

Decoding Currency Fluctuations: Exploring Exchange Rate Dynamics Through Generalized Sup ADF Tests In Emerging Markets

Rafiq Ahmed¹, Aftab Hussain Tabasam (correspondence Author)², Shahid Mahmood³, Nowsherwan Sarwar⁴, Lubna Zafar⁵, Syed Tehseen Jawaid⁶

Abstract

The present empirical research is a pioneering study to identify the multiple episodes of bubbles in Pakistan's economy's nominal rupee-dollar exchange rate for three data sets: annual, quarterly, and monthly. The high-frequency data sets benefit from the close analysis of the dilemma. The famous Generalized Supremum Augmented Dickey-Fuller GSADF test determines the explosive multiple bubbles in Pakistan's exchange rate. Annual data revealed that the two episodes of bubbles were first from 1988 to 2003 and second from 2018 to 2019. The quarterly data set reported that there are three episodes of the bubble: the first starts from the 1st quarter of 2009 to the 2nd quarter of 2015, the second from the 3rd quarter of 2015 to the 3rd quarter of 2017, the third starts from the 4th quarter of 2017 to 2nd quarter of 2021. Finally, the monthly data set reports a single bubble episode from 2009M03 to 2021M06—such bubbles in the exchange rate call for instability in forthcoming trade contracts. Pakistan's government should adopt tight monetary and fiscal policies to avoid exchange rate bubbles in the future.

Keywords: Bubbles, Generalised Supremum Augmented Dickey-Fuller (GSADF), Exchange rate, Pakistan.

Introduction

In the 1970s, the fixed exchange rate system following the Bretton Woods system was changed to a flexible system, and significant countries of the world adopted it. Under such a system, the currencies could float around the dollar, and the fixed exchange rate regime ended. The exchange rates are affected by significant historical events, notably the Asian financial crisis. The abrupt and sudden changes in the exchange rates gather the attention of researchers and economists to inquire about a situation from multiple dimensions. Some economists believe that speculative bubbles cause such abrupt movements in the exchange rate. There are some

¹Assistant Professor College Education Department, Government Of Sindh, Karachi-75270, Pakistan ORCID ID 0000-0002-9229-758X

²Department Of Business Administration University Of Poonch Rawalakot Azad Kashmir, Pakistan ORCID: <https://Orcid.Org/0000-0002-3788-7966>

³MUST Business School Mirpur University Of Science And Technology (MUST) Mirpur-10250 Azad Kashmir Pakistan

⁴MS Management Sciences Riphah International University Islamabad, Pakistan

⁵Department Of Computer Sciences University Of Poonch Rawalakot Azad Kashmir, Pakistan

⁶Assistant Professor Applied Economics Research Centre, University Of Karachi Karachi-75270, Pakistan ORCID:

<https://Orcid.Org/0000-0002-5639-4788>

Corresponding Author: Aftab Hussain Tabasam

examples of such bubbles in the exchange rate, for example, sterling-dollar bubbles during 1980 (Evans, 1986) and some studies reported mixed results (Wu, 1995), (Meese, 1986) and (West, 1987b).

According to economic literature, a bubble is an observable phenomenon; the sudden rise and fall of economic magnitude is known as a bubble. Usually, bubbles are attributed to asset prices that show volatile behaviour in the market, specifically when their current value exceeds the fundamental value (Brunnermeier, 2016). The investors speculate that future prices will be higher, making selling more profitable. That is why they hold assets and do not make any transactions. The behaviour of prices affects the economy; hence, its understanding is necessary to plan or forecast the future. Exchange rates facilitate trade with different nations and serve as economic assets to contain bubbles in the current context (Obstfeld et al., 1996). There were bubbles in the economic literature when the peso depreciated 15 per cent against the dollar, raising the famous Mexican peso crisis from 1994 to 1995. The Asian financial crisis also caused the major currencies to fall abruptly during 1997-1998; these crisis periods caused great uncertainty about future ventures.

Wealth is redistributed among various factors in an economy when a bubble occurs, and it can be direct or indirect, whereas the collapse of a bubble hampers economic indicators globally. It can be fruitful or destroy economic performance (Jiménez & Vilella, 2011). In light of these circumstances, several methods and models were used to investigate bubbles in the exchange rates around the world (Thompson & Hickson, 2006), (Tirole, 1985), (Evans, 1991), (Diba & Grossman, 1988). And (Kindleberger, 2000). The flexible exchange rate is beneficial to the macroeconomic performance and it will also facilitate international trade. The countries with open capital accounts benefit from this flexible exchange rate position. It is hazardous to have pegged exchange rates and open capital accounts simultaneously. The inflow and outflow of the capital accounts will be achieved through a flexible exchange rate policy by amending the domestic policy. If the country experiences a surplus in the balance of payments with the appreciation of the exchange rate, it will increase domestic production prices.

An exchange rate theory (Johnson, 2015) attributed movements of the exchange rate, apart from two other factors, to expected inflation relative to the foreign country. The price level ratio of two trading countries is explained according to the purchasing power parity theory and its relative counterpart is affected by the changes in the inflation rate. Higher inflation in the domestic economy brings about currency depreciation in Pakistan (Zada, 2010). The exchange rate volatility for Pakistan is examined in a study that concludes that due to inflationary pressure, currency devalues (Parveen et al., 2012). In addition, Pakistan's exchange rate has depreciated drastically at 20% from April to July of 2018, and its fluctuations hurt gross domestic product (GDP); however, its stability will benefit not only GDP but entire economic indicators (Hussain et al., 2019). In another study, the exchange rate of the United States (the US hereafter) is analysed for its major trading partners. This stance examines the consumer price index (CPI hereafter) ratio for the United Kingdom (the UK hereafter) and the US versus Japan.

Resultantly, their relationship is negative between CPI differential and exchange rate, the high amount of the CPI will lead to devaluation of the domestic country's currency (Jamal, 2005). A study focused on the determinants of the exchange rate found that the inflation rate differential negatively affects the exchange rate in the case of less developed economies (Ogun, 2012). The consumer price index (CPI hereafter) is a reliable measure of inflation in the country. When the CPI is low central bank reduces interest rates and vice versa to cut inflation back to its original level. In the same manner, CPI significantly impacts the exchange rate, and Figure 1 shows the annual exchange rate of Pakistan.

