Explosiveness in foreign remittance inflow to Pakistan

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Abstract: - Foreign remittance inflow to Pakistan is mounting erratically upward from almost a decade and half at a pace never seen historically. We examine the explosiveness in remittance inflow to Pakistan from July 1972 to July 2016 and from various source (host) countries. We use a rolling-window based augmented Dickey–Fuller unit root test and find that periods of abrupt remittance inflow match with the important historical events occurring in the country and internationally. Overall, we put forward conceptually the new notion of temporary explosiveness in the remittance inflow.

Key-Words: - Remittance, explosiveness, rolling window unit root, unforeseen events

1. Introduction

Global estimates of the remittance, in 2015, are US dollar 601 billion. Of these about US dollar 441 billion are the remittance that migrants sent to their home countries in developing world. This number is three times the volume of official development assistance (ODA). Remittance are a major part of the GDP of developing countries and thus, contributes to increased investments in sectors like; health, education, and small enterprises. The top five South Asian remittance recipient countries in 2015 are India ($72.2bn), Pakistan ($20.lbn), Bangladesh ($15.8bn), Sri Lanka ($7.2bn), and Nepal ($6.6bn).

Globally, Pakistan is among top ten (at number 8) and in South Asia Pakistan stood second after India in terms of remittance receipt. Remittance constitute about 7 percent of National income of Pakistan. Furthermore, in the year 2013, about 6.17 million (3.4 percent of the total population) Pakistanis migrated to various parts of the world. Most important destination for Pakistani immigrants includes Saudi Arabia, Gulf Cooperation Council (GCC), and United Arab Emirates (UAE) among others [1]. In last three decades, remittance inflow increased more than ten folds from a meagre amount of 2.88 billion in 1982-83 to about 20 billion in year 2014-15 [2-4]. Pakistan has an impressive remittance growth of 16.1 percent during July-April 2014-15 compared to the corresponding period last year. This remittance growth has accelerated over time and especially in the last four years, remittance growth in Pakistan has been the strongest among top 20 remittance recipient's countries in the world [4]. It is important to note that foreign remittance play an important role in the economy of Pakistan and remittance are an important component of foreign exchange [3]. Almost 80 percent of Pakistan's oil imports are financed through foreign remittance. Number of factors at national, regional and global level played a pivotal role in

explaining the erratic upward surge in foreign remittance flow to Pakistan [2].

This paper aims at empirically examining the trends of remittance flow using monthly and host countries disaggregated data set of remittance flow to Pakistan. This is first of its kind study that is analyzing the explosivity of remittance using a developing country monthly remittance inflow data. This study is unique in the following ways. First, we employ nationally representative monthly time series data for almost five decades (July 1972-June 2016) to empirically examine the fluctuations of remittance from various source (host) countries. Second, previous studies have examined the micro as well as macroeconomic determinants of remittance inflow and the disproportionate as well as dominant role of high-profile, unforeseen, and rare events of large magnitude and consequence (e.g., 9/11, financial crisis of 2007-08, earthquake, floods etc.) with respect to remittance inflow has remained unattended. In this way, we bridge the gap in the past and current literature, to the best of our knowledge, exploring the determinants of remittance inflow over last two decades. Third, we use a rolling-window based augmented Dickey–Fuller unit root test to examine the statistical properties of monthly remittance inflow to Pakistan. As a robustness check, we also compare the rolling-window based augmented Dickey–Fuller unit root test results with the forward recursive method and the bubble detection method [5].

Finally, this study analyzes the monthly inflow of remittance data disaggregated by host country over a period of almost 5 decades. Not only has this study used all the available host countries but also the regional level disaggregation. We have used GCC and Saudi Arabia disaggregation keeping in view that nearly 88 percent of the total increase in remittance during FY15, was contributed by countries of Middle East region, especially Saudi Arabia and UAE. The remittance growth in Pakistan over the past five years was sourced primarily from these countries, which relied heavily on migrant workers to support their booming construction industry. Furthermore, predominant majority of unskilled and semi-skilled workers from Pakistan have migrated to Saudi Arabia and Middle East (the GCC) countries.

