the same vein, Lueth & Ruiz-Arranz (2006) reported that remittances do not seem to increase in the wake of natural disasters. However, if altruism dominates, migrants are expected to transfer more money during economic crises to compensate for the decrease in income suffered by the family left behind (Quartey, 2007; Yang and Choi, 2007).

Pakistan is among the top ten remittance receiving countries. Remittances sent by Pakistani migrants from around the world have grown sharply. These flows have not only provided critical

support to the balance of payments, but have also helped to improve the external debt situation. Remittances have alleviated poverty and reduced inequality (Mughal and Anwar, 2012). The rise in remittances to Pakistan also helped to partially offset the negative effects of the oil crisis, reduce unemployment and improve the living standards of recipient households (Pakistan Economic Survey, 2012). As a result, the country is increasingly relying on remittances for its economic development (Mughal, 2012). This is particularly the case during times when FDI and Official Development Assistance (ODA) flows dry up. The country is not succeeding in attracting new foreign investments due to the fragile state of the economy and the inflow has been deteriorating continually. Similarly, foreign aid to the country is quite volatile over time (Malik, 2009). It is thus imperative to know the driving forces behind the cyclical behavior of these sources of foreign exchange, namely foreign aid and FDI. Are they procyclical, i.e. moving in the same direction as the economy, countercyclical, i.e. moving in the opposite direction to the receiving economy, or acyclical, i.e. having no association with economic performance? This study attempts to find these cyclical properties of remittance inflows in comparison to alternative sources of foreign exchange. Although some previous studies exist on the business cycle properties of one of the flows,[3] only two studies have compared the behavior of various flows. Vargas-Silva (2009) compared remittances and FDI and Neagu and Schiff (2009) compared the cyclicality, stability and stabilization impacts of remittances with FDI and ODA. To the best of our knowledge, this study is the first to present a comprehensive and comparable empirical analysis of financial flows in the context of Pakistan.

The main goal of the study is to assess the stylized facts of the cyclicality of migrants' remittances, ODA and FDI employing annual time series data over the period 1974-2011. We explore to what extent these financial flows neutralize macroeconomic shocks and contribute to macroeconomic stability in the country. Moreover, we will also examine these flows with respect to the business cycles of major sending economies. It is relevant because if migrant remittances are pro-cyclical to the source economy business cycle, then remittances could be another channel through which economic fluctuations in the regions can impact the economic conditions of Pakistan. In order to achieve the abovementioned goals, we estimate an SVAR model to evaluate the extent to which migrant remittances respond to cyclical fluctuations in Pakistan's and source countries' output in comparison to ODA and FDI.

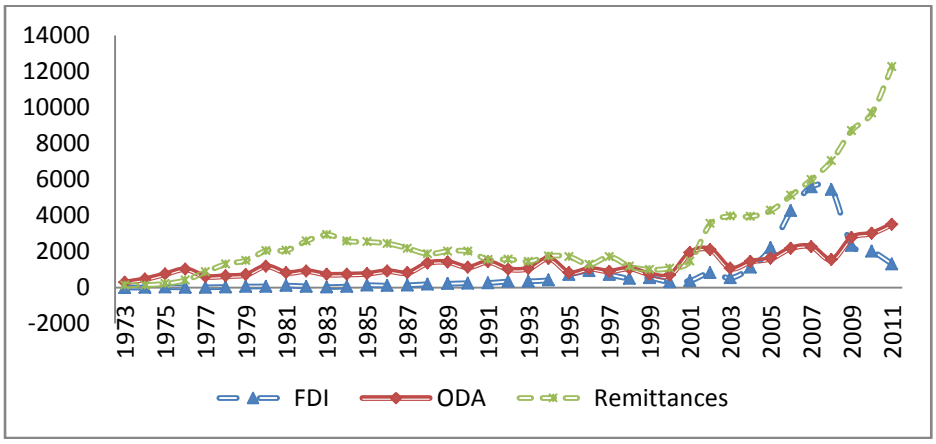
The rest of the paper proceeds as follows: Section 2 documents the stylized facts of capital inflows to Pakistan. Section 3 discusses the data and methodology. Section 4 presents a comprehensive assessment of our main findings and Section 5 contains the concluding remarks.

1.1 Remittances, FDI and ODA Inflows to Pakistan: Some Stylized Facts

In this section, we highlight the pattern of remittances and other capital inflows to Pakistan.
During the last decade, remittances have grown significantly. The influx of remittances has surpassed that of foreign direct investment and official development assistance (Figure 1), becoming the second largest source of foreign exchange after the country's exports.

[3] For instance, Giuliano and Ruiz-Arranz (2009), Akkoyunlu and Kholodilin (2008), Sayan and Tekin-Koru (2010) , Ahmed (2012), Lueth and Ruiz-Arranz (2007) and Barjas et.al (2012) on the cyclical nature of remittances and Bulir and Hamann (2003), Chauvet and Guillaumont (2009) and Pallage and Robe (2001) on foreign aid.

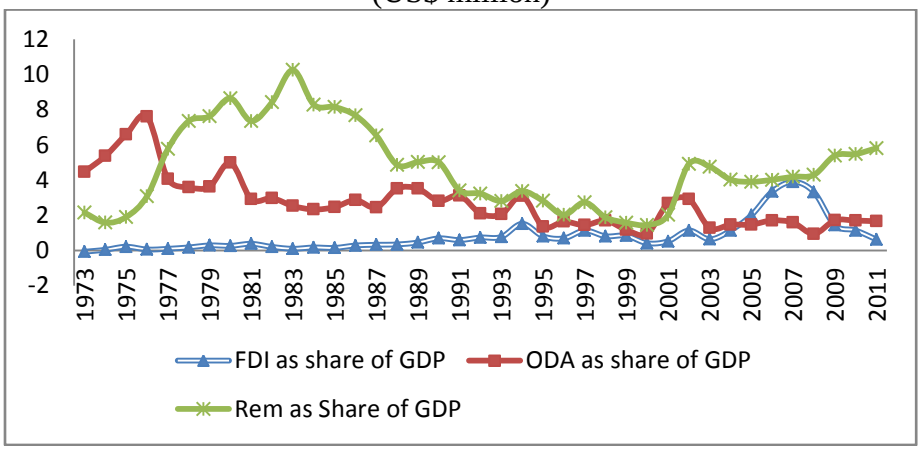
Figure 1 Remittances and other resource flows to Pakistan (US$ million)



Source: calculation based on World Bank and OECD (2012) data

Recorded remittances have risen from less than $1 billion in 2000 to $12 billion in 2011, equivalent to 6 percent of GDP (Figure 2).

Figure 2 Remittances and other resource flows as a share of GDP to Pakistan (US$ million)

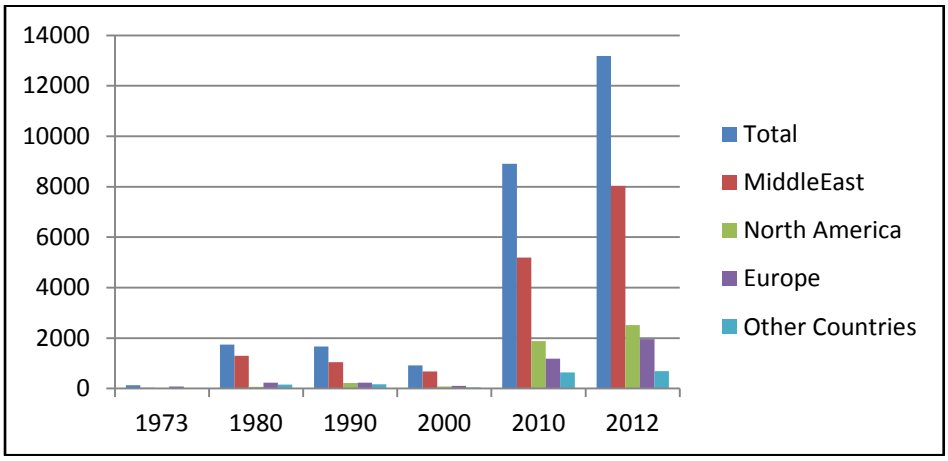


Source: calculation based on World Bank and OECD (2012) data

The significant growth in remittance inflows has proved a lifeline for the economy during times of economic crisis. Lowering the cost of remitting to redirect these flows from unofficial to official channels under the Pakistan Remittances Initiative (State Bank of Pakistan, 2012) and the increase in the size of Pakistani diasporas[4] (World Bank, 2006; Pakistan Economic Survey, 2012) are among the main reasons for this spectacular rise in remittances. The Middle East is the foremost source of remittances to Pakistan, followed by North America and Europe (Figure 3).