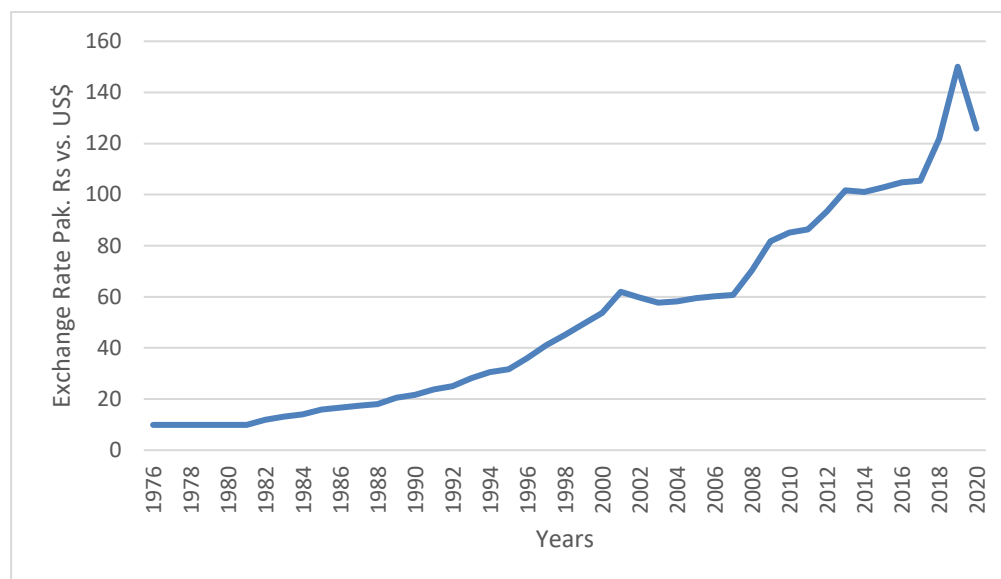


Figure 1 Exchange Rate of Pakistani Rupees versus United States dollar
Source: Author's Construction

The exchange rate shifting from fixed to flexible in 1973 led to the debate about its volatility and uncertainty on trade flows worldwide. Its stability is essential for a developing country like Pakistan because it heavily depends on international trade (Saqib et al., 2021). The exchange rate has been under debate in different directions for the economy of Pakistan. The depreciation of the exchange rate has recently been explored with the help of a macroeconomic model focusing on the expansionary effect of the exchange rate (Akbar & Ahmad, 2021). The analysis of the exchange rate is an essential development of the time for effective policy design. We are motivated by the fact that this may produce bubbles in the exchange rate. We use the technique developed by (Phillips et al., 2015) to test the explosive bubbles in the US dollar and Pakistani Rupee exchange rate. The rest of the paper is organised as section 2 discusses relevant literature, section 3 briefly explains the methodology, section 4 presents results, and section 5 concludes with policy recommendations.

Literature Review

A massive amount of literature is available on the phenomenon of the bubble. Asset price bubbles were considered the earliest to analyse; the exchange rate bubbles are also crucial to the audience. There are various aspects in which bubbles can be classified, and they are regarded as the theoretical areas of bubbles (Brunnermeier & Oehmke, 2013; Thompson & Hickson, 2006). Broadly, the literature on bubbles is spread over four categories, which will define the possibilities of having bubbles in the exchange rate (Brunnermeier, 2016). At the outset, investors in the market have enough information regarding rational expectations (Kindleberger, 2000), (West, 1987a), (Flood & Garber, 1980), (McKelvey & Palfrey, 1992), (Evans, 1991), and (Diba & Grossman, 1988). According to the information provided by these models bubbles with an explosive path can be estimated empirically.

Second, investors in the market have asymmetric information, and they can experience bubbles due to the absence of their occurrence (Brunnermeier & Brunnermeier, 2001), (Tirole, 1982), and (Allen & Gorton, 1993). Likewise, the third class of models refers to the behavioural and rational traders in the market for assets such as bubbles. Rational investors cannot manipulate the price impact of the behavioural nature of traders because of the limits on the arbitrage (Abreu & Brunnermeier, 2003), (Temin & Voth, 2004), (Shleifer & Vishny, 1997),

(Brunnermeier et al., 2013). Finally, according to the fourth class of models, if the investors believe in different fields in that case the presence of bubbles is valid because of their pessimistic behaviour; hence, there remains disagreement on its fundamental value (Scheinkman & Xiong, 2003) (Harrison & Kreps, 1978), (Miller, 1977), and (Ofek & Richardson, 2003).

The analysis of these models is segregated into two categories. The first two classes of models pertain to the rational expectations approach of the inquiry about bubbles. However, they differ according to assumptions underlying asymmetric or similar information of the investors and the interaction between non-rational and rational behaviour investors. Finally, the fourth group refers to the traders' pessimistic decision-making, which is why they disagree with the decision. This debate will draw attention to analysing the bubbles according to a behavioural or rational decision. The psychological approach to analysing the causes of bubbles has proved an important one in recent times (Vissing-Jorgensen, 2003), (Hirshleifer, 2001), and (Abreu & Brunnermeier, 2003). Despite such a debate about the bubbles, rational bubbles take precedence over irrational bubbles, this is evident from the shift of focus of analysis in the recent past (LeRoy, 2004).

The presence of rational bubbles nullifies the formal relationship between prices and the nominal exchange rate, and for decades, there has been an incredible amount of literature on the exchange rate concerning rational bubbles. In the 1980s, (Evans, 1986) analysed the sterling and US dollar exchange rates and found the presence of rational bubbles. Similarly, some studies showed mixed results about the bubbles in the exchange rate, and such studies include (Wu, 1995), (West, 1987b), and (Meese, 1986). The state-space model is used by (Elwood et al., 1999), along with Monte Carlo simulations for the synthesis of the Japanese-German exchange rate, and concluded that a bubble burst between April and May of 1990 because this period is considered financial turmoil between both nations.