Our findings indicate that September 11, 2001 has a strong determining effect on remittance inflow to Pakistan. Climatic changes and heavy rains also brought a lot of havoc to Pakistan and those periods of unforeseen events experienced explosiveness in remittance inflow.

The rest of the study is organized as under. Section 2 discusses in detail the previous literature on remittance inflow. Section 3 outlines the employed methodology. Section 4 presents the data and empirical findings. Finally, section 5 concluded the study.

2. Literature Review

Previous works that examined the main motives behind remittance include altruism [6, 7], self-interest [8], loan repayment [9, 10] and insurance [11, 12]. For the well-being of their families at home country, altruistic emigrants remit money during bad times: hence, remittance inflow helps in consumption smoothing during periods of transitory income shocks [13-15]. However, a totally different phenomenon is observed when the immigrants remit by a motivation of self-interest. Under this phenomenon, immigrants are motivated by the reason of investment in various assets during good times. This ultimately leads to a positive association between domestic economic activity and remittance inflow [16].

Various studies that examined motivations to remit include, for example, [13, 14, 16], among others. [14] collect a combined data of 36 African (Sub-Saharan) countries for a sample period of 1990 to 2005 and reports that more remittance inflow are observed in countries where the families of immigrants are experiencing income shocks. [13] finds an increase in remittance inflow as income level in home countries drops below potential. Conversely, [16] use a panel of 11 developing economies to investigate the association between remittance and GDP per capita growth rate. The findings of the study favor the hypothesis of self-interest as the authors conclude positive relationship between remittance inflow and GDP per capita growth rate.

Different theories considering various aspects i.e. the household welfare, utility functions etc. reported contrast findings regarding the determinants of remittance inflow. In studies that investigated the impact of microeconomic variables on remittance may include immigrants' level of income, education, stay period in abroad, marital status and number of dependents in home country (17, 18). While, researches that accounted for macroeconomic determinants may comprise differences in economic conditions and wage rate at home and host countries

[19], income differential, inflation rate, exchange rate volatility, real interest rate differences, political stability of home and host countries, government immigration policy and ease of funds transfer (see, e.g., [20-22].

[23, 24] find a significant impact of exchange rate, political stability, government policies and financial intermediations on remittance inflow. [25, 26] for Turkey and [19] for Egypt report that the major determinants of remittance inflow are growth rate, income level, inflation rate, interest rate differences, black market premium and military regimes in host countries. Similarly, [3] in their study report that agriculture output at home country and investment opportunities at home as well as host country are the significant determinants of workers' remittance. [27] conclude that inflation exhibits significant inverse and terrorism significant relation with remittance. Moreover, they find that financial liberalization index negatively influences, whereas democracy encourages immigrants to remit to their homes.

[28] test the hypotheses of motivations to remit. The results do not support the hypothesis of altruism as home income contractions do not seem to have an impact on remittance inflow. This shows that the immigrants are not induced to remit more as the income level in the home country declines.

As can be seen from the above discussion that studies examine the micro as well as macroeconomic determinants of remittance inflow, however the explosivity of remittance because of unforeseen events such as 9/11, financial crisis of 2007-08, earthquake, floods etc. that can increase the remittance inflow has remained unexplored. Hence, this paper to the best of our knowledge is the first attempt that analyzes the explosivity of remittance using a large monthly dataset of a developing country.

3. Methodology

The statistical properties of monthly remittance inflow to Pakistan from different important immigrant destinations are examined using a rolling-window based application of an augmented Dickey–Fuller (ADF) unit root test proposed by [29]. The null hypothesis of a unit root is tested against the alternative of an explosive root. Therefore, the following equation is estimated:

$$x_t = \mu_x + \delta x_{t-1} + \sum_{j=1}^{J} \emptyset_j \Delta x_{t-j} + \varepsilon_{x,t},$$
$$\varepsilon_{x,t} \sim NID(0, \sigma_x^2), \quad (1)$$