[4] An estimated 6.3 million Pakistanis live abroad. In regional terms about 3 and a half million Pakistanis migrated to the Middle East, 1.8 to Europe and 1.2 to the Americas, respectively (Bureau of Emigration and Overseas Employment, 2012). The main concentrations of Pakistani migrants are found in Saudi Arabia, United Arab Emirates, United Kingdom, United States and Canada, respectively.

Figure 3 Top remittance sending regions (figure in US$ million)



Source: calculation based on State Bank of Pakistan data

FDI constitutes the second major source of foreign exchange for Pakistan. Although FDI rose over the last decade, flows have generally lagged behind those reaching other major Asian economies. The share of FDI inflows to the economy was negligible before the 1990s, due to the regulatory policy framework (Arshad and Sujaat, 2011). After the liberalization program in 1992, FDI displayed remarkable progress (Khan, 1997). For instance, in 2001-02 FDI stood at US$ 823 million, but rose to $5.4 billion during 2006-07 accounting for approximately four percent of GDP. Since then, flows have fallen sharply (Figure 2). In 2011-12, foreign direct investment (FDI) in Pakistan witnessed a 36 percent decline from US$ 840 million in 2011 to US$ 532 million (State Bank of Pakistan, 2012), in spite of the fact that Pakistan ranks 83rd among the 183 economies of the world in terms of ease of doing business, ahead of several other Asian economies (World Bank and IFC, 2011). Pakistan's major investors include the United States, the United Arab Emirates, China, Japan and the European Union. Banking and finance, telecommunications, oil and gas and retail sectors have attracted most of the recent foreign direct investment inflows to Pakistan (State Bank of Pakistan, 2012).

Foreign aid is another form of capital inflows. It refers to grants, loans and technical and economic assistance. Pakistan received US$ 3509 million net official development assistance in 2011, which accounts for only about 1.6 percent of Pakistan's GDP (see figures 1 and 2). Given such low inflows of foreign aid, Pakistan is not considered an aid-dependent country (Malik, 2009). Inflows have fluctuated substantially depending on the changing circumstances during different decades. Flows remained high during the 1980s given the country's frontline state role in the US-Soviet conflict in Afghanistan (Malik et al 1994). Flows decreased during the following decade, drying up in the aftermath of Pakistan's nuclear tests in 1998. Aid flows returned to the country after 2001, as Pakistan once again became a frontline state in the American-led war in Afghanistan (Aning, 2007). In general, the top donors to Pakistan are the USA, International Development Association (IDA), Asian development Bank special funds, the UK, Japan, EU institutions, Germany, the United Arab Emirates, Turkey and Australia (OECD, 2012).

2. Financial Flows and the Business Cycle: A Review of the Empirical Literature

In this section we review the empirical literature that examines the relationship between financial flows and output fluctuations, placing special emphasis on remittances, but also covering foreign aid and FDI. In particular, we start by revising studies that focus on remittances for a cross-section of countries and for specific countries before revising the literature that addresses aid and FDI. Chami et.al (2009) suggest that remittances have a significant impact on smoothing macroeconomic fluctuations in recipient countries, concluding that remittances can be used as a stabilizing tool. They employ data for 70 different countries, including 16 advanced economies and 54 developing countries. Similarly, Giuliano and Ruiz-Arranz (2009) examine remittances and output cycles for a sample of approximately 100 developing countries over the period 1975-2002. They find that remittances are pro-cyclical for about two-thirds of the countries. In the same fashion, Sayan (2006) studies the behavior of migrant remittance flows for 12 developing countries. Using a polynomial fitting model for the period 1976-2003, the study finds that while aggregate country data exhibit counter-cyclicality with GDP, greater heterogeneity is present by country, as remittances can be pro-, counter-, or even a-cyclical. Lueth and Ruiz-Arranz (2006) reported that in the wake of a natural disaster, remittances appear to be aligned with the receiving-country's business cycle and may not play a major role in restraining vulnerability to shocks. The analysis is based on estimating a gravity model for migrants' remittances to a sample of developing countries. In contrast, Frankel (2011), using the same datasets of bilateral remittances, suggests that migrants' remittances play a stabilizing role in the receiving countries. Vargas Silva (2009) revealed that remittances are countercyclical with respect to the Mexican business cycle, but the result was not sufficiently robust to different definitions of remittances. However, strong coherence was found between the cyclical component of remittances and the US business cycle. In the context of South Asia, Lueth and Ruiz-Arranz (2007) determined that remittances in Sri Lanka are positively associated with the country's business cycle. In contrast, Ahmed (2012) argued that remittances to Pakistan are counter-cyclical with respect to the cyclical components of receiving output and consumption, whereas their behavior with respect to the cyclical components of source output from the United States and the United Kingdom is acyclical. Indian remittances are likewise found to be acyclical with respect to source economies (Mughal and Ahmed, 2013).

Foreign aid and FDI are similarly found to be pro-, counter- or a-cyclical depending on the country or set of countries studied and the time periods examined. For instance, using a sample of 33 countries over the period 1969-95, Pallage and Robe (2001) determined that in the majority of cases aid has been pro-cyclical. Similarly, Bulir and Hamann (2003) showed that foreign aid is more volatile than domestic fiscal revenues and appeared to be pro-cyclical in the majority of countries. However, Chauvet and Guillaumont (2009) compared the cyclical behavior of aid over the period 1970-1999 using the trade cycle instead of the output cycle. They showed that foreign aid is more effective in countries that are vulnerable to exogenous shocks, because it dampens their negative effects on growth. They assert that the main factor behind aid effectiveness for growth is the stabilizing nature of aid. In the same vein, comparing the cyclicality and stabilization impacts of migrant remittances with other major capital inflows, Neagu and Schiff (2009) claim that ODA are counter-cyclical while remittances tend to be pro-cyclical, but less so than FDI over the period 1980-2007 including a sample of 116 developing countries.

Furthermore, they show that ODA is more stable than remittances and, in turn, remittances are more stable than FDI.
In this study we take a similar approach to Neague and Schiff (2009) and Vargas-Silva (2009) with some modifications. We extend their results using the recent dataset (1974-2011) and take a closer look by focusing on a single country.

3 Data and Methodology

3.1 Data Description

In order to explore the stabilizing role of remittances and other financial flows to Pakistan, this study utilizes yearly data over the period 1974-2011. The main variables used in our study are Remittances, FDI net inflows, ODA, and GDP for receiving countries (e.g. Pakistan), while output for source economies for each of the four regions is calculated as the weighted sum of GDP for all the respective regions' constituent countries[5]. The datasets used in this study were obtained from the OECD (Organization of Economic Cooperation and Development), WDI (World Development Indicators, World Bank), United Nations Conference on Trade and Development (UNCTAD) and State Bank of Pakistan databases. The data on remittances come from receipts from the WDI and State Bank of Pakistan. Remittances are current private transfers by migrants who are employed or intend to remain employed for more than one year in the source country in which they are considered residents. Therefore, remittances are recorded in the current account of the balance of payments. The data on FDI are taken from the WDI. It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital as shown in the balance of payments. It reveals net inflows (new investment inflows minus disinvestment) from foreign investors. Finally, the net ODA data as a measure of foreign aid comes from the UNCTAD and OECD databases. ODA flows include grants and concessional loans—that is, loans that are at least 25% grants. We gather the Gross Domestic Product data for both source and receiving countries from the WDI in constant 2000 US dollars. All series are in real 2000 values in US dollars. Only, remittances, ODA and FDI data are initially in current US$ and converted to constant 2000 US$ using the GDP deflator. We take a logarithm of the variables before estimation.

Table 2 presents the descriptive statistics of key variables in real terms used in the analysis.

