



Nexus between Monetary Freedom, Political Stability and Exchange Rate with Sustainable Stock Market Development in Pakistan: A Comparative Analysis by ARDL and NARDL

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ABSTRACT

This study scrutinizes both symmetric and asymmetric impact of monetary freedom (MF) on the sustainable stock market development (SMD) in Pakistan, in the presence of political stability and foreign exchange rate. The study uses the time series data for the period of 1992 to 2022, the study applies Non-linear Auto-regressive Distributed Lag (NARDL) and ARDL Bounds Testing for comparative analysis. Monetary freedom with sound political stability and stable foreign exchange rate do Granger Cause and significant correlation with the SMD of Pakistan. The results from ARDL Bound Testing show that MF and exchange rate has highly significant long-run impact on the SMD with coefficient values of 4.64 and 3.32. The Positive asymmetric cumulative dynamic multipliers (ACDMs) of MF have highly significant impact on SMD. Political stability has been a Positive Function of its ACDMs, while exchange rate has been a Negative Function of its respective ACDMs. The impact of exchange rate is highly significant with its Negative ACDMs coefficients of 17.42 and 16.76, denoting a long-lasting impact on the sustainable economic growth of Pakistan by strengthening the pace of stock market development. This comparative study will add revised practical credence to the existing literature on autoregressive models and will facilitate modified and improved policy-making at operational and strategic level to achieve decent economic growth under sustainable development goals (SDG).

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1. Introduction

Monetary freedom plays a pivotal role in the sustainable stock market development (SMD) of any state, especially, the big economies always get a direct benefit by using the delicate tool of monetary freedom (MF) to develop its stock exchanges (Luo, 2014). A. Khan, Ejaz, and Safdar (2023) Khan and Ejaz (2023) tested and discussed monetary freedom related supportive policies (like financial freedom, investment freedom, and trade freedom, government transparency, judicial effectiveness and rule of law) with stable politics and foreign exchange rate pose a positive and significant correlation with the equity market development (Ali, Javid, Ahmad, Ahmad, & Khan, 2021; Suhaibu, Harvey, & Amidu, 2017; Tchereni & Mpini, 2020).

However, the theoretical considerations are also vital that need to be addressed to make any developing country more stable, efficient, and financially functioning (Imran, Murtiza, & Akbar, 2023; Ivanović & Stanišić, 2017). The rationale behind promoting monetary freedom (MF) to achieve a sound and sustainable stock market development is that early growth models were mostly non-monetary and they mainly focused the physical and tangible mobility of goods.

Most of the models did not follow monetary variables (Economou, 2019; A. Khan et al., 2023). The ground reality is that all the variables are interconnected. Hence, the modern economies are based upon financial and monetary policies that reshape the traditional system of governance, regulatory and institutional mechanisms that are the real backbone of the modern economies (Azeez & Obalade, 2018; Caraiani & Călin, 2020; Grigolashvili, 2019).

Suhaibu et al. (2017) pointed out that monetary freedom is a delicate tool for stimulating real-time stock market. Many empirical studies have supported this theoretical paradigm that the links between MF and sustainable SMD cannot be ignored (Bogdan & Lomakovych, 2021; Luo, 2014; Sugimoto & Matsuki, 2019; Tchereni & Mpini, 2020). A unanimous conclusion in the latest studies has concluded the impact of MF on SMD is now unquestionable (Imran et al., 2023; Oduyemi, Osinusi, & Adekunle, 2019). The evils of well-established macro-economic variables: inflation, fluctuations in the foreign exchange rate, bad fiscal health, credit creation issues, problems in applying qualitative and quantitative aspects of monetary policies.

Ellahi et al. (2021) concluded that institutional rigidities and structural improvements can be best mitigated with the help of sound monetary freedom mechanisms (Sikarwar and Appalaraju, 2018). Many studies have pointed out instability in market prices, the lower standard of living, and lower rates of stock market development (SMD) can be improved by the mainstream *monetary doctrine* in the transitional economies, hence the monetary stabilization and liberalization of various components of monetary freedom has been imperative (Akbar, 2023; Elbasani & Šabić, 2018; Emara & El Said, 2021; Ivanović & Stanišić, 2017; MUGABLEH, 2021; Rafique, Ahmad, & Ilyas, 2023). Market-led institutional economies enable entrepreneurial activities by greater freedom of decision making like regulatory effectiveness in its distinct forms of labor freedom and business freedom, then open market mechanisms; (i) trade freedom (ii) financial freedom (iii) investment freedom (Alsamara & Mrabet, 2019; Polat & Satti, 2013).