Such a bubble has a stochastic rational bubble nature because both are typically distributed. The exchange rate is also analysed concerning the tourism industry by constructing a panel approach (Bozkurt et al., 2021); in another instance, the impact of the exchange rate is seen on the domestic price of the Turkish economy (Bilgili et al., 2021). The relationship of the exchange rate channel is seen in the case of Yemen on the monetary transmission mechanism, and the study has used a vector autoregressive model for the analysis, it has empirically proved the theoretical foundations (Hilmi Özkaya & Alhuwesh, 2021). The misalignment of the exchange rate through its regime is also explored. In the case of developing countries, the floating exchange rate is used when economies experience peak and expansion to cope with overvaluation, whereas, in the case of fixed exchange rate regimes, the monetary policy expansion will be used to mitigate the overvaluation (Jebeniani & Trabelsi, 2022).

To test the speculative bubble's significance, (Maldonado et al., 2012) took tree models for the period and concluded that there are rational bubbles at the 5 per cent significance level. Furthermore, the explosive behaviour in the exchange rate of the pound-dollar is found by (Bettendorf Chen, 2013) using the sequential unit root test. However, some of the literature about speculative bubbles in the exchange rate is unclear. In another study, rational speculative bubbles were analysed by the Danish krone, the South African rand, the British pound, and the Canadian dollar against the US dollar (Jirasakuldech et al., 2006). The findings reveal that the exchange rate, money supply, income and interest rates are stationary at first difference. It means insufficient evidence of rational speculative bubbles found in the exchange rates. The cointegration results show that there is a long-run cointegration between fundamental variables and the exchange rates, its further clarified that the rational exception bubbles do not affect the exchange rate for the selected currencies at all. During the COVID-19 pandemic, the exchange rate of most economies has been hurt by the economic slowdown around the world; the impact of deaths and confirmed cases negatively affected the exchange rate of not only developing countries but also of China and the United States of America (Li et al., 2021).

The bubbles in the exchange rate of BRICS countries are analysed by (Maldonado et al., 2018). The currencies of the countries in the sample include Brazil, Russia, India, China and South Africa compared to the US dollar. The study considered rational bubbles that are recurring in nature periodically. The fundamental value affecting the exchange rate is derived from the purchasing power parity theory concerning interest rate differentials. This study concluded in the case of the Chinese economy, that the models which considered fundamental values in addition to the asset prices are more suitable to define exchange rate bubbles rather than speculative bubbles. To find out the exchange rate bubbles in the BRICS countries' exchange rate against the US dollar (Maldonado et al., 2021) they have used the purchasing parity principle (PPP) and modified PPP. They found the presence of bubbles in all BRICS countries except China. The results of the study confirm the periodically recurring bubbles.

The international financial crisis, especially exchange rate bubbles, have gained much importance in this connection (Yildirim et al., 2022), analysed the exchange rates of BRICS countries and Turkey. They used monthly data from 2002 to 2019 with the help of SADF and GSADF tests to find the presence of bubbles in all the counties in the sample except the US dollar vs Indian rupee exchange rate. They suggested that the speculative nature of the bubbles may cause severe concerns for the countries analysed.

The interaction between the Renminbi and the dollar of Hong Kong is checked with the help of logistic regression, and the result shows multiple episodes of bubbles with the GSADF test. The occurrence of bubbles is seen in the nominal exchange rate in the short run and the real exchange rate in the long run (Su et al., 2022). It reported additionally that the bubbles were seen during the financial crisis; the bubbles were seen in the Renminbi only in the domestic financial crisis, whereas the Hong Kong dollar reported bubbles in both domestic and international financial crises. Both currencies interact in terms of their bubbles. This study proved that the Hong Kong dollar is more stable than Renminbi. Similarly (GÜLCAN et al., 2021) found the presence of bubbles in the exchange rate of Turkey with the help of the famous technique Supremum Augmented Dickey-Fuller (SADF) and GSADF tests. They concluded that the exchange rate fluctuations are significant for international financial contracts and businesses.

From the methodological perspective, most of the studies in the literature have employed cointegration techniques. The most popular technique is (Johansen, 1988; Johansen & Juselius, 1990). It comprises a linear autoregressive model that assumes the parameters are linear. When we see this according to the theoretical perspective, most economic time series are nonstationary and nonlinear (Barnett & Serletis, 2000). Hence, we have examples available in the financial time series literature that have reported exchange rates as nonlinear (Lee & Chou, 2013), (Basci & Caner, 2005), and (Norman & Phillips, 2013). Similarly (Bierens, 2004) and (Bierens, 1997) gave essential information using Monte Carlo simulations. The misspecification problem persists when the parameters are nonlinear, and considering the magnitude of the disequilibrium, the speed of adjustment varies from case to case.

In such a situation (Phillips et al., 2011) suggested a recursive method of analysis, the Supremum Augmented Dickey-Fuller (hereafter SADF). The SADF technique, in the presence of inflation can more efficiently detect the exuberance in the asset price. It is powerful enough to detect any bubble in the series under observation, such as the housing price bubble in the US housing market during the 2000s (Phillips & Yu, 2011). Therefore, there is a possibility of having multiple bubbles in the financial time series, the current study intends to find the episodes of the bubbles in the Pakistani Rupee exchange rate concerning the US dollar. A new test of multiple bubble detection proposed by (Phillips et al., 2015) is known as the generalised sup augmented dickey fuller (hereafter GSADF) test, which allows analysis of the nonlinear structure and brake mechanisms. This is the intrinsic usefulness of this test.

Hence, we use the GSADF test to detect episodes of bubbles in the Pakistani exchange rate. The exchange rate of Pakistan has been very volatile and erratic in the wake of different events like the Afghan war, the Asian financial crisis and the like. (Siddiqui et al., 1996) Made simultaneous equation model and concluded that real sector and monetary sector variables affect the real exchange rate. Another study (Waheed, 2012) found the determinants of the exchange rate, and he also found the uncertainty related to external debt, output current account balance, domestic investment and the budget deficit. (Khan & Qayyum, 2011) We analysed the interaction of monetary variables on the exchange rate. Similarly (Parveen et al., 2012) analysed the factors that might affect the volatility of the rupee-dollar exchange rate. Finally, the bubble in the Pakistani and Chinese capital markets is also analysed regarding the China-Pakistan Economic corridor with the help of GSADF (Liaqat et al., 2020).