The null hypothesis $H_0: \delta = 1$ is tested against the alternative $H_1: \delta > 1$. This test is a standard unit root test except for the formulation of the alternative hypothesis. Unlike, the traditional ADF unit root testing where the alternate hypothesis is that the series is stationary, the null of a unit root in this case is tested against explosiveness in the time series. For the rolling window approach, we fix the rolling window size and unit root test is applied for each sub-sample and the fixed rolling window moves forward until the last sample observations is reached. This procedure yields a sequence of t-statistics with corresponding p-values. These sequences are used to identify origination $\hat{r}_e$ and collapse dates $\hat{r}_f$ of explosive behavior in the data:

$$\hat{r}_e = \inf_{s \geq r_0} \left\{ s: \mathrm{ADF}_s > \mathrm{cv}_{\beta_n}^{\mathrm{adf}}(s) \right\}$$
$$\hat{r}_f = \inf_{s \geq \hat{r}_e} \left\{ s: \mathrm{ADF}_s < \mathrm{cv}_{\beta_n}^{\mathrm{adf}}(s) \right\}$$

We also compare the rolling-window based test statistics sequence with the results obtained through forward recursive method and the bubble detection method [5].

4. Data and Findings

We use an extensive monthly remittance inflow data set for Pakistan. We consider total remittance inflow to Pakistan as well as some important immigrant's destinations such as remittance inflow from USA, UK, Saudi Arabia, GCC, EU and other remaining countries. This monthly data spans from July 1972 till July 2016, a total of 529 monthly observations. The data for this purpose is monthly remittance flow to Pakistan in million US dollars from State Bank of Pakistan.

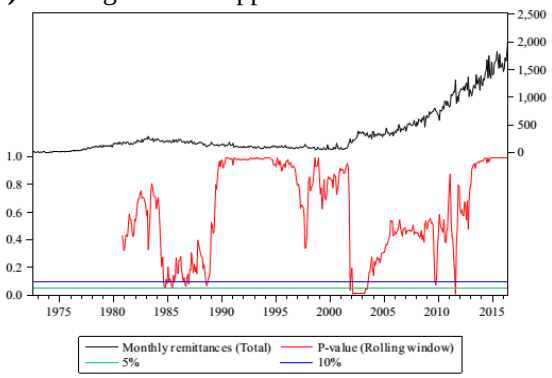
We present the results obtained using the test procedure outlined in methodology section to the total monthly remittance inflow to Pakistan. The estimated t-statics and corresponding p-values are obtained using the rolling window method, and each window has 100 monthly observations. The panel (a) of Figure 1 displays total remittance inflow series as well as the sequence of p-values; p-values below 5% and 10% indicate rejection of the null hypothesis at respective level of significance. The horizontal axis indicates the date for the corresponding estimation window. For example, the first estimation window uses observations from 1972M7 to 1980M9 so that the first p-value on the horizontal axis is shown from 1980M10. The number of the out-of-sample observations is 429. As explained in the methodology section, rejection of null hypothesis of unit root during

a specific period implies explosiveness in remittance inflow series. This is found to be true during 2001/2002 and in 2011 as the p-values are lower than 5% level. September 11, 2001 has a strong determining effect on remittance inflow to Pakistan [27]. It is due to the fact that after terrorist attacks of September 11, 2001, USA especially and other industrialized countries tighten their financial regulations especially transactions occurring in Muslim majority countries. Furthermore, due to the September 11, 2001 event, Pakistani diaspora transfer their assets and savings to Pakistan particularly from US [2]. Of note, is the increase of remittance from EU and from North America (USA and Canada) through official channels (e.g., Banks). During 2011, the altruistic behavior of remitters to Pakistan is also notable. Climatic changes and heavy rains brought a lot of havoc to Pakistan as in the year 2010 Pakistan faced a devastating episode of flood due to torrential rains. The flood of 2010 brought a lot of damage to standing food and cash crops in the provinces of KPK, Punjab and Sindh and also a lot of death occurred of livestock.

Since our rolling window procedure is based on a fixed window size and we arbitrarily set to 100 months, it is possible that our results may be sensitive to the rolling window size. To check the robustness of our results to different window sizes, we perform rolling window unit root test for different rolling window sizes i.e., 80, 100 and 120 monthly observations. The comparison provided in panel (b) of Figure 1 shows the p-values obtained under different rolling window sizes and it can be seen that same conclusion is achieved and hence our results are not sensitive to rolling window size.