This paper mainly focuses on an important component of regulatory efficiency: MF and its distinct impact on sustainable SMD in Pakistan. The basic monetary pre-requisites for the efficient proper resource allocation and its productive engagement of various economic agents are vital. It is to note that the effects of MF on the equity performance have been categorized under the various aspects of economic freedom. The joint impact of MF and stable exchange rate, duly supported by the distinct political stability shall be vital for SMD. But the compelling proofs and causalities regarding sustainable SMD have been determined by the Monetary Freedom. Hence, MF has been a part of an overall freedom Index/score. Studies also show that economic efficiency is inevitable without monetary freedom (Ali et al., 2021; Sugimoto & Matsuki, 2019; Uzelac, Davidovic, & Mijatovic, 2020).

In this study, after an extensive review of related studies, two macro-economic variables have been selected for this current investigation namely (i) political stability (ii) foreign exchange rate. The rationale behind selecting the two variables is: the first is directly related to the internal institutional strength of the government of Pakistan, while the 2nd variable is the representative factor that is directly connected with the external hindering factors. The aim of addressing the two variables is to have an upper and more stable adjusted R-squared to signify perfect stability, so that the results can be generalized to developing countries and the unseen causalities and asymmetries between the variables can be discovered and used accordingly.

Hence, the aim of this research paper is to examine the symmetric as well as asymmetric link between the Index of monetary freedom (defined and developed by The Heritage Foundation, 2022) and sustainable SMD in Pakistan in the presence of two allied macro-economic variables (i) political stability (ii) foreign exchange rate. The simultaneous uni-directional and bi-directional impact of MF, political stability and exchange rate on the sustainable SMD of Pakistan covers the methodological and literature gap in the context of Pakistan. The rest of the paper will be as: section 2 covers relevant literature, section 3 highlights the underpinning theory and conceptual framework, section 4 addresses the methodological frame, and section 5 explains the technical and statistical discussion of the results/analysis. The last section concludes the discussion by presenting the evidenced-based policy recommendations.

2. Literature Review

2.1. Monetary Freedom and Sustainable Stock Market Development

The current research endeavor scrutinizes the impact of monetary freedom (MF), as the major part of the regulatory effectiveness index, on the pace of sustainable SMD in Pakistan. In addition to the persistent rise in consumer prices, a part of the monetary tool to handle market distortions has been one of the core issues of modern studies. The studies in the last two decades have moved the attention of policymakers and government agencies from the inflationary threats towards MF (Bogdan & Lomakovych, 2021; Hanusch, Chakraborty, & Khurana, 2017; Stoian & Iorgulescu, 2020). The concept of MF has a broader/wider canvas compared to inflation, deflation, stagflation, etc. The MF index covers a list of factors like (i) price stability (ii) price assessment (iii) price distortion (iv) price mechanism cycle (Caraiani & Călin, 2020; Suhaibu et al., 2017).

From an economic perspective, monetary freedom (MF) has greater relevancy compared to general price stability techniques because both of them reflect the core monetary requisites for effective resource allocation and distribution, resource generation, and resource monetization. All the components facilitate the aggressive utilization, engagement of economic agents (Al-Maadid, Caporale, Spagnolo, & Spagnolo, 2020; Elbasani & Šabić, 2018). Tchereni and Mpini (2020) pointed out that monetary freedom refers to financial liberalization as the key to economic and financial growth into two dimensions: (i) price stability is sustainable only and all socialist economies are much prone to economic freedom. Monetary Freedom acts as an 'analytical engine' to support stock growth via mitigating the volatility in stable equity market (Akbar, 2023; Rafique et al., 2023; Rocheteau, Wright, & Xiao, 2018; Sikarwar & Appalaraju, 2018; Stoian & Iorgulescu, 2020).