Table 2 Descriptive statistics

	Mean	**Maximum**	**Minimum**	**Standard deviation**
Remittances	5426.24	14002.88	1075	3714.18
Foreign Direct Investment	806.89	3530.70	46.25	783.83
Official Development Assistance	3001.13	8455.64	702.69	1949.71
Pakistanis Output	59635.94	118800	19411.12	29921.19
North American Output	7.36E+08	1.10E+09	4.00E+08	2.35E+08
Middle East Output	15725573	27967814	8423992	5585159

[5] We separated source economies into four major geographic regions, namely North America (USA, Canada), Middle East (Saudi Arabia, United Arab Emirates, Kuwait, Qatar, Bahrain, Oman, Turkey), Europe (United Kingdom, Germany, France, Italy, Netherland, Spain, Greece, Belgium, Ireland, Switzerland, Sweden, Denmark, Norway), and Asia Pacific (Japan, Australia, Singapore, Hong Kong, Malaysia, New Zealand, China).

European Output	99669866	1.32E+08	65951596	21522452
Asia Pacific Output	3.11E+08	3.91E+08	1.74E+08	68345080
Number of observation = 38				

3.2 Methodology

The empirical method consists of four steps. Firstly, we use different types of filters to estimate the cyclical component of remittances, other financial flows and output of both receiving and source countries. Secondly, we estimate the co-movement between the cyclical components (including correlations using leads and lags). Thirdly, we check the stabilization role of remittances in comparison with other financial inflows. Finally, we estimate impulse response functions and variance decompositions using a structural vector autoregressive (SVAR) model.

3.2.1 Time Series Filtering

In order to observe the cyclical behavior of time series, it is common practice to de-trend the series by employing different filters. These filters eliminate the slowly-evolving (long-term trend) component and the rapidly-varying (irregular) component of a variable, leaving behind the intermediate-term or business-cycle component of the variable (Baxter and King, 1999). In this study, we take a skeptical approach to this problem: none of the filtering methods employed is exclusively supposed to be adequate. Instead, following Canova (1998), we assume that all procedures are approximations which isolate different aspects of the trend and cyclical components of the series, separating the intermediate components. In order to isolate the cyclical components from the long-run trend, the Hodrick-Prescott (hereafter HP) is a high-pass filter, extracting only low frequencies and leaving all higher frequency fluctuations. (Hodrick and Prescott, 1997). Two band-pass filters are also used that depart all frequencies above 8 years and below 1.5 years, namely the Baxter and King (hereafter BK) time domain-based filter and the Ouliaris and Corbae (hereafter OC) frequency domain filter.
In this study, we carry out estimations using three different filters[6], although we primarily discuss the findings of the OC filter. This is because the OC filter is considered to perform better than both the HP and the BK filter, as it overcomes some of the shortcomings of the other two filters (Ouliaris and Corbae, 2002).

3.2.2 Main Features of Macroeconomic Fluctuations

Following Kydland and Prescott (1990), Agénor *et al.* (2000) and Pallage and Robe (2001), the degree of co-movement between two stationary series x_t and y_t is measured by the magnitude of correlation coefficients $\rho(j), j \in \{0, \pm 1, \pm 2 \ldots\ldots\}$. The cyclical component of x_t and y_t derived from using HP and BK and OC filters. For instance, the degree of co-movement between a variable x_t and another variable y_t is said to be one of the following:

(a) Pro-cyclical if $\rho(j) > 0$

(b) Countercyclical if $\rho(j) < 0$ and

[6] Details are available in the Appendix.

(c) Acyclical if $\rho(j) = 0$

Similarly, in order to observe significant correlation between two series, as Sayan and Tekin-Koru (2010) did, we consider the variable x_t to be procyclical (countercyclical) with y_t if $0.32 \leq |\rho(0)| < 1$[7]. Moreover, we also check the timing of the most significant correlation coefficient to decide the dynamics of the relationship between a variable x_t and y_t. The purpose is to ascertain whether there are possible phase shifts by looking at how early and how late the highest correlation appears relative to the contemporaneous period (Pallage and Robe, 2002). For instance, we say that series x_t leads the cycle by j periods if significant $|\rho(j)|$ peaks at x_{t-j} with $j > 0$, the series x_t coincides with the cycle if $|\rho(j)|$ peaks for $j = 0$ and that the series x_t lags the cycle by j periods if significant $|\rho(j)|$ peaks at x_{t+j} with $j > 0$. Finally if all correlations are trivial, then we can conclude that the association between the variables is acyclical.

3.2.3- SVAR Model Specification and Identifications of Restrictions

Cross correlations are useful for our analysis but with some limitations. Firstly, correlations do not give information regarding causality with other variables. Secondly, correlations provide straightforward bi-variate information and we would like to control for other variables. In order to address these limitations, we employ Structural Vector Autoregression (SVAR); this model is composed of a system of five equations including source output i.e. (Middle East, North American, European and Asia Pacific output), receiving output, migrant remittances, official development assistance and foreign direct investment. Furthermore, applying VAR addresses the potential problem of endogeneity among variables. For instance, it is possible for remittances to impact the receiving business cycle; it is also possible that these variables respond to changes in the receiving business cycle.

Structural VAR is widely used in the empirical literature to distinguish the effects of endogenous disturbances within a system. The aim of a structural VAR is to use economic theory, rather than the Cholesky decomposition, to recover structural innovations from residuals of a reduced-form VAR. A VAR is an n-equation, n-variable linear model in which each variable in turn is explained by its own lagged values, current and past values of the remaining n-1 variables. According to Sims (1980), variables should be treated on equal footing if there is simultaneity among a set of variables. There should not be any a priori distinction between endogenous and exogenous variables (Gujarati, 2004 p.848). Before estimating the VAR model, an important decision must be made regarding the selection of the optimum number of lags. Adding too many lagged terms can lead to insufficient degrees of freedom. However, adding too few lags can lead to specification errors[8]. The subsequent recognition of VAR models still requires

[7] In this study, the correlation coefficients that fall outside the [-0.32, 0.32] range require the null hypothesis to be rejected, that is, it will be considered statistically significant. Details of how the minimum value 0.32 has been calculated are available in Appendix A.1.

8 The decision of the appropriate lag length is made using the criterion of Akaike, Schwarz and Hannan-Quinn and Final Prediction Error.

identifying assumptions[9]. A variety of structural VAR models have been proposed, supporting short-term constraints (Sims, 1986; Bernanke, 1986; Blanchard and Watson, 1986), long-term restrictions (Blanchard and Quah, 1989), or groups of both short-term and long-term restrictions (Gali, 1992) on impulse response derived from the underline economic theory. The main objective of a structural VAR estimation is to obtain non-recursive orthogonalization of the error terms for the impulse response analysis. This alternative to the recursive Cholesky orthogonalization requires the imposition of sufficient restrictions to identify the orthogonal (structural) components of the error terms.

The structural model to be implemented in this study is described by the following dynamic system of simultaneous equations (1 to 5).

$$Y_t^s = b_{10} - a_{12}Y_t^r - a_{13}X_t^{rem} - a_{14}X_t^{oda} - a_{15}X_t^{fdi} + \sum_{i=1}^{p} b_{11}^i Y_{t-p}^s + \sum_{i=1}^{p} b_{12}^i Y_{t-p}^r + \sum_{i=1}^{p} b_{13}^i X_{t-p}^{rem} + \sum_{i=1}^{p} b_{14}^i X_{t-p}^{oda} + \sum_{i=1}^{p} b_{15}^i X_{t-p}^{fdi} + \varepsilon_t^s \quad (1)$$

$$Y_t^r = b_{20} - a_{21}Y_t^s - a_{23}X_t^{rem} - a_{24}X_t^{oda} - a_{25}X_t^{fdi} + \sum_{i=1}^{p} b_{21}^i Y_{t-p}^s + \sum_{i=1}^{p} b_{22}^i Y_{t-p}^r + \sum_{i=1}^{p} b_{23}^i X_{t-p}^{rem} + \sum_{i=1}^{p} b_{24}^i X_{t-p}^{oda} + \sum_{i=1}^{p} b_{25}^i X_{t-p}^{fdi} +, \varepsilon_t^r \quad (2)$$