However, the GSADF technique is used by (Ahmed et al., 2021) to find multiple bubbles in the housing price for the economy of Pakistan. To the best of our knowledge, none of the studies has used this technique to discover the bubbles for the exchange rate of Pakistan, hence it is a novel work.

Methodological Framework

We have used the GSADF test developed by (Phillips et al., 2015) to detect multiple bubbles in the exchange rate of Pakistan. This is the newest technique widely applied to the financial time series data worldwide. The details of the methodology of the test are given in the study (Ahmed et al., 2021). This new technique is used widely in the economic literature because it identifies and date-stamps various periods in the series under observations; in this instance (Ahmed et al., 2022) also used this to find out the bubbles in the prices of petroleum products separately for Pakistan. Hence the usage of this technique for the exchange rate movement will be fruitful. The data on the nominal exchange rate of the Pak rupee versus the US dollar is obtained from the State Bank of Pakistan. The sample under study ranges from 1976 to 2020 annually, from 1985Q1 to 2021Q2 every quarter, and from 1985M01 to 2021M07 monthly. The logarithm of the nominal exchange rate data is used in the empirical analysis (Bettendorf & Chen, 2013) have also used it.

The nominal exchange rate was fixed at 4.7619 from 1960 to 1971; it was free to float for some time, and again, it was fixed at 9.9 from 1974 to 1981; it remained flexible afterwards. The high-frequency data (quarterly and monthly breakup) is preferred over low-frequency data because it has excellent empirical advantages and captures the lowest volatility in the series under observation (Ahmed et al., 2021). Table 1 reports the results of ADF, SADF, and GSADF test results for the annual, quarterly and monthly data sets and all data sets confirm that there are multiple episodes of bubbles in the rupee-dollar exchange rate for the economy of Pakistan. Table 2 reports the episodes of those bubbles which have been detected.

Table 1: The Results of ADF, SADF and GSADF tests for the log of Nominal Exchange Rate

Annual Data set				
	Exchange Rate	90%	95%	99%
ADF	-0.659	-0.450	-0.184	0.464
SADF	2.482*	2.102	1.174	2.102
GSADF	2.482**	1.491	1.880	2.732
Notes: Critical values of both tests are obtained from Monte Carlo simulation with 1000 replications (sample size 45). The smallest window has 13 observations. * indicates significance at a 10% level. ** indicates significance at a 5% level. *** indicates significance at a 1% level.				

Quarterly Data set				
ADF	2.118	-0.427	0.089	0.768
SADF	4.062	1.073	1.393	2.031
GSADF	5.910	1.737	2.066	2.705
Notes: Critical values of both tests are obtained from Monte Carlo simulation with 1000 replications (sample size 30). The smallest window has 13 observations.				
Monthly data set				
ADF	2.332	-0.494	-0.180	0.590
SADF	3.969	1.233	1.565	1.984
GSADF	3.763	2.004	2.245	2.874
Notes: Critical values of both tests are obtained from Monte Carlo simulation with 1000 replications (sample size 45). The smallest window has 13 observations. * indicates significance at a 10% level. ** indicates significance at a 5% level. *** indicates significance at a 1% level.				

Source: Author’s calculation

Table 2 Episodes of Bubbles for the Log of Exchange Rate

Episodes of Bubbles	Time Period of Bubble
Annual Data set	
1	1988-2003
2	2018-2019
Quarterly Data set	
1	2009Q01-2015Q02
2	2015Q03-2017Q03
3	2017Q04-2021Q02
Monthly Data set	
1	2009M03-2021M06

Source: Author’s estimation

After the Bretton Woods system, the nominal exchange rate of an economy has become more important than the price level in the short run. Under the floating exchange rate system, the changes in the real exchange rate are related to the changes in the nominal exchange rate. Hence, the response of the nominal exchange is essential in framing any policy, and the identification of the episodes of multiple bubbles in the series is crucial for prosperous decision making.

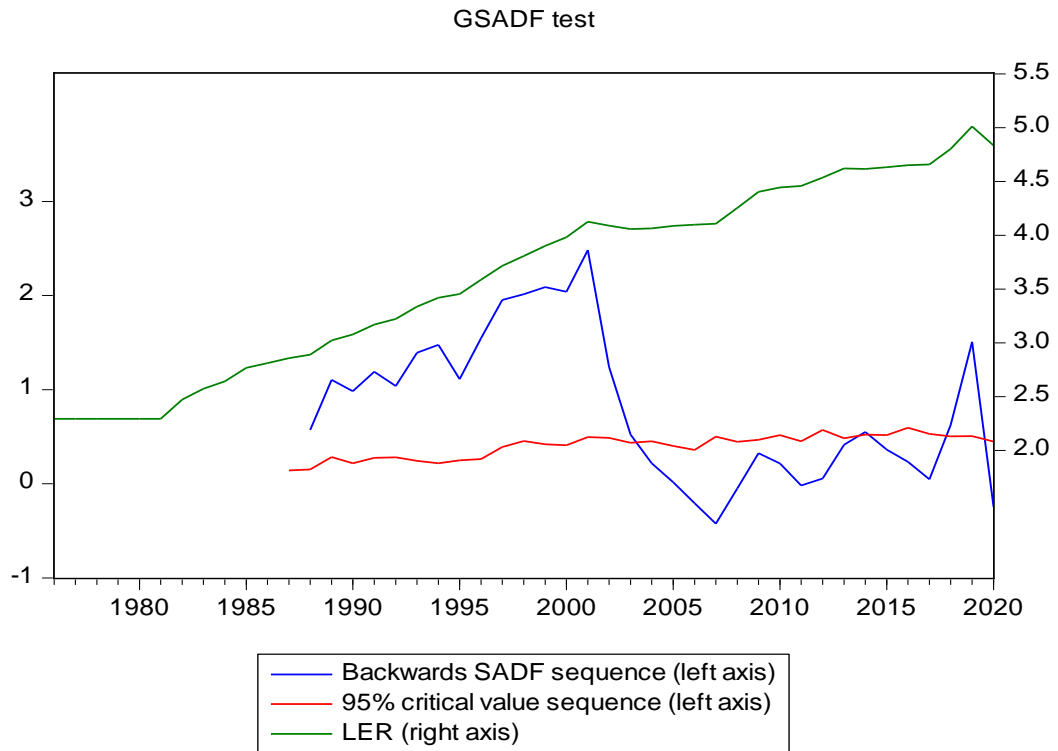


Figure 2 Graph of GSADF test (Annual data)