The proper use of monetary freedom (MF) not only covers the bad impact of deflation and stagflation but also helps to achieve balanced price control. The studies have concluded that *price liberalization* is a vital component for achieving the required sustainable equity performance. The free-market price mechanism helps to achieve a sustainable SMD world-wide (Caraiani & Călin, 2020; İlhan, 2020; A. Khan et al., 2023; M. A. Khan et al., 2020; Suhaibu et al., 2017). The issues in many socialist economies can be efficiently mitigated to avoid *suppressed* inflation. At the same time, if the prices are handled under synchronized control, this will help to maintain a stable monetary mechanism in the country (Ali et al., 2023; Chen and Chiang, 2020). With reference to economic freedom, the price control tools, sometimes, become a threat to make co-operative orientation and to avoid competitive orientation among all the respective stakeholders (Emara & El Said, 2021; Grigolashvili, 2019; Magau, Roodt, & Van Zyl, 2021; Sugimoto & Matsuki, 2019).

The system of relative market prices has been very much vital. It is also vital to note that correct market information acts as an 'agent of growth', by facilitating the system of allocative efficiency. Raza, Baiqing, Kay-Khine, and Ali Kemal (2023) concluded that the expected deviations and dysfunctional pricing mechanism never incentivize economic agents to prioritize their preferences in the given real economic possibilities (Ming & Jais, 2020; Nkoro & Uko, 2016). In most cases, the analytical engines of the price mechanism will be temporarily disconnected the mutual associations between the individual prices shall be unable to reflect the relative scarcity of scarce resources (Rocheteau et al., 2018). In the light of above discussion, the following hypothesis are tested.

H1= Monetary freedom has a positive impact on the SMD of Pakistan

2.2. Foreign Exchange Rate and Sustainable Stock Market Development

The volatility of exchange rates is at the heart of our current discussion on how well exchange rate regimes play its distinct role in sustainable SMD of the countries (Ogbulu, 2018; Ullah, Ullah, Urooge, Ali, & Rahman, 2019). Since the shift to flexible interchange rate systems have served to increase this worry. The impact of exchange rate volatility (ERV), a key characteristic of variable exchange rate systems, is a significant worry (Imran et al., 2023; Mechri, Ben Hamad, de PERETTI, & Charfi, 2018). Serious concerns about exchange rate volatility have raised in several economies, including Pakistan. Exchange rate volatilities has an impact on a nation's financial system, particularly the equity market (Alsamara & Mrabet, 2019; Meo, Chowdhury, Shaikh, Ali, & Masood Sheikh, 2018). Golder, Islam, and Kayser (2020) have investigated no long-run parallels between ordinary prices of shares and any of the interchange

rates were discovered by the Johansen's co-integration test across the study period. For short-run in-sample underlying parallels between market values of prices and exchange rates, the study also discovered one uni-directional link between stock prices and the US interchange rate (Ajala, Sakanko, & Adeniji, 2021; Ming & Jais, 2020; Nakibullah, 2017; Sulehri & Ali, 2020).

Since exchange rates and stock returns both have a significant impact on how an economy develops, especially the emerging or frontier economies are no exception (Alsamara & Mrabet, 2019; Polat & Satti, 2013). The economists and scholars have become preoccupied with the inter-temporal associations between the two (Okere, Muoneke, & Onuoha, 2021). In addition, Raza et al. (2023) pointed out as global commerce and money flows have continued to rise, exchange rates have emerged as one of the key determinants of company profits and stock prices (Meo et al., 2018; Nakibullah, 2017). Changes in exchange rates have a direct impact on the pace of SMD world-wide (Delgado, Delgado, & Saucedo, 2018; Imran et al., 2023; Jain & Biswal, 2016; A. Khan et al., 2023; Mechri et al., 2018; Ogbulu, 2018).

Ajala et al. (2021) concluded that fluctuations in the foreign exchange rate (FER) have been vital for the growth of equity market, hence the relationship between FER and SMD is always given priority by the Economist and theorist (Akbar, 2023; Mechri et al., 2018; Polat & Satti, 2013; Ullah et al., 2019). The stability of the foreign currency market can affect an economy's financial status and Pakistan is no exception (Delgado et al., 2018; Mehta, Sohail, Rehman, Naqvi, & Sair, 2020). The state, businesses, and people are all affected financially by changes in the foreign exchange market. The stability of a state's economy and price firmness are impacted by interchange rate of volatility (Nakibullah, 2017). In different bi-variate models, there has been no proof of a co-integrating association between exchange rate measures and equity prices, but there has been a co-integration, when funds and the money supply (M2) were taken into account (Golder et al., 2020; Okere et al., 2021; Raza et al., 2023). So following hypothesis is tested.