$$X_t^{rem} = b_{30} - a_{31}Y_t^s - a_{32}Y_t^r - a_{34}X_t^{oda} - a_{35}X_t^{fdi} + \sum_{i=1}^{p} b_{31}^i Y_{t-p}^s + \sum_{i=1}^{p} b_{32}^i Y_{t-p}^r + \sum_{i=1}^{p} b_{33}^i X_{t-p}^{rem} + \sum_{i=1}^{p} b_{34}^i X_{t-p}^{oda} + \sum_{i=1}^{p} b_{35}^i X_{t-p}^{fdi} + \varepsilon_t^{rem} \quad (3)$$

$$X_t^{oda} = b_{40} - a_{41}Y_t^s - a_{42}Y_t^r - a_{43}X_t^{rem} - a_{45}X_t^{fdi} + \sum_{i=1}^{p} b_{41}^i Y_{t-p}^s + \sum_{i=1}^{p} b_{42}^i Y_{t-p}^r + \sum_{i=1}^{p} b_{43}^i X_{t-p}^{rem} + \sum_{i=1}^{p} b_{44}^i X_{t-p}^{oda} + \sum_{i=1}^{p} b_{45}^i X_{t-p}^{fdi} + \varepsilon_t^{oda} \quad (4)$$

$$X_t^{fdi} = b_{50} - a_{51}Y_t^s - a_{52}Y_t^r - a_{53}X_t^{rem} - a_{54}X_t^{oda} + \sum_{i=1}^{p} b_{51}^i Y_{t-p}^s + \sum_{i=1}^{p} b_{52}^i Y_{t-p}^r + \sum_{i=1}^{p} b_{53}^i X_{t-p}^{rem} + \sum_{i=1}^{p} b_{54}^i X_{t-p}^{oda} + \sum_{i=1}^{p} b_{55}^i X_{t-p}^{fdi} + \varepsilon_t^{fdi} \quad (5)$$

Where,

$\varepsilon_t^s, \varepsilon_t^r, \varepsilon_t^{rem}, \varepsilon_t^{oda}$ *and* $\varepsilon_t^{fdi} \sim i.i.d(0, \sigma_{\varepsilon i}^2)$ *and* $cov(\varepsilon_t^s, \varepsilon_t^r, \varepsilon_t^{rem}, \varepsilon_t^{oda}, \varepsilon_t^{fdi}) = 0$

source output (Y_t^s), receiving output (Y_t^r), remittances (X_t^{rem}), official development assistance (X_t^{oda}) and foreign direct investment (X_t^{fdi}) are endogenous variables and assumed to be stationary. Here the exogenous error terms $\varepsilon_t^s, \varepsilon_t^r, \varepsilon_t^{rem}, \varepsilon_t^{oda}$ *and* ε_t^{fdi} are independent and denoted as structural innovation.

Using matrix algebra, we can write the system (eq. 1 to 5) in matrix notation,

9 The "identification problem" calls for imposing restrictions on some of the structural parameters. Identification by means of the Cholesky decomposition is considered a mechanical technique that some deem unrelated to economic theory.

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} Y_t^s \\ Y_t^r \\ X_t^{rem} \\ X_t^{oda} \\ X_t^{fdi} \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \\ b_{30} \\ b_{40} \\ b_{50} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{bmatrix} \begin{bmatrix} Y_{t-i}^s \\ Y_{t-i}^r \\ X_{t-i}^{rem} \\ X_{t-i}^{oda} \\ X_{t-i}^{fdi} \end{bmatrix} + \begin{bmatrix} \varepsilon_t^s \\ \varepsilon_t^r \\ \varepsilon_t^{rem} \\ \varepsilon_t^{oda} \\ \varepsilon_t^{fdi} \end{bmatrix} \quad (6)$$

Where i= 1, 2, 3,…, n

Simply, it can be expressed as follows.

$$AZ_t = B_0 + B_1 Z_{t-i} + \varepsilon_t \quad (7)$$

Where Z_t is the (n *x* 1) vector of the endogenous variables and Z_{t-i} is the (n *x* n) matrix that contains the lagged endogenous variables, while $\Sigma_\varepsilon = E(\varepsilon\varepsilon')$ yields the variance-covariance matrix of the structural innovations.

Pre-multiplying with A^{-1} , we obtained the corresponding reduced form (VAR)[10] in the context of SVAR given in Equation (7), as we cannot use OLS directly to estimate SVAR, due to contemporaneous effects correlated with the structural shocks (ε_t).

$$AA^{-1}Z_t = B_0A^{-1} + B_1Z_{t-1}A^{-1} + \varepsilon_t\, A^{-1}$$

Thus,

$$Z_t = B_0A^{-1} + B_1Z_{t-1}A^{-1} + \varepsilon_t\, A^{-1} \quad (8)$$

In other words the reduced form model given in eq. (7) is equal to

$$Z_t = C_0 + C_1Z_{t-i} + e_t \quad (9)$$

Where, $B_0A^{-1} = C_0$, $B_1A^{-1} = C_1$ *and* $\varepsilon_t\, A^{-1} = e_t$, the variance-covariance of the reduced form is given by $\Sigma_e = E(ee')$

Equation (9) can be written in matrix form as:

$$\begin{bmatrix} Y_t^s \\ Y_t^r \\ X_t^{rem} \\ X_t^{oda} \\ X_t^{fdi} \end{bmatrix} = \begin{bmatrix} c_{10} \\ c_{20} \\ c_{30} \\ c_{40} \\ c_{50} \end{bmatrix} + \begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} \\ c_{21} & c_{22} & c_{23} & c_{24} & c_{25} \\ c_{31} & c_{32} & c_{33} & c_{34} & c_{35} \\ c_{41} & c_{42} & c_{43} & c_{44} & c_{45} \\ c_{51} & c_{52} & c_{53} & c_{54} & c_{55} \end{bmatrix} \begin{bmatrix} Y_{t-i}^s \\ Y_{t-i}^r \\ X_{t-i}^{rem} \\ X_{t-i}^{oda} \\ X_{t-i}^{fdi} \end{bmatrix} + \begin{bmatrix} e_t^s \\ e_t^r \\ e_t^{rem} \\ e_t^{oda} \\ e_t^{fdi} \end{bmatrix} \quad (10)$$

10 The main problem in estimating the structural model is that one cannot directly estimate the variables of interest, such as A *and* B_1 in Equation (7)

Equations (9) and (10) represent a standard reduced form VAR which can be estimated with OLS. The predetermined variables are comprised on the right hand side of the equation, while the error terms are white noise. The errors are serially uncorrelated, but correlated across equations.

Let us recall equation (9), in which the structural model relates the regression residuals and the pure innovations in the following way.

$$\varepsilon_t \, A^{-1} = e_t$$

We can model the contemporaneous relationships among the variables as suggested by Vargas Silva (2009) with some modifications.

$$y^s = \varepsilon^{\,s} \tag{11}$$

$$y^r = a_{21}y^s + a_{23}x^{rem} + a_{24}x^{oda} + a_{25}x^{fdi} + \varepsilon^r \tag{12}$$

$$x^{rem} = a_{31}y^s + a_{32}y^r + \varepsilon^{rem} \tag{13}$$

$$x^{oda} = a_{41}y^r + \varepsilon^{oda} \tag{14}$$

$$x^{fdi} = a_{51}y^s + a_{52}y^r + \varepsilon^{fdi} \tag{15}$$

Where $y^s, y^r, x^{rem}, x^{oda}, x^{fdi}$ are the regression residuals obtained from the reduced form VAR, and $\varepsilon^s, \varepsilon^r, \varepsilon^{rem}, \varepsilon^{oda}, \varepsilon^{fdi}$ are the pure shocks (i.e., structural innovations) to the detrended series in terms of log, *(Y^s) (Y^r), (X^{rem}), (X^{oda}) and (X^{fdi})* respectively. Hence the model specified above in reduced form provides the number of assumptions necessary to identify the structural VAR model. The assumptions imply that changes in the source output are assumed to be affected only by its own shocks, meaning that source output is not promptly affected by other variables in the model. Receiving output is affected by shocks to source output, remittances, ODA and FDI. Remittances are influenced by source and receiving output shocks. This is consistent with the evidence that changes in the economic conditions of receiving countries are significant in explaining remittance behavior (Kock and Sun, 2011). Similarly, FDI is also influenced by source and receiving output. However, ODA is only affected by innovation to source output. The above specification is appealing, as it does not impose any restrictions on the long-run behavior of economic variables.

