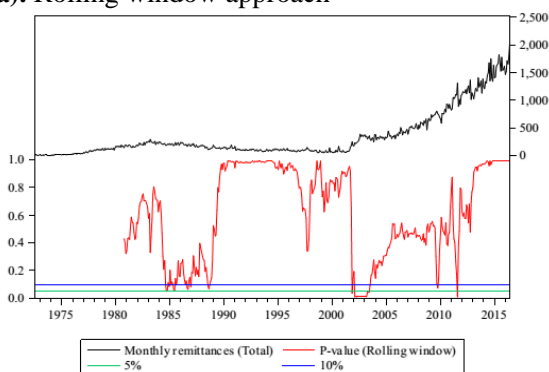


a specific period implies explosiveness in remittance inflow series. This is found to be true during 2001/2002 and in 2011 as the p-values are lower than 5% level. September 11, 2001 has a strong determining effect on remittance inflow to Pakistan [27]. It is due to the fact that after terrorist attacks 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.

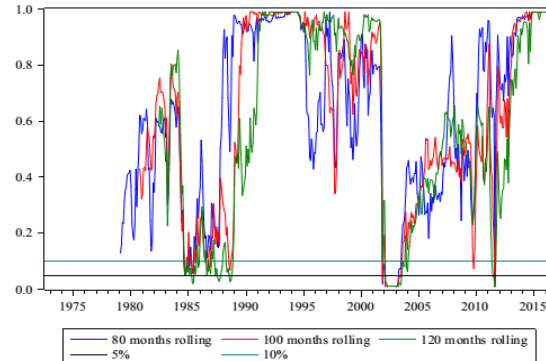
Figure 1: Explosiveness of monthly total remittance inflow to Pakistan

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.



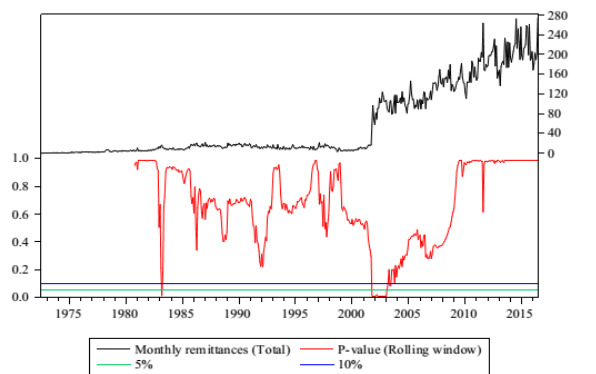
Note: Vertical axis represents the sequence of p-values where the p-values below 5% and 10% indicate a rejection of the null hypotheses at the respective levels of significance. The horizontal axis indicates the date for the corresponding estimation window.

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

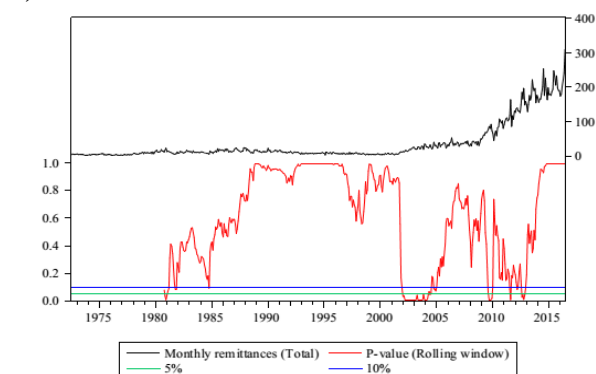
Minister of Pakistan in the none party elections. These were the times when Martial law and political party bans were lifted. Benzair Bhutto came back to Pakistan in 1986 and political uncertainty ended with the 1988 democratic election in Pakistan. This restored the trust of the immigrants and hence 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