Source: Author's Construction

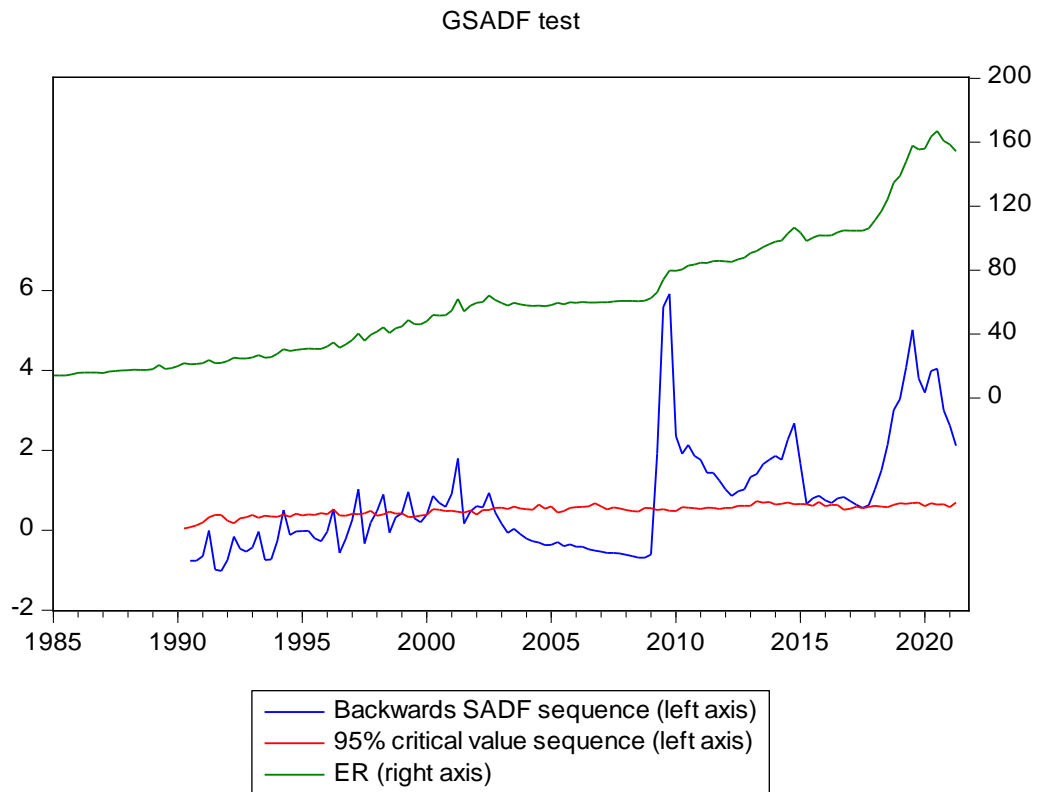


Figure 3. Graph of GSADF test of Exchange Rate (Quarterly data)

Source: Author's Construction

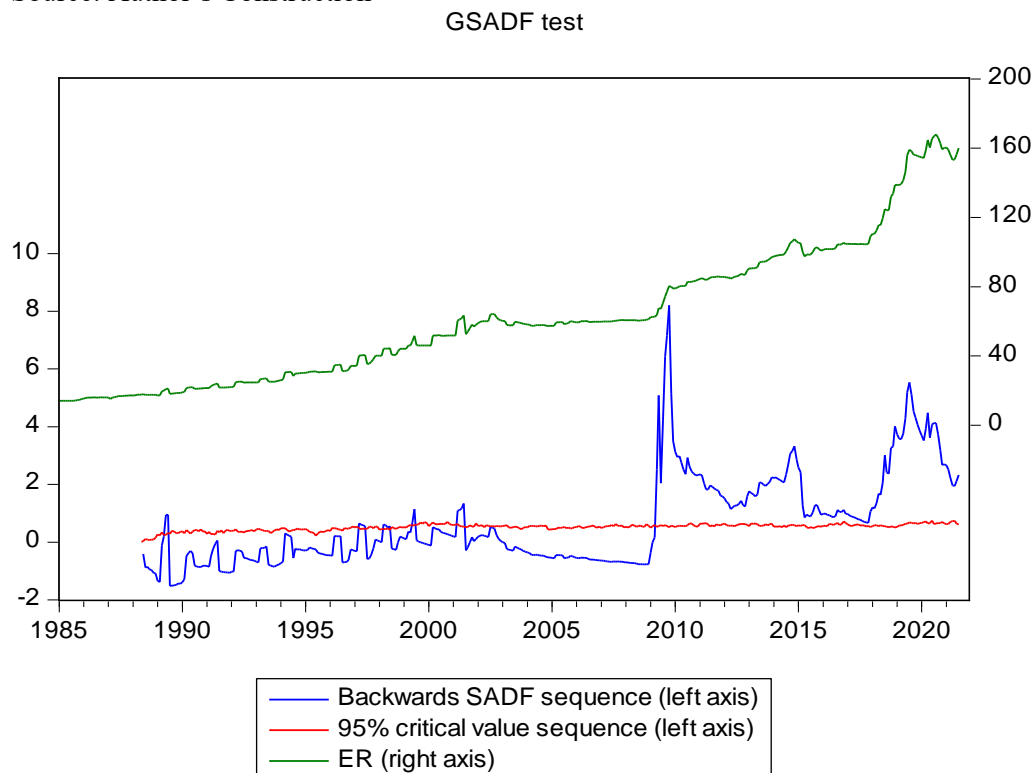


Figure 4. Graph of GSADF test of Exchange Rate (Monthly data)