4- Main Results:

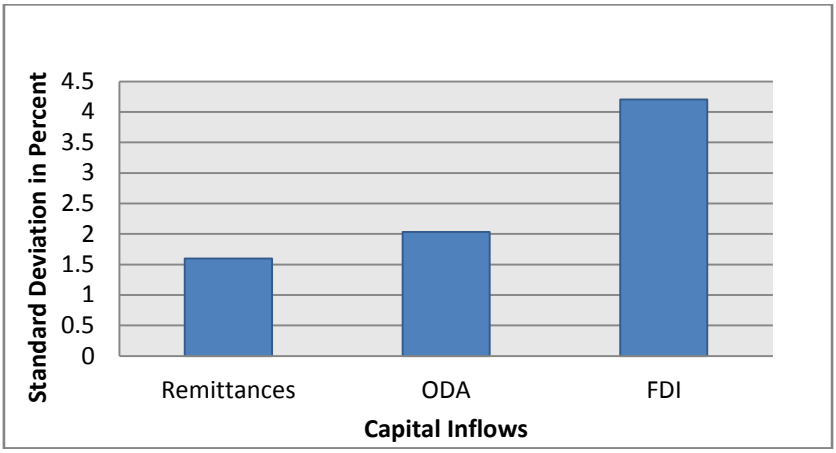
Subsection 4.1 presents the volatility of the analyzed flows derived from the filtered series and the corresponding correlation. The stabilizing nature of remittances, ODA and FDI with respect to output are also reported in this section. The SVAR estimations are discussed in section 4.2.

4.1 Volatility, Cyclicality and Stabilization of Financial Flows

Figure 4 reports the volatility of each capital inflow over the period 1974-2011 based on the standard deviation of the cyclical ratio of the corresponding variable to GDP. According to our

calculations, FDI is 163 percent and ODA is 27 percent more volatile than remittances during the sample period 1974-11. These findings revealed that remittances to Pakistan are a relatively stable source of external finance, compared with ODA and FDI inflows. The figures showing the greater resilience of remittances corroborate the findings of Buch et al. (2002), IMF (2005), Lueth et al. (2007) and Mughal and Makhlouf (2011).

Figure 4 Volatility of Capital Inflows to Pakistan, 1974–2011



Note: Volatility is defined as the percentage standard deviation of the detrended ratio of the relevant inflows to GDP. The OC filter has been used to extract detrended series.

Next we look at the cross-correlation between the cyclical components of the financial flows and the corresponding annual GDP for receiving and source economies. As discussed earlier, HP, BK and OC filters are used to extract the cyclical components of a series. Following Burns and Mitchel (1946), Business-cycle frequency is defined to be between 2 and 8 years in estimating the cyclical components using BK-filtered (time domain) and OC –filtered (frequency domain) technique. Meanwhile, the HP Filter is applied to the trend-cycle component of each variable, in order to extract the stationary (cyclical) and non-stationary (trend) components. In this case, we do so following the business cycle definition by Lucas (1977) and Kydland and Prescott (1990), stated as deviations of aggregate real output from its long-run trend (a growth cycle). The smoothing parameter (lambda) is set to 6.25 for the HP filter as suggested by Ravn and Uhlig (2002). In next step of the correlation analysis, we compute correlation coefficients between the detrended real output of both source and receiving countries and the lead, current and lag of detrended remittances, ODA and FDI. The maximum number of leads and lags is fixed to two in each case. The results of contemporaneous cross-correlation as well as asynchronous correlation are presented in Table 3.

We look first at the correlations between the cyclical components of financial inflows and Pakistani GDP during the period 1974- 2011. The negative association and statistical significance of the contemporaneous correlation coefficient reported in Table 3 implies that remittances sent to Pakistan tend to move counter-cyclically relative to receiving output, regardless of which filter has been used[11]. This implies that remittances provide relief to low income families, mainly in times of economic hardship. The results corroborate the findings of Anwar and Mughal (2012) that remittances to Pakistan are sent mainly for altruistic motives. Remittances therefore perform

[11] Results of both HP and BK filters are available upon request

a welcome stabilization function during times of economic recession. On the contrary, the association between FDI and receiving output appears to be positive and significant, implying that FDI tends to act pro-cyclically and synchronous to the country's business cycle. Similarly, the pro-cyclical nature of FDI depicts that more is to be gained by a foreign investor when the receiving economy performs better. This explains the fall in FDI flows over the last five years, as the country is suffering from economic insecurity.

The correlation coefficient for ODA is found to be insignificant, implying acyclical behavior with respect to receiving output. The results are not surprising as finalizing aid budgets, commitment and disbursement procedures might be too sluggish to readily react to the ups and downs of economic activity at receiving country output level. However, we find that FDI exhibits acyclical behavior with receiving output by using the HP and BK filter. Overall, both ODA and FDI do not seem to play a major role in limiting the vulnerability to macroeconomic shocks in the receiving country.

Table 3 Summary of Cross Correlations between Source and Receiving Country Output at Time *t* (*t* = 1974, …, 2011) and Remittances, FDI and ODA.

Variables	**Remittances**		**Official Development Assistance**	**Foreign Direct Investment**	
	Cyclicality	**Lead/Lag**	**Cyclicality**	**Cyclicality**	**Lead/Lag**
Pakistanis Output	Counter-cyclical	Coincident	Acyclical	Pro-cyclical	Coincident
Middle East Output	Counter-cyclical	Lagging	Acyclical	Acyclical	_____
North American Output	Acyclical	_____	Acyclical	Pro-cyclical	Lagging
European Output	Acyclical	_____	Acyclical	Pro-cyclical	Lagging
Asia Pacific Output	Acyclical	_____	Acyclical	Pro-cyclical	Coincident

Table 3 shows the contemporaneous and asynchronous (up to two years) cross correlation of remittances and major source countries' business activity. In this scenario, remittance inflows depend on the economic conditions of source economies. For instance, if incomes rise in the source economy, Pakistani migrants may send more money back home, so the boom in the source economy is transmitted to the receiving economy through remittances.

Remittances from Pakistan appear to move acyclicaly with Middle East output during the examined period 1974-2011. However, when the OC filter is used, remittances to Pakistan and the business cycle activity of the Middle East appeared to be negatively correlated, that is moving counter cyclically and peaking one year after Middle East output. This last finding warrants some discussion. In the 1970s and 1980s, Pakistan supplied a large proportion of the labor requirements of countries in the Middle East. Official remittances to Pakistan during that period accounted for about 10 percent of GDP and as a result were hit the hardest by the 1990-91 Gulf war and the ensuing financial difficulties that the countries in the region faced. Thousands of

temporary Pakistani migrants returned home, bringing all of their savings with them. This reflects in the negative correlation between flows to Pakistan and Middle East output. Another explanation may be that during the current economic slump, remittances to Pakistan from the Middle East have not suffered, but in fact kept on increasing, again indicating a negative correlation. In similar fashion, it is important to ascertain how other external factors, such as economic growth in the region, have influenced FDI and ODA flows to Pakistan. We find acyclical behavior between FDI (ODA) and Middle East output, regardless of which filter is used. This implies that investors' decisions to invest in Pakistan as well as donors' preferences for aid are not primarily based on the country's business cycle.

However, as shown in Table 3, we fail to find any association between the cyclical components of remittances and economic activity in North America, Europe or the Asian pacific region. Therefore, remittances are acyclical to major source countries. Similarly, correlation estimation suggests that ODA inflows are unaltered by source countries' economic cycles. However, the HP filter suggests a significant relationship in the case of North America.

In contrast, FDI to Pakistan is typically pro-cyclical in regard to regional output. Our findings show that FDI outflows from these countries contract when conditions in investor countries are unfavorable. The finding shows that remittances to Pakistan remain acyclical regardless of fluctuations in most of the source countries, particularly due to the diverse nature of migrant outflows from Pakistan to different regions around the globe.