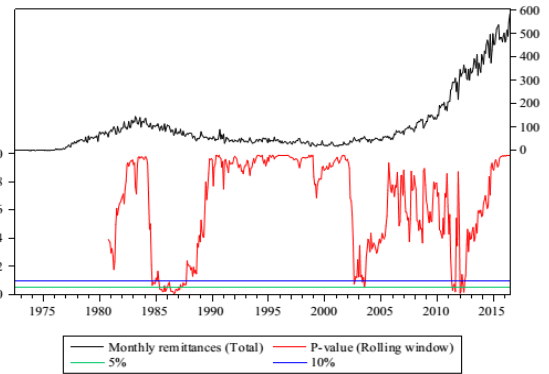
a). USA



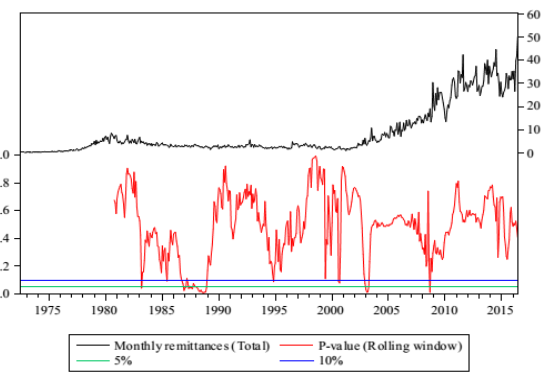
b). UK



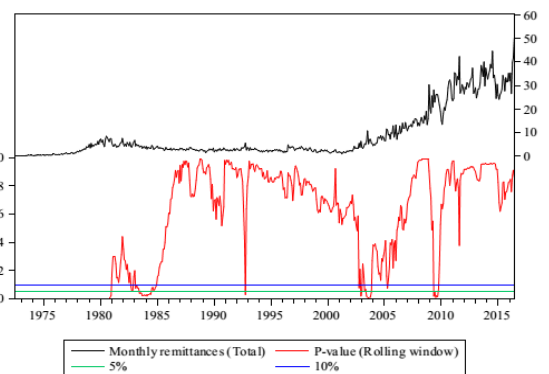
c). KSA



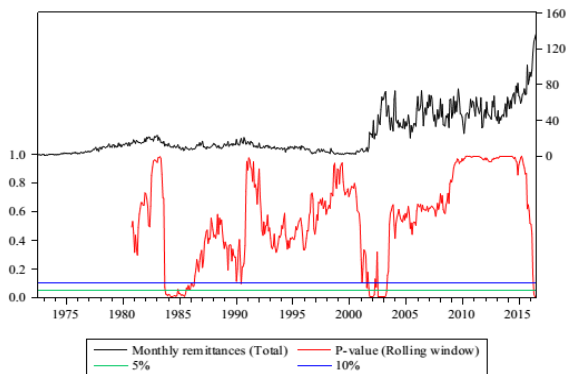
d). GCC



e). EU



f). Other countries



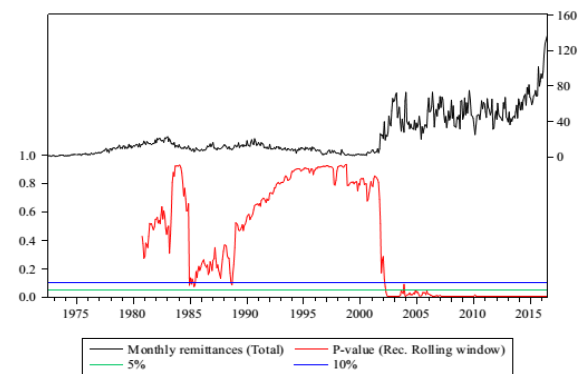
Note: See notes to Figure 1(a).

Finally, we compare results of our procedure of explosiveness detection with i). same methodological procedure 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 explosiveness at first instance however, recursiveness makes it harder to draw valid inference afterwards. We can also see that the method somehow presents p-values as an inverse of the original time series trend.

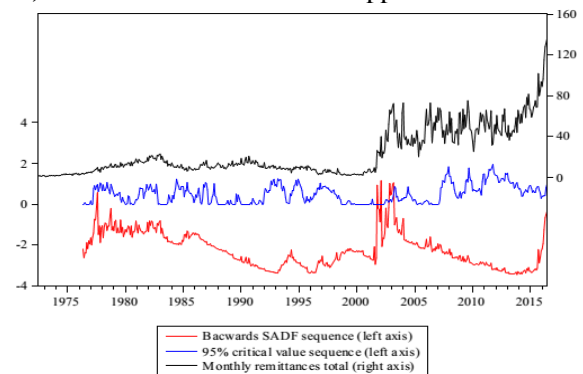
The results of recursive GSADF are shown in panel (b) of Figure 3. The method, inline with previous findings, suggest explosive increase in remittance inflow during 2002/2003; however, again the sudden increase in remittance at the end of our sample i.e., 2016 was not detection by recursive GSADF method. Furthermore, this method only depicts the explosiveness (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 approaches

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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