Source: Author's Construction

The results of the annual data show that there are two episodes of exchange rate bubbles. The first starts from 1988 to 2003, and the second from 2018 to 2019; results are reported in Figure 2. The behaviour of the exchange rate in the quarterly data set is quite different from the annual data, and it showed three episodes of bubble first starting from the 1st quarter of 2009 to the 2nd quarter of 2015, second from the 3rd quarter of 2015 to the 3rd quarter of 2017, finally third starts from 4th quarter of 2017 to 2nd quarter of 2021, the results are reported in figure 3. In the case of the monthly data, a single episode of the bubble has been identified, and it covers the three quarterly findings from 2009M03 to 2021M06; the results are reported in Figure 4. The contribution of the GSADF test in this literature has proved that there are bubbles in the exchange rate of the economy of Pakistan and they have never been tested with this technique earlier. Hence, it is the best addition to the time series empirical testing for the Pakistani exchange rate.

The volatility of the exchange rate affects almost all the sectors in an economy. There is a negative relationship between exchange rate and stock returns. In this sense, there is a dire need to take cautious measures for the stability of the exchange rate behaviour to get the inflow of investment in the country (Adjasi et al., 2008), (Aydemir & Demirhan, 2009). The exchange rate indicates the decision making for the investment in the country (Jawaid & Ul Haq, 2012). It is clear from the above discussion as well as analysis that the behaviour of the exchange rate is essential before framing trade policy for the country.

Conclusion and Policy Recommendations

The fixed exchange rate regime of the Bretton Woods system ended, and the exchange rate widely fluctuated globally. The exchange rate's high volatility badly affects an economy's international trade position, so the trading partners desire a stable exchange rate; hence, it cannot affect future trade deals or contracts. This study is intended to analyse the dynamics of the rupee-dollar exchange rate for three data sets: annual, quarterly and monthly. The GSADF test proposed by (Phillips et al., 2015) is used to detect the explosive bubbles in the rupee-dollar exchange rate. The findings of the study are as follows. First, the empirical tests ADF, SADF, and GSADF show explosive bubbles for the annual, quarterly and monthly data sets. Second, the graph shows that there are multiple bubbles in the exchange rate; in the annual data set, bubble time is from 1988 to 2003, and the second bubble first starts from the 1st quarter of 2009 to the 2nd quarter of 2015, the second from 3rd quarter of 2015 to 3rd quarter of 2017, finally third starts from 4th quarter of 2017 to 2nd quarter of 2021. In the case of the monthly data, a single episode of the bubble has been identified, and it covers the three quarterly findings from 2009M03 to 2021M06. Managing the exchange rate is vital for foreign investment and overall economic decision-making (Jawaid & Ul Haq, 2012).

Our results are consistent with (Jiang et al., 2015), who found multiple explosive bubbles for the Chinese exchange rate concerning the US dollar; similarly, it is further endorsed by (Bettendorf & Chen, 2013) and (Betts & Kehoe, 2008). The empirical analysis confirmed the bubbles in the rupee-dollar exchange rate, and the literature supports that the bubbles in the exchange rate redistribute wealth among many sectors of an economy, albeit it has negative consequences for too financial and real sectors. Pakistan's public authorities should adopt tight monetary and fiscal measures to avoid bubbles in the exchange rate shortly. The government should pay attention to the stability of the current account balances and budget balances because both of these can correct the exchange rates effectively. Similarly, the positive figures of export earnings contribute in the stability of the exchange rates which is also a necessary condition for the economic growth.

Declaration of Interest Statement:

There is no conflict of interest

Disclosure Statement:

No financial grant is taken.

References

- Abreu, D., & Brunnermeier, M. K. (2003). Bubbles and crashes. *Econometrica*, 71(1), 173-204.
- Adjasi, C., Harvey, S. K., & Agyapong, D. A. (2008). Effect of exchange rate volatility on the Ghana stock exchange. *African journal of accounting, economics, finance banking research*, 3(3), Available at SSRN: <https://ssrn.com/abstract=1534178>.
- Ahmed, M., Irfan, M., Meero, A., Tariq, M., Comite, U., Abdul Rahman, A. A., . . . Gunnlaugsson, S. B. (2022). Bubble Identification in the Emerging Economy Fuel Price Series: Evidence from Generalised Sup Augmented Dickey–Fuller Test. *Processes*, 10(1), 65. <https://www.mdpi.com/2227-9717/10/1/65>
- Ahmed, R., Jawaid, S. T., & Khalil, S. (2021). Bubble Detection in Housing Market: Evidence From a Developing Country. *SAGE Open*, 11(2), 1-11. <https://doi.org/10.1177/21582440211006690>
- Akbar, M., & Ahmad, E. (2021). Repercussions of exchange rate depreciation on the economy of Pakistan: Simulation analysis using macroeconomic model. *Journal of Policy Modeling*, 43(3), 574-600. <https://doi.org/https://doi.org/10.1016/j.jpolmod.2020.06.007>
- Allen, F., & Gorton, G. (1993). Churning bubbles. *The review of economic studies*, 60(4), 813-836.