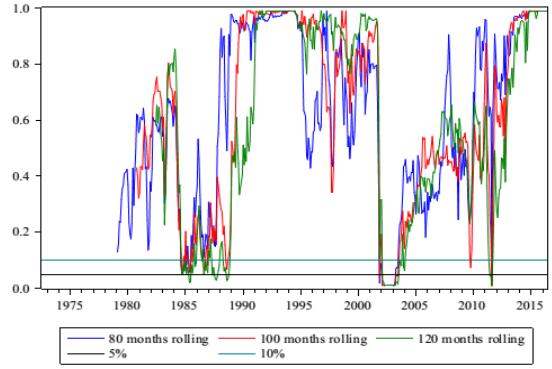
Figure 1: Explosiveness of monthly total remittance inflow to Pakistan

a). Rolling window approach



Note: The RHS of the vertical axis represents remittance inflow, whereas the LHS represents the sequence of p-values where the p-values below 5% and 10% indicate a rejection of the null hypotheses at the respective levels of significance. The horizontal axis indicates the date for the corresponding estimation window.

b). Robustness check using different rolling window sizes.



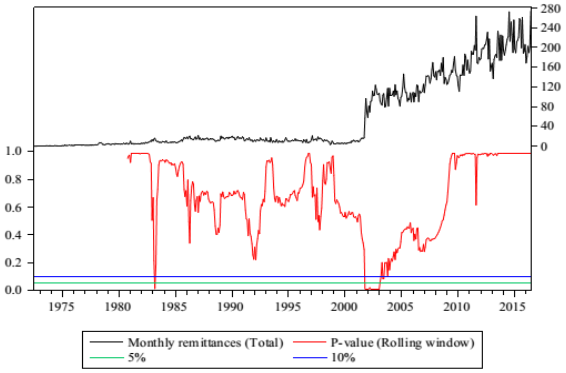
Note: Vertical axis represents the sequence of p-values where the p-values below 5% and 10% indicate a rejection of the null hypotheses at the respective levels of significance. The horizontal axis indicates the date for the corresponding estimation window.

Figure 2 (panel a-f) shows the results of rolling window unit root test to detect the explosiveness in remittance inflow from USA, UK, KSA, GCC, EU and other countries. The remittance inflow from USA (panel a) experience a sudden rise during 1983 and 2001/2002. From UK, remittance explode during 1980, 2002/2004, 2009, 2011 and 2013. 1980 coincides with the end of American-Afghan war where Pakistan was also a victim to it. The war ended in 1979 and political aid from USA flooded in Pakistan, things were getting better and thus due to investment motive, number of Pakistani workers remitted their money to Pakistan for investment purposes. In 2002-04, Pakistan had a severe crisis of water scarcity due to no rain and hence damage to agriculture crops. Also, this was the time after September 11, 2001 event happened and US Led coalition forces started the war in Afghanistan. 2009, 2011 and 2013 had consecutive severe flooding in Pakistan which damaged the human settlements, agriculture, livestock and hence the livelihood of many Pakistanis. In these hard times remittance inflow was obvious due to making both ends meet [15]. Explosiveness in remittance series from KSA is evident during 1985/1987 and 2012/2013. Another significant inflow episode is during 2003/2004; however, the p-values are only significant at 10% level. Zia-ul-Haq's Martial Law ended in December 1985 and Muhamad Khan Junejo became the prime

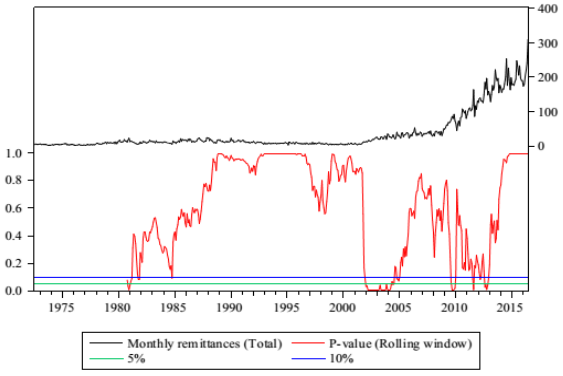
Minister of Pakistan in the none party elections. These were the times when Martial law and political party bans were lifted. Benzair Bhutto came back to Pakistan in 1986 and political uncertainty ended with the 1988 democratic election in Pakistan. This restored the trust of the immigrants and hence the remittance inflow from Middle East to Pakistan increased. 2012-13 coincides with the political upheaval and terrorism in Pakistan. Number of terrorist attacks happened across Pakistan in the year 2012-13 which affected the psychosocial health and wellbeing of people as well as Pakistan saw a continuity of dwindling democracy and had its second consecutive elections. Democracy is linked to remittance flow [27].