H2 = Foreign exchange rate has a negative impact on the SMD of Pakistan

2.3. Political Stability and Sustainable Stock Market development

In the modern world, political unrest has a stronger impact on the stock markets (Uzelac et al., 2020). Any country's political stability affects its economy (Latif, Safi, & Hassan, 2017). Investors won't make investment decisions with confidence if a country's political system is unstable because they will be afraid of losing their money (Ijaz & Sarwar, 2020; Imran et al., 2023). Events involving political unrest have an impact on the nation both internally and outside, which causes financial markets to trend lower (Maqbool, Hameed, & Habib, 2018). Investors like to place their money in politically stable nations. Political unrest is thought to have a detrimental effect on stock prices (Mehta et al., 2020; Nazir, Khan, Akram, & Ahmed, 2018; Raza et al., 2023; Rehman, Khilji, Kashif, & Rehan, 2022; Sulehri & Ali, 2020).

Mechri et al. (2018) pointed out that events like terrorism that is directly linked to political unrest may, make the financial markets and world economies of any nation riskier (Alsamara & Mrabet, 2019). The stock market is regarded as an essential component of economic development. Finding the major features that may have an impact on the stock market and, eventually, the economic growth of any nation, is indispensable in the present (Okere et al., 2021). Political unrest with terrorism has been two core issues that need to be meticulously discussed in order for financial sector to grow (Ajala et al., 2021; Akbar, 2023; Meo et al., 2018).

Financial economists have long been interested in how global political regime events affect stock values, especially in the light of the sharp gains and declines in stock prices (Latif et al., 2017; Rafique et al., 2023). Intuitively, stock markets often experience advanced degrees of instability during the periods of political and civil turmoil as the manifestation of significant political happenings signal a potential swing in policy that might result in market value dynamics (Delgado et al., 2018; Jain & Biswal, 2016; Raza et al., 2023; Sulehri & Ali, 2020). Similar research is done in different emerging countries as Bangladesh and Turkey following a substantial political shift there, and the findings are comparable, showing that political instability and stock market volatility are strongly related (Imran et al., 2023; Maqbool et al., 2018; Ogbulu, 2018).

Karime and Sayilir (2019) demonstrate that good political news results in positive returns while negative news results in negative returns. To ascertain whether political tremors have impact on ordinary markets, Al-Maadid et al. (2020) conducted a study in a number of emerging markets. Their verdicts revealed dramatic changes in excess rewards as PR (political risk) changed overtime, indicating PR has always been a vital price determining factor in the portfolios of stock returns. Further research by Liu, Choo, and Lee (2020) confirmed that the majority of the 77 terrorist acts that took place in 25 different countries had a damaging impact on financial markets. Though few studies have been done on the effects of political unpredictability resulting from civilian uprisings (such as the Tunisian revolution) for stability and appearances of ordinary market cycles, the majority of earlier studies in this field mainly focused on political events like elections, wars, and terrorist attacks (Karime & Sayilir, 2019; Nazir et al., 2018; Raza et al., 2023).

As a result of political unpredictability, financial markets appear to be unstable, and stock market cycles appear to be more prominent. The strong shock of the Tunisian revolution causes the trend to veer (offset) from its intended course. Mnif (2017) pointed out that Tunisian stock market cycles have been significantly more amplitude and volatile in the years after civil unrest. Since the shocks are unanticipated, the amplitude and unpredictability of stock market cycle have been amortized over time to attain low levels (Ijaz & Sarwar, 2020; Uzelac et al., 2020).

Studies suggest that political unpredictability influences financial volatility. It refers that in addition to the usual financial as well as economic considerations, the movement of financial asset prices is influenced, at least in part, by political events (Mehta et al., 2020; Nazir et al., 2018; Rehman et al., 2022). Overall, our findings add to the increasing body of research on the connection amid political risk and asset prices by demonstrating the financial consequences of the Arab Spring uprisings (Imran et al., 2023; Maqbool et al., 2018). Therefore, to support the regional financial permanency and economic progress, it is crucial for the new administrations to reestablish corporate trust.