- Aydemir, O., & Demirhan, E. (2009). The relationship between stock prices and exchange rates: Evidence from Turkey. *International research journal of finance and economics*, 23(2), 207-215.
- Barnett, W. A., & Serletis, A. (2000). Martingales, nonlinearity, and chaos. *Journal of economic dynamics control*, 24(5-7), 703-724.
- Basci, E., & Caner, M. (2005). Are real exchange rates nonlinear or nonstationary? Evidence from a new threshold unit root test. *Studies in Nonlinear Dynamics Econometrics*, 9(4), 1-21.
- Bettendorf, T., & Chen, W. (2013). Are there bubbles in the Sterling-dollar exchange rate? New evidence from sequential ADF tests. *Economics Letters*, 120(2), 350-353.
- Betts, C. M., & Kehoe, T. J. (2008). Real exchange rate movements and the relative price of non-traded goods. *National Bureau of Economic Research*, wp. 14437.
- Bierens, H. J. (1997). Testing the unit root with drift hypothesis against nonlinear trend stationarity, with an application to the US price level and interest rate. *Journal of econometrics*, 81(1), 29-64.
- Bierens, H. J. (2004). Information criteria and model selection. Manuscript, Penn State University.
- Bilgili, F., Ünlü, F., Gençoğlu, P., & Kuşkaya, S. (2021). Modeling the exchange rate pass-through in Turkey with uncertainty and geopolitical risk: a Markov regime-switching approach. *Applied Economic Analysis*, Vol. ahead-of-print No. ahead-of-print, DOI: <https://doi.org/10.1108/AEA-08-2020-0105>.
- Bozkurt, K., Tekin, H. A., & Ergün, Z. C. (2021). An investigation of demand and exchange rate shocks in the tourism sector. *Applied Economic Analysis*, 29(86), 171-188.
- Brunnermeier, M. K. (2016). Bubbles. In *Banking Crises* (pp. 28-36). Springer, https://doi.org/10.1057/9781137553799_5.
- Brunnermeier, M. K., & Brunnermeier, M. K. (2001). Asset pricing under asymmetric information: Bubbles, crashes, technical analysis, and herding. Oxford University Press on Demand.
- Brunnermeier, M. K., Nagel, S., Brealey, R., Dimson, E., Fung, B., & Green, R. (2013). Hedge Funds and the Technology Bubble. *Journal of Finance*,
- Brunnermeier, M. K., & Oehmke, M. (2013). Chapter 18 - Bubbles, Financial Crises, and Systemic Risk. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the Economics of Finance* (Vol. 2, pp. 1221-1288). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-44-459406-8.00018-4>
- Diba, B. T., & Grossman, H. I. (1988). The theory of rational bubbles in stock prices. *The Economic Journal*, 98(392), 746-754.
- Elwood, S. K., Ahmed, E., & Rosser, J. B. (1999). State-space estimation of rational bubbles in the Yen/Deutsche Mark exchange rate. *Weltwirtschaftliches Archiv*, 135(2), 317-331.
- Evans, G. W. (1986). A test for speculative bubbles in the sterling-dollar exchange rate: 1981-84. *The American Economic Review*, 621-636.
- Evans, G. W. (1991). Pitfalls in testing for explosive bubbles in asset prices. *The American Economic Review*, 81(4), 922-930.
- Flood, R. P., & Garber, P. M. (1980). Market Fundamentals versus Price-Level Bubbles: The First Tests. *Journal of political economy*, 88(4), 745-770. <https://doi.org/10.1086/260900>
- GÜLCAN, N., BOYACIOĞLU, N., & HÖL, A. Ö. (2021). Investigation of speculative bubbles in financial markets: The example of foreign exchange market. *Süleyman Demirel Üniversitesi Vizyoner Dergisi*, 12(29), 176-187.
- Harrison, J. M., & Kreps, D. M. (1978). Speculative investor behavior in a stock market with heterogeneous expectations. *The Quarterly Journal of Economics*, 92(2), 323-336.
- Hilmi Özkaya, M., & Alhuwesh, M. (2021). Effectiveness of exchange rate channel in transiting monetary policy impact to real economy: the case of Yemen. *Journal of Sustainable Finance & Investment*, 1-14. <https://doi.org/10.1080/20430795.2021.1886549>
- Hirshleifer, D. (2001). Investor psychology and asset pricing. *the Journal of Finance*, 56(4), 1533-1597.
- Hussain, I., Hussain, J., Ali Khan, A., & Khan, Y. (2019). An analysis of the asymmetric impact of exchange rate changes on GDP in Pakistan: application of non-linear ARDL. *Economic research-Ekonomska istraživanja*, 32(1), 3094-3111.
- Jamal, A. (2005). A nonlinear model of exchange rates: some recent evidence. *International Journal of Management*, 22(2), 189.