Figure 2: Explosiveness of monthly remittance inflow to Pakistan

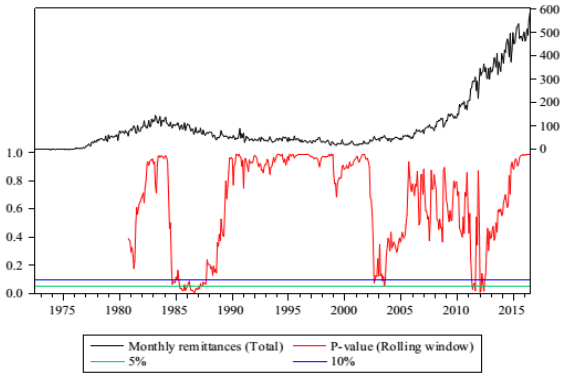
a). USA



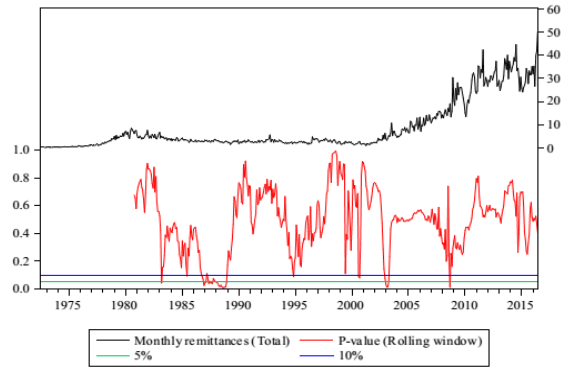
b). UK



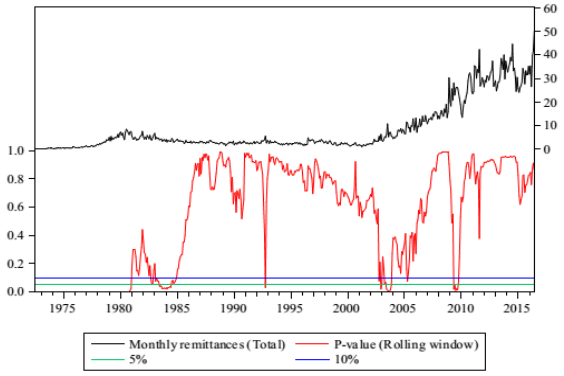
c). KSA



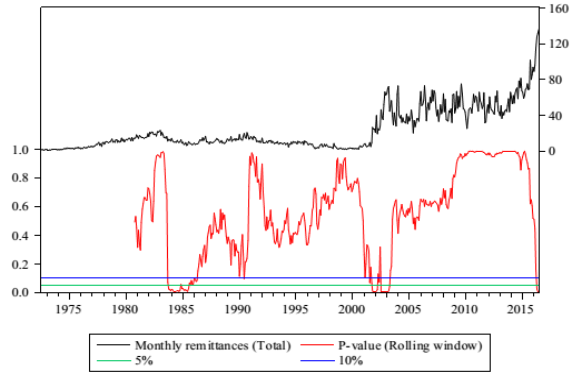
d). GCC



e). EU



f). Other countries

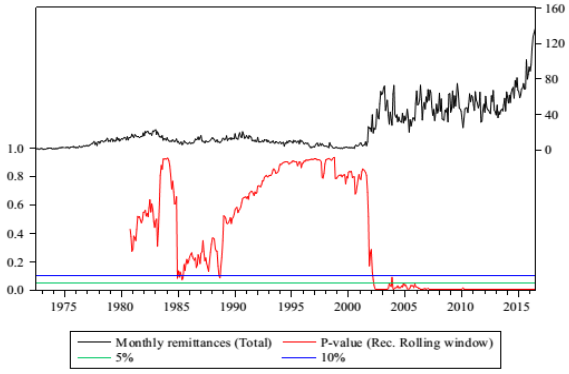


Note: See notes to Figure 1(a).