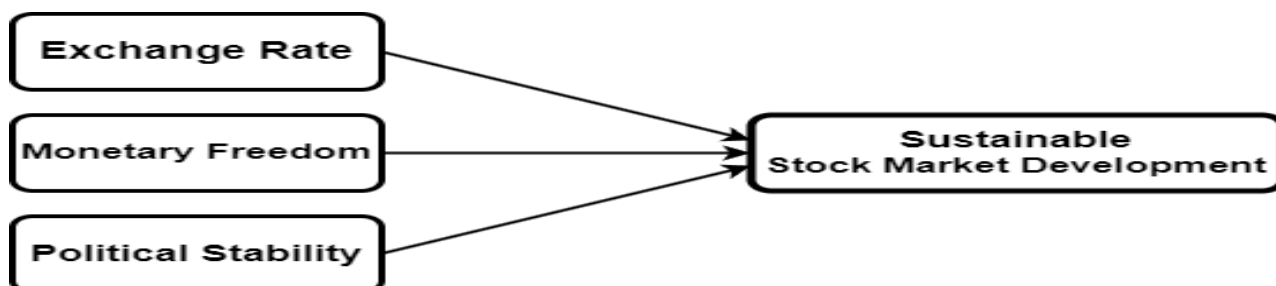
One of the biggest issues, particularly for emerging economies like Pakistan's, is political instability. It has the potential to be extremely problematic and to halt national growth (Raza et al., 2023; Sulehri & Ali, 2020; Ullah et al., 2019). The country's flimsy government institutions and networks are engulfed in political upheaval (Mehta et al., 2020; Rafique et al., 2023). It might have a direct negative influence on speculating the strategies and disrupt market and corporate activities. In a country, where political polarization is normally strong, political instability can increase vulnerability to changes in the administration. The above debate has been concluded to investigate the given below hypothesis: -

H3 = Political stability has a positive impact on the SMD of Pakistan

3. Theoretical Framework

The concept of monetary freedom (MF) was supported by Ludwig, Friedrich Hayek, Murray Rothbard, by their subsequent research. Neo-liberal economists also had believe in 'free market' with lesser intervention of government and promoted its role in facilitating a sound political and economic business environment. In this paper, the idea of "wealth/capital accumulation, an index of Economic Prosperity" given by Alfred Marshal (1890), in his book, has been followed.

Figure 1: Concept Model



4. Material and Methods

The study uses annual data of stock market of Pakistan over the last 31 years starting from 1992 to 2022 to probe the impact of monetary freedom on SMD (the proxy for measuring SMD is percentage of GDP, as a given stock turnover) of Pakistan in the presence of political stability and foreign exchange rate. The suitable proxy “percentage of GDP, being the stock market turnover” to represent the SMD of Pakistan is used (Ajala et al., 2021; M. A. Khan et al., 2020). The proxies used in the literature include: number of shares traded on equity market, the market capitalization on the basis of GDP or as percentage of USD, annually enlisted enterprises (Babarinde, 2021; Osaseri & Osamwonyi, 2019; Polat & Satti, 2013; Yusuf, Abubakar, & Mamman, 2020). The *selected proxy* has been finalized (selected amongst the above mentioned proxies) by E-views-10 to simulate ARDL and NARDL to finalize the above mentioned proxy (İlhan, 2020; Imran et al., 2023; Islam, Bilal, & Zaidi, 2022).

The annual data for monetary freedom (MF) has been taken from the website of EF index (<http://www.ef.org>), officially known as the economic freedom index, while the data for SMD is retrieved from WDI (world development indicators, officially managed by world Bank). The data for political stability has been taken from WGI (world governance indicators) for the last 31 years. Here the Table-1, given below enlisted the dependent variable as well as independent variables. The literature indicated several proxies that measure SMD in Pakistan, (M. A. Khan et al., 2020). The proxies used in previous literature have been tested and one of the best ‘proxy’ been finalized on the basis of extensive E-views experiments i.e., “SMD in terms of stock market turnover as percentage of GDP” has been used for an in-depth analysis by using NARDL (bi-directional linkages) and its comparison with ARDL Bounds.