Another way to examine the stabilization impact of financial flows that goes beyond cyclicality was suggested by Chauvet and Guillaumont (2008) and Neague and Schiff (2009). The authors propose a stabilization index that is given by

Stabilization index of X= volatility of Y-volatility of (X+ Y)

Where X represents the financial flows to the country (Remittances, ODA or FDI) and Y corresponds to receiving GDP.

$$CV(X) - CV(X+Y) > 0 \text{ stabilizing}$$
$$CV(X) - CV(X+Y) < 0 \text{ destabilizing}$$

If this difference is positive (negative), the variable X has a stabilizing (destabilizing) nature with respect to output.

Table 4 Stabilizing nature of remittances, ODA and FDI with respect to Output.

	Standard deviation	**Mean**	**Coefficients of Variation**
Remittances	0.706	8.367	8.43
ODA	0.678	7.793	8.70
FDI	0.936	6.310	14.8
GDP	0.548	10.86	5.04
Remittances + GDP	0.681	19.23	3.54
ODA + GDP	0.318	18.65	1.70
FDI + GDP	1.400	17.17	8.16

Note: CV= Coefficient of variation, computed as (standard deviation/mean) * 100

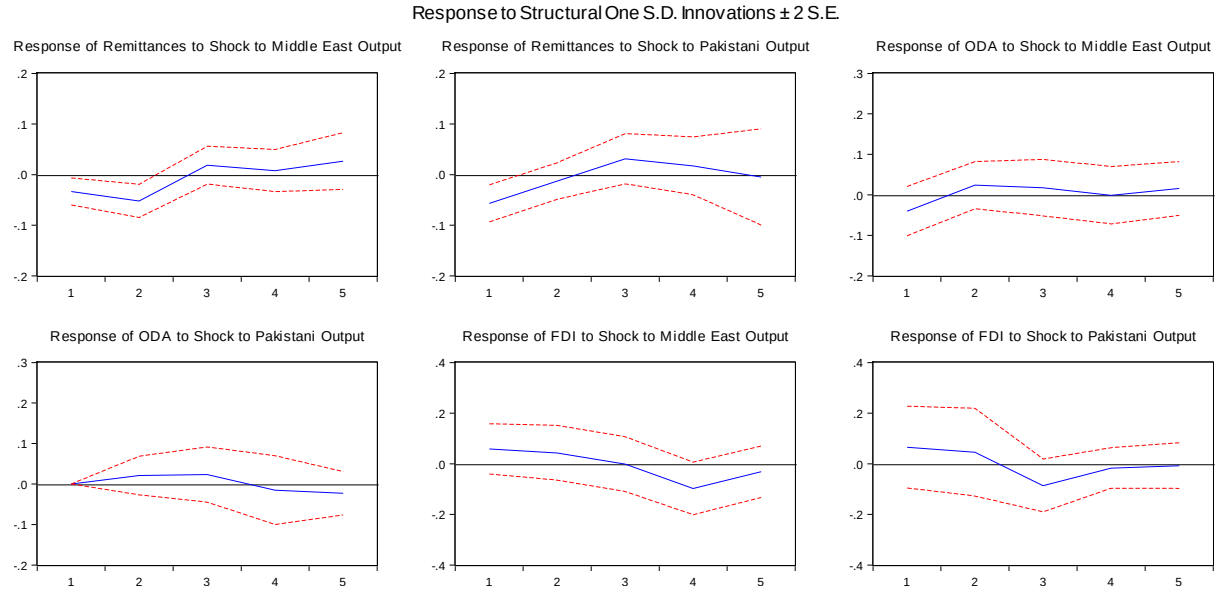
Stabilization Index of remittances = **1.5**
Stabilization Index of ODA= **3.3**
Stabilization Index of FDI= **-3.1**

Table 4 reports the stabilizing nature of Remittances, FDI or ODA, which helps decrease the variability of GDP measured by the coefficient of variation. The results depict that both remittance and ODA inflows appear to exert a stabilizing influence, but the opposite is true in case of FDI, which emerges as destabilizing. This finding reflects that the relative stability of remittances may provide further assistance to the economy in terms of reduced volatility of receiving output.

4.2. Empirical Evidence from a Structural VAR

As a preliminary step, we investigate the time series properties of the data by testing for the presence of unit roots. The results of the Augmented Dickey Fuller test[12] show that all variables are non-stationary in levels but stationary in first differences. Next, we use impulse response functions commonly used in SVAR analysis in order to examine the responses of the variables to exogenous shocks. For a lag length selection, an optimal lag length of two is chosen based on different information criteria in order to obtain reasonable dynamics. Two lags were sufficient to remove any serial correlation to satisfy the normality and stability tests, without losing too many degrees of freedom. We then utilize impulse response functions to examine the dynamic causal relationship between remittances, FDI, ODA and source and receiving output. The plot of impulse responses presented in Figure 5 reveal the dynamic effects of remittances, ODA and FDI to Pakistan and Middle East output shocks. The impulse response of remittances to Pakistan to one standard deviation shock to Middle East output looks negative and significant after one year. This is in line with the significantly negative correlation found for remittances to Pakistan. In contrast, the impulse response of inward FDI and ODA is insignificant in the case of Middle East annual output. Similarly, the response of remittances to Pakistani output is negative and significant describing a counter-cyclical mechanism for these flows, which would rise when the receiving country is growing below its potential level of income. However, the response of ODA is mildly pro-cyclical, that is, it increases once economic conditions improve in the recipient economy. Meanwhile, no significant association is found between FDI and receiving output.

Figure 5. Response of Remittances, ODA and FDI to Shocks to Middle East and Pakistani Output



[12] Test results are reported in the Appendix

Figure 6 presents impulse responses to a shock in North American output and responses of financial flows. ODA to the country responds counter-cyclically after the shock to North American output, while FDI responds positively and significantly after the second period to an initial shock to North American output. The response of remittances to a shock to North American output seems negative, but is not statistically significant. As regards the shock to the receiving economy, ODA and FDI respond pro-cyclically, that is, they increase when the receiving country enters an economic boom and would decrease in periods of economic recession. In contrast, remittances appear to be counter-cyclical, but are not significantly associated to Pakistan's economic activity.

Figure 6 Response of Remittances, ODA and FDI to Shocks to North American and Pakistani Output