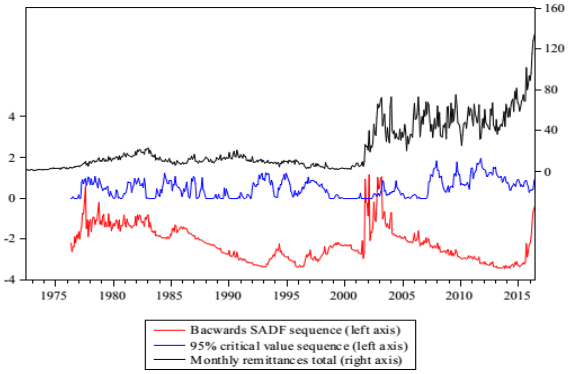
Finally, we compare results of our proceedure of explosiveness detection with i). same methodogical proceedure using a forward recursive approach and ii). The Generalized Supremum Augmented Dickey–Fuller (GSADF) test procedure proposed by [5]. For the later case, we perform a recursive generalized sup ADF (GSADF) technique to test the significant deviations in the remittance inflow series. The results of forward recursive method for the remittance inflow from other countries series are shown in panel (a) of Figure 3. It can be seen that method identifies the start of explosive increase in remittance similar to that obtained using rolling window method; however, the p-values remains under 5% level through the period afterwards. This pattern suggests that method may capture the explosivenss at first instance however, recursiveness makes it harder to draw valid inefrence afterwards. We can also see that the method somehow presents p-values as an inverse of the origional time series trend.

The results of recursive GSADF are shown in panel (b) of Figure 3. The method, inline with previous findings, suggest explosive increase in remittance inflow during 2002/2003; however, again the sudden increase in remittance at the end of our sample i.e., 2016 was not detection by recursive GSADF method. Furthermore, this method only depicts the explosivesness (bubbles) but could not find the reverse explosiveness (sudden decrease in remittance flows) which is apparent in our time series during 1884/1985.

Figure 3: Comparison of rolling window method with alternative approachs
a). Recursive forward approach



b). GSADF bubble detection approach



Note: See notes to Figure 1(a).

5. Conclusion

Present study employs nationally representative monthly time series data for almost five decades (July 1972-June 2016) to empirically examine the fluctuations of remittance from various source (host) countries. Further, we analyze the monthly inflow of remittance data disaggregated by host country. Not only has this study used all the available host countries but also the regional level disaggregation. The study uses a rolling-window based augmented Dickey–Fuller unit root test to examine the statistical properties of monthly remittance inflow to Pakistan.

Findings indicate that September 11, 2001 has a strong determining effect on remittance inflow to Pakistan. It is because after terrorist attacks of September 11, 2001, USA especially and other industrialized countries tighten their financial regulations especially transactions occurring in Muslim majority countries. During 2011, the altruistic behavior of remitters to Pakistan is also notable. Further, the results regarding the explosiveness in remittance inflow from USA, UK, KSA, GCC, EU and other countries indicate that the inflow from USA experience a sudden rise during 1983 and 2001/2002. From UK, remittance explode

during 1980, 2002/2004, 2009, 2011 and 2013. Explosiveness in remittance series from KSA is evident during 1985/1987 and 2012/2013. Another significant inflow episode is during 2003/2004. Finally, the comparative results of rolling-window using a forward recursive approach and the generalized supremum ADF (GSADF) based unit root tests indicate that rolling-window based ADF test provides more robust findings.

In summary, our study provides a concise estimate of the periods where historical foreign remittance flow deviated significantly since July 1972. Although, the debate as to the exact causes of the identified periods of explosivity remains open, the impact of foreign remittance inflow seems altruistic and investment oriented and thus contributed towards macro-economy of Pakistan.

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