Table 1: List of Dependent and Independent Variables

Description of Variables	Variables	Unit of Measurement	Data Sources
Stock Market development	SMD	SMD terms of US dollars	WDI, 2022
Monetary Freedom	MF	A Component of EF Index	Economic Freedom Index, 2022
Political Stability	P.STAB	A Component of WGI	World Governance Index, 2022
Foreign Exchange Rate	FER	Annual Avg. Exchang Rate	WDI, 2022

Source: (author)

4.1. Selection of Methodological Framework

Linear models though have been dominating in the literature during the last decade, yet asymmetric models (called bi-variate associations between the variables) have been used by the experts of Economics and Finance to substitute unidirectional relations between MF and SMD in the presence of (i) stable politics (ii) exchange rate dynamics respectively. The experts ignore this non-linearity trend normally, but to fill this research gap w.r.t Pakistan, NARDL (non-linear autoregressive distributive lag) has been used to capture the impact of two links: (i) unidirectional (ii) bi-directional impacts. Here, the NARDL frame, which was developed by Greenwood-Nimmo in 2014 is used. NARDL framework is a technique to uncover the hidden non-linearities between variables of Economics and Finance. The logic behind using NARDL is that the magnitude, intensity or density of the change in the dependent variable has been different to respond the changes in the explanatory variables.

This methodology is applicable even if the under-study variables are stationary at the $I(0)$ or $I(1)$ while $I(2)$ variables never facilitate the mechanism of true empirical analysis (Banerjee, Dolado, & Mestre, 1998). A framework for bound test deals with the tool of classical co-integration that is used for mixed order of integration. Hence, the positive as well as negative shockwaves to handle this spurious regression situation due to its decomposed partial dynamics of multipliers for the under-study variables can be handled by Non-linear ARDL. It works well for small samples (Nkoro & Uko, 2016; Rafique et al., 2023; Raza et al., 2023).

With ECM, both ARDL and NARDL are worthwhile to disentangle ‘long-run’ associations from the ‘short-run’ associations. At the same time, it addresses various diagnostics issues namely: (i) heterogeneity (ii) multi-linearity (iii) endogeneity. The broader scope of this study also covers the comparative discussion about ARDL and NARDL frames to modify the old recommendations for non-linearity (asymmetries) between the said variables.

4.2. Econometric Modelling for Variables

In order to test the directional and non-directional hidden dynamics of monetary freedom, and political stability, the following equations are formed to test their impact on the SMD of Pakistan (a proxy used for economic development).

$$SMD = \beta_0 + \beta_1(MF) + \beta_2 (PSTAB) + \beta_3 (XRATE) + u \tag{1}$$

Here, the long-run as well as and short-run parameters i.e. $\beta_1 + \beta_2 + \beta_3$ that indicate MF (monetary freedom), PSTAB (political stability), and XRATE (foreign interchange rate), as shown in equation [1] above. To convert this equation into bi-directional dynamics, the equation [1] is remodeled. For this purpose, ECM parameters (Smith, Shin 2001) are used. The resulting proposed equation [2], after ensuing the required mechanism is as

$$\Delta SMD = \theta + \sum_{k=1}^{p_1} \theta \Delta SMD(t-k) + \sum_{k=1}^{p_2} \theta \Delta MF(t-k) + \sum_{k=1}^{p_3} \theta \Delta PSTAB(t-k) \sum_{k=1}^{p_4} + \lambda_1 * MF(t-1) + \lambda_2 PSTAB(t-1) + \lambda_3 XRATE(t-1) + \mu \tag{2}$$

The proxy given in equation [2] is of a uni-directional that shows its lagged values. Hence, in eq. [2], the long-run given coefficients are denoted by λ_1, λ_2 & λ_3 , respectively. Here, the short-run measurements are reflected by θ . The occurrence of the co-integration of MF, PSTAB, and XRATE with SMD is authenticated by the F-Bound Testing statistics. The ultimate aim of this study is to examine non-linear, bi-variate, or asymmetric regression. The above equation integrates both, short-run and long-run coefficients. Here, 'Y_t' shows the 'vector of the independent variables' being disintegrated. Hence, equations [3 and 4] below show the Positive and Negative partial sums of decomposed multipliers as: -

$$\delta = \delta^+ + Y_t + + \delta^- - Y_t - + \mu t \tag{3}$$

To link the long-run coefficients to use δ^+ and δ^- to show both *positive and negative* decomposition, y_t displays the vector of expounding variables that have been disintegrated in Equation given below. The equation also displays the elementary model of NARDL. Following equation demonstrates the fundamental concept of NARDL where Y_t represents the vector of illustrative variables, disintegrated in the Equation given below to link the long-run coefficients by using + and - to display positive (POS) and negative (NEG) decomposition.

$$Y_t = Y_0 + Y_t^+ + Y_t^- \tag{4}