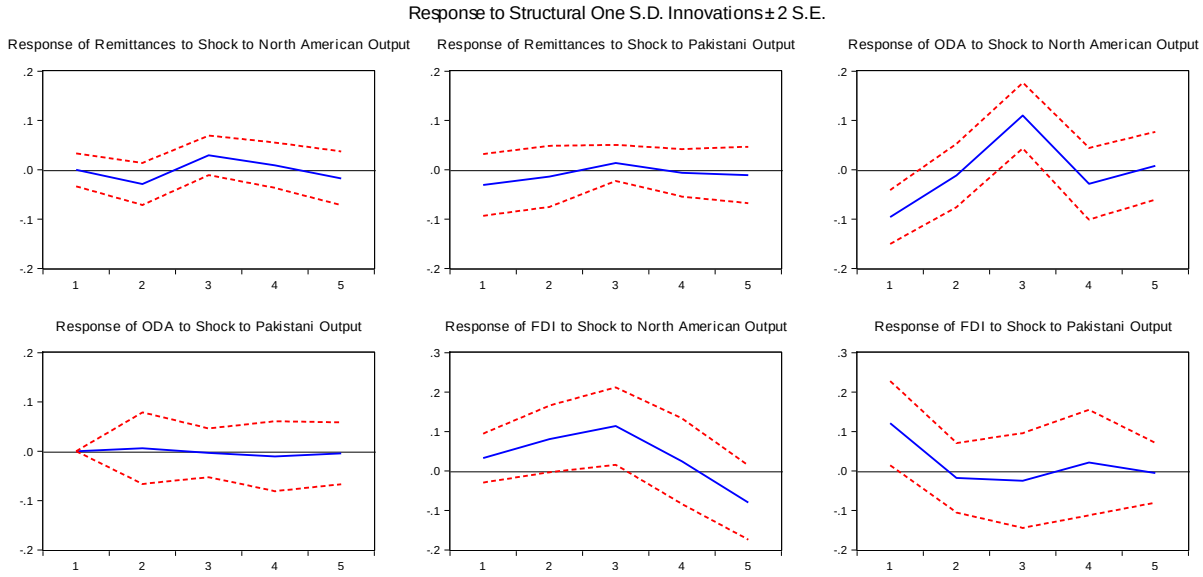
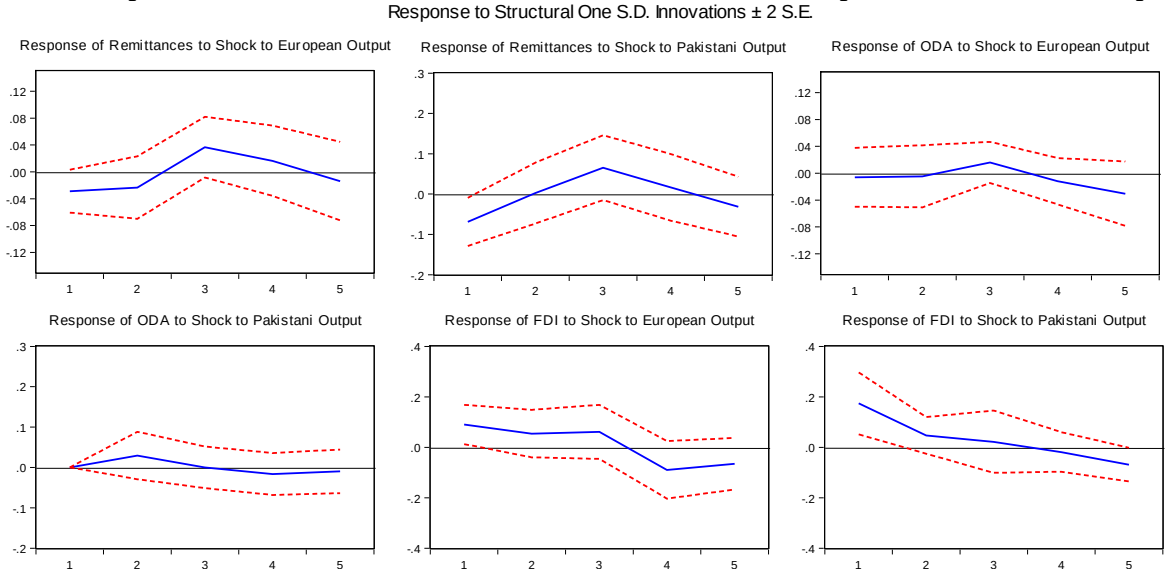
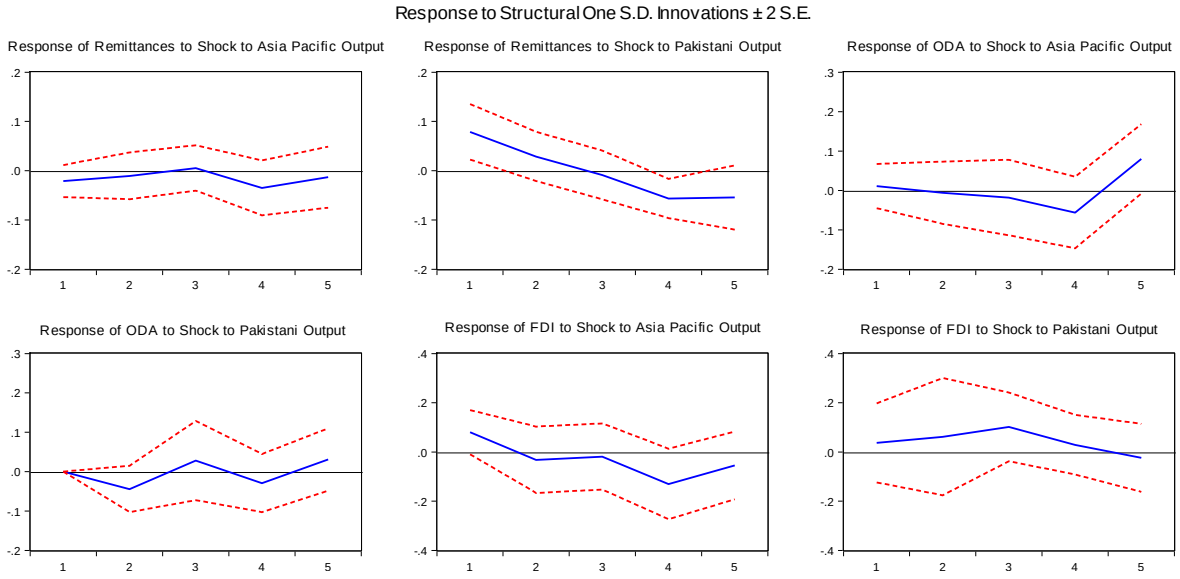


Figure 7 Response of Remittances, ODA and FDI to Shocks to European and Pakistani Output



The response of FDI to innovations in European output tends to be pro-cyclical (Figure 7). In contrast, the impulse response of Remittances and ODA to a shock to European output remains insignificant. Similarly, it seems that a shock to the cyclical component of Pakistani output is negatively associated to both remittance inflows, confirming the altruistic motivation of migrants, an economic recession in the receiving county accompanied by an increase in the inflows of remittances. In contrast, both FDI and ODA react pro-cyclical to shock to Pakistani output. However, the response of ODA to receiving output is temporary.

Figure 8. Response of Remittances, ODA and FDI to shocks to Asia Pacific and Pakistani Output



The responses of resource flows to shocks to output in the Asia Pacific region and Pakistan are illustrated in Figure 8. ODA shows significant impulse response to innovations in Pakistani output. The response is countercyclical, albeit temporary. The initial impulse response of remittances to shocks to receiving output is positive and significant, before turning negative and significant in the fourth period. However, FDI appears as acyclical to shocks to receiving output. Similarly, we found no association between remittances, FDI or ODA and Asia Pacific output.

Having examined how migrants' remittances and other financial inflows to Pakistan respond to the receiving and source business cycles, we now assess which of the two sets of cycles is more important for Pakistan. We obtain forecast error variance decompositions corresponding to our SVAR models. These show the extent of the variability that each shock accounts for in the total variation of the endogenous variable. The higher the share of the variable in the error variance, the more important the variable is in the system. We follow Sim and Bernanke (1986) to obtain forecast error variance decomposition. A variance decomposition of five future periods is reported. The variance decomposition reported in Table 5 depicts to what extent the forecast error variance in the cyclical component of remittances, FDI and ODA inflows to Pakistan explain structural shocks to Pakistan's and source regional output.

Table 5 Error Variance Decomposition: Percentage of Variation in Capital Inflows Explained by Pakistani and Regional Outputs

Period	Percentage of the variation in Remittances explained		Percentage of the variation in ODA explained		Percentage of the variation in FDI explained	
	Middle East output	**Pakistani Output**	**North American output**	**Pakistani Output**	**North American output**	**Pakistani Output**
1	16.48	**47.19**	**30.05**	0	3.121	**43.06**
2	30.22	**26.54**	**26.75**	0.111	11.91	**23.35**
3	23.45	**24.34**	**41.47**	0.094	20.60	**15.57**
4	18.94	**20.70**	**37.57**	0.259	17.74	**13.42**
5	13.91	**13.22**	**36.94**	0.283	21.58	**12.55**

Table 5 shows that remittances are the main driving factor, since they explain around 47 percent of variation due to receiving output. The fraction of FDI variance explained by Pakistani output ranges between 13 and 43 percent. However, a shock to regional output explains little variation in both remittances and FDI. Similarly, 41 to 27 percent of variance in inflows of ODA to Pakistan are due to North American output.

In general, the study shows that the inflows of remittances and FDI to the country are typically affected by their innovations to Pakistani output rather than source output. However, inflows of ODA are mostly affected by source output fluctuations, rather than Pakistani output.

5- Conclusions

Remittance inflows have become an important source of foreign exchange earnings in Pakistan, surpassing the inflow of FDI and Official Development Assistance. In this study, we examined the stability, cyclicality and stabilization impact of remittances together with other major capital inflows. We find that capital inflows exhibit different types of volatility, remittances being more stable than ODA and, in turn, ODA being more stable than FDI. Similarly, we describe stylized facts regarding capital flows and their co-movements with source and receiving real output. We found that remittances are counter-cyclical and stabilizing, serving consequently as a macroeconomic stabilizer for the Pakistani economy. ODA appeared to be acyclical and stabilizing, whereas FDI is pro-cyclical and destabilizing. Moreover, no clear pattern of cyclicality is found for remittances and source output, suggesting that remittances should not be a factor through which business cycles in these regions are affecting the economic conditions of Pakistan. However, we detected a positive association between FDI and source countries' real output. In particular, our findings show that two features make remittances an important source of foreign exchange to Pakistan compared to FDI and ODA. Firstly, they are relatively stable and to a certain extent compensate for the variability in output. Secondly, they tend to be counter-cyclical, increasing in times of economic hardship in the migrants' receiving countries.