- Jawaid, S. T., & Ul Haq, A. (2012). Effects of interest rate, exchange rate and their volatilities on stock prices: evidence from banking industry of Pakistan. *Theoretical Applied Economics*, 19(8), 153-166.
- Jebeniani, J., & Trabelsi, J. (2022). Effects of the business cycle on real exchange rate misalignments with respect to exchange rate regimes. *International Economics*, 170, 92-102.
<https://doi.org/https://doi.org/10.1016/j.inteco.2022.02.009>
- Jiang, C., Wang, Y., Chang, T., & Su, C.-W. (2015). Are there bubbles in Chinese RMB–dollar exchange rate? Evidence from generalised sup ADF tests. *Applied Economics*, 47(56), 6120-6135.
- Jiménez, Á., & Vilella, J. (2011). Understanding economic bubbles. Programa Universitat-Empresa, Barcelona, available at: www.eco.uab.es/ue/trabajos%20premi/tfc, 2061.
- Jirasakuldech, B., Campbell, R. D., & Knight, J. R. (2006). Are there rational speculative bubbles in REITs? *The Journal of Real Estate Finance and Economics*, 32(2), 105-127.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration— with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2), 169-210.
- Johnson, H. G. (2015). 8. The Case for Flexible Exchange Rates, 1969. Princeton University Press.
- Khan, M. A., & Qayyum, A. (2011). Exchange Rate Determination in Pakistan: Role of Monetary Fundamentals. *Journal of Economic Cooperation Development*, 32(2), 67-96.
- Kindleberger, C. P. (2000). Manias, panics, and crashes: a history of financial crises. *The Scribnerian the Kit-Cats*, 32(2), 379.
- Lee, C.-H., & Chou, P.-I. (2013). The behavior of real exchange rate: Nonlinearity and breaks. *International Review of Economics Finance*, 27, 125-133.
- LeRoy, S. (2004). Bubbles and the intertemporal government budget constraint. *Economic Bulletin*, 5(18), 1-6.
- Li, C., Su, Z.-W., Yaqoob, T., & Sajid, Y. (2021). COVID-19 and currency market: a comparative analysis of exchange rate movement in China and USA during pandemic. *Economic research-Ekonomska istraživanja*, DOI: 10.1080/1331677X.2021.1959368, 1-16.
- Liaqat, A., Nazir, M. S., Ahmad, I., Mirza, H. H., & Anwar, F. (2020). Do stock price bubbles correlate between China and Pakistan? An inquiry of pre-and post-Chinese investment in Pakistani capital market under China-Pakistan Economic Corridor regime. *International Journal of Finance Economics*, 25(3), 323-335.
- Maldonado, W. L., Ribeiro, J., & Tourinho, O. A. F. (2021). Testing Four Types of Bubbles in BRICS Exchange Rates. *Emerging Markets Finance and Trade*, 57(4), 1103-1123.
<https://doi.org/10.1080/1540496X.2019.1603542>
- Maldonado, W. L., Tourinho, O. A., & Abreu, J. A. d. (2018). Cointegrated Periodically Collapsing Bubbles in the Exchange Rate of “BRICS”. *Emerging Markets Finance Trade*, 54(1), 54-70.
- Maldonado, W. L., Tourinho, O. A., & Valli, M. (2012). Exchange rate bubbles: Fundamental value estimation and rational expectations test. *Journal of International Money Finance*, 31(5), 1033-1059.
- McKelvey, R. D., & Palfrey, T. R. (1992). An experimental study of the centipede game. *Econometrica: Journal of the Econometric Society*, 60, 803-836.
- Meese, R. A. (1986). Testing for bubbles in exchange markets: A case of sparkling rates? *Journal of political economy*, 94(2), 345-373.
- Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. *the Journal of Finance*, 32(4), 1151-1168.
- Norman, S., & Phillips, K. (2013). What is the shape of real exchange rate nonlinearity? *Applied financial economics*, 23(5), 363-375.
- Obstfeld, M., Rogoff, K. S., & Rogoff, K. (1996). *Foundations of international macroeconomics*. MIT press.
- Ofek, E., & Richardson, M. (2003). Dotcom mania: The rise and fall of internet stock prices. *the Journal of Finance*, 58(3), 1113-1137.
- Ogun, O. D. (2012). Exchange rate determination in developing economies. *Modern Economy*, 3(5), 518-521.

- Parveen, S., Khan, A. Q., & Ismail, M. (2012). Analysis of the factors affecting exchange rate variability in Pakistan. *Academic Research International*, 2(3), 670.
- Phillips, P. C., Shi, S., & Yu, J. (2015). Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500. *International Economic Review*, 56(4), 1043-1078.
- Phillips, P. C., Wu, Y., & Yu, J. (2011). Explosive behavior in the 1990s Nasdaq: When did exuberance escalate asset values? *International Economic Review*, 52(1), 201-226.
- Phillips, P. C. B., & Yu, J. (2011). Dating the timeline of financial bubbles during the subprime crisis. *Quantitative Economics*, 2(3), 455-491. <https://doi.org/https://doi.org/10.3982/QE82>
- Saqib, A., Chan, T.-H., Mikhaylov, A., & Lean, H. H. (2021). Are the Responses of Sectoral Energy Imports Asymmetric to Exchange Rate Volatilities in Pakistan? Evidence From Recent Foreign Exchange Regime. *Frontiers in Energy Research*, 9, doi: 10.3389/fenrg.2021.614463.
- Scheinkman, J. A., & Xiong, W. (2003). Overconfidence and speculative bubbles. *Journal of political economy*, 111(6), 1183-1220.
- Shleifer, A., & Vishny, R. W. (1997). The Limits of Arbitrage. *the Journal of Finance*, 52(1), 35-55. <https://doi.org/https://doi.org/10.1111/j.1540-6261.1997.tb03807.x>
- Siddiqui, R., Afridi, U., Mahmood, Z., & Bhatti, R. H. (1996). Exchange Rate Determination in Pakistan: A Simultaneous Equation Model [with Comments]. *The Pakistan Development Review*, 35(4), 683-692.
- Su, X., Peng, C., Lv, Z., & Deng, C. (2022). Do the Renminbi and Hong Kong dollar bubbles interact? *International Journal of Finance Economics*, 27(1), 312-319.
- Temin, P., & Voth, H.-J. (2004). Riding the south sea bubble. *American Economic Review*, 94(5), 1654-1668.
- Thompson, E. A., & Hickson, C. R. (2006). Predicting bubbles. *Global Business Economics Review*, 8(3-4), 217-246.
- Tirole, J. (1982). On the possibility of speculation under rational expectations. *Econometrica: Journal of the Econometric Society*, 1163-1181.
- Tirole, J. (1985). Asset bubbles and overlapping generations. *Econometrica: Journal of the Econometric Society*, 1499-1528.
- Vissing-Jorgensen, A. (2003). Perspectives on behavioral finance: Does" irrationality" disappear with wealth? Evidence from expectations and actions. *NBER macroeconomics annual*, 18, 139-194.
- Waheed, A. (2012). Effects of Policy Uncertainty on Nominal Rupee-Dollar Exchange Rate in Pakistan. *International Journal of Trade, Economics Finance*, 3(6), 428-431.
- West, K. D. (1987a). A specification test for speculative bubbles. *The Quarterly Journal of Economics*, 102(3), 553-580.
- West, K. D. (1987b). A standard monetary model and the variability of the deutschemark-dollar exchange rate. *Journal of International Economics*, 23(1-2), 57-76.
- Wu, Y. (1995). Are there rational bubbles in foreign exchange markets? Evidence from an alternative test. *Journal of International Money Finance*, 14(1), 27-46.
- Yildirim, H., Akdag, S., & Alola, A. A. (2022). Is there a price bubble in the exchange rates of the developing countries? The case of BRICS and Turkey. *Journal of Economics, Finance and Administrative Science*, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/JEFAS-04-2021-0025>
- Zada, B. (2010). An analysis of factors affecting exchange rate of Pakistan 1979-2008. (Unpublished master thesis). Hazara university, Pakistan.