We proceed with SVAR-based identification in order to examine the responses of remittances to innovation in receiving and source economies. We find a negative relationship between the cyclical components of remittances and the cyclical components of receiving output, which

corroborates the results we found earlier. The results revealed that migrants increase their transfers during recessive phases of economic activity in Pakistan. Similarly, we find that FDI responds positively to fluctuations in the economic conditions in the receiving country. However, the response was insignificant in some cases. In contrast, results were inconclusive regarding the relationship between ODA and the economic conditions in the receiving country. Meanwhile, with regards to host region business cycles, remittances are acyclical except for the Middle East, where they display a counter-cyclical trend. In variance decomposition analysis, inflows of remittances and FDI to the country are typically affected by innovations in receiving output rather than by source output. However, inflows of ODA are mostly affected by source output fluctuations rather than by receiving output.

Our results indicate that remittance flows to Pakistan mainly respond to economic conditions in the receiving economy. Similarly, a confluence of global factors and favorable domestic conditions played a role in driving FDI flows to Pakistan. One major challenge for our policymakers is to find substitutes to reduce reliance on remittances, so that the country is capable of coping with the associated risks if inflows slow down.

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Appendix:

A.1 Statistical Significance of Cross-Correlation:

In order to calculate the statistical significance of these correlation coefficients, the null hypothesis $H_0: \rho = 0$ is tested against the two-sided alternative hypothesis that $H_A: \rho \neq 0$, using the correlation coefficients, *r*, calculated from the given samples over the period 1974-2011.
In deciding whether to reject or not reject the null hypothesis, the critical t-values are determined according to $t = r.\sqrt{\frac{n-2}{1-r^2}}$

Where *n* is the number of observations in each sample. With *n*=37 this value is expected to Fall with a 95% probability into the [-2, 2] bracket, when the null hypothesis is true.

$$t^2 = \frac{r^2(n-2)}{(1-r^2)}$$

So, by rearranging terms in equation (2), we obtain

$$\frac{n-2}{t^2} = \frac{1-r^2}{r^2} \Rightarrow \frac{37-2}{(\pm 2)^2} = \frac{1-r^2}{r^2} \Rightarrow \frac{35}{(\pm 2)^2} = \frac{1}{r^2} - 1$$

$$9.8 = \frac{1}{r^2} \Rightarrow r = \pm(9.8)^{-0.5} \cong 0.32$$

In our study the correlation that falls outside the (-0.32, 0.32) range requires the null hypothesis to be rejected

A.2 Augmented Dickey Fuller Test

The simple Dickey and Fuller (DF) test is valid only if the series is an AR (1) stochastic process. If the series is correlated at higher order lags, the assumption of white noise error term is violated and the DF test will no longer be useful. If the error term u_t is correlated, Dickey and Fuller have developed another test, known as the augmented Dickey-Fuller (ADF) test. This test constructs a parametric correction for higher-order correlation by assuming that the series follows an AR (p) process, by adding further lagged differences of the dependent variable. The ADF tests the null hypothesis that a time series is *I (1)* against the alternative hypothesis that it is *I (0).* The ADF here consists of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t$$

Augmented Dickey Fuller has the following hypothesis:
Null Hypothesis $H_0: \delta = 0$, the time series is non-stationary.
Alternative Hypothesis $H_1: \delta \neq 0$, the time series is stationary.

If the null hypothesis is rejected, it means that the variable is stationary, whereas acceptance of the null hypothesis means the series is non-stationary at that level and needs to be differenced to make it stationary.

Table A.1 ADF Test Results for Unit Roots

Variables'	*Level*	*HP Filter*	*BK Filter*	*OC Filter*
Remittances	-2.54(0)	-5.50*(1)	-4.78*(1)	-5.29*(1)
Foreign Direct Investment	-3.48(3)	-5.18*(0)	-4.18*(0)	-5.70*(4)
Official Development Assistance	-3.14(0)	-7.55*(1)	-6.61*(1)	-5.01*(5)
Pakistanis Output	-1.35(1)	-4.46*(1)	-3.94*(1)	-5.69*(1)
North American Output	-1.62(1)	-5.19*(1)	-4.27*(1)	-4.73*(1)
Middle East Output	-2.37(0)	-4.83*(3)	-4.60*(0)	-5.07*(3)
European Output	-1.04(1)	-5.68*(1)	-3.74**(7)	-5.21*(8)
Asia Pacific Output	-1.40(0)	-5.68*(1)	-4.78*(1)	-4.77*(8)

ADF represents the Augmented Dickey-Fuller unit root test with trends for the original and the detrended series. Asterisk,* represents 1% level of significance and ** represents 5% level of significance. For Lag length selection, SIC Criterion was used. HP, BK and OC filter shows Hodrick Prescott, Baxter and King and Corbae and Ouliaris filters.

A.3 Hodrick and Prescott Filter

The HP Filter is applied to the trend-cycle component of each variable in order to extract the stationary (cyclical) and non-stationary (trend) components. We do so using the definition of a business cycle provided by Lucas (1977) and Kydland and Prescott (1990), stated as deviations of aggregate real output from its long-term trend (a growth cycle). In order to examine the cyclical aspects of remittances for instance, we first de-trend each series using the HP filter. The filter decomposes a time series y_t into an additive cyclical component and trend components.

$$y_t = y_t^T + y_t^c$$

For any series *y* the HP filter decomposes the trend (non-stationary) component y^T represents the long-run movements in the series, and the cyclical (stationary) component i.e. $y_t^c = y_t - y_t^T$ arising from business cycle fluctuation. The HP filter removes smooth trends from some given data y_t by solving

$$min \sum_{t=1}^{T} [ln(y_t) - \ln(y_t^T)]^2 + \lambda \sum_{t=2}^{T-1} [ln(y_{t+1}^T - y_t^T) - ln(y_t^T - y_{t-1}^T)]^2$$

y_t is the natural logarithm of the series at time t. y_{t-1}^T y_t^T y_{t+1}^T is the trend components at time *t-1, t , t+1*. y_t^c is the cyclical component at time . The first term $(y_t - y_t^T)$ is the deviation from trends over long time periods corresponds to cyclical components and is the object of economic interest. The second term is the sum of squares of the growth components' second difference, i.e. smoothness of y_t^T . λ is the smoothing parameter that reflects the relative variance of the two components. The larger the value of λ the greater the smoothness. If λ =0 then the filtered series is the original series, i.e. there is no smoothing.

If λ approaches infinity, then growth components correspond to a linear trend. We adopt the value of λ =6.25 recommended by Ravn and Uhlig (2002). All the series are in logarithmic form throughout our study, as we are concerned with percentage deviations from trends.

A.4 Band Pass Filters

Baxter and King (Time domain) Filter: Following Burn and Mitchell (1946), the classical business cycle is defined as the sequential pattern of expansion and contraction in aggregate economic activity. The Baxter-King (1999) filter is a band-pass filter that attempts to isolate cycles with period lengths of between 1.5 and 8 years, which is the typical length of U.S. business cycles. Any cycle lengths longer than 8 years are identified by the trend and the remainder is consigned to the irregular component. The data is detrended using a band-pass filter that leaves out all frequencies above 8 year and below 1.5 year. It can be shown that the exact band pass filter is a double-sided moving average of the original series of infinite order and with known weight. Moreover, *Corbae-Ouliaris ideal (Frequency domain) filter* are also used (Corbae and Ouliaris, 2006) to extract the cyclical component of a series. Once the series is translated from time domain to frequency domain, we can filter out all the components in a series, except those that correspond to the selected frequency band (Bjornland , 2000). All variations in the data with cycles between 1.5 and 8 years belong to the business-cycle component of the data, while removing lower and higher frequencies. It follows the definition by Burns and Mitchell (1946) that a business cycle is the fluctuation of real output with periodicity between 1.5 and 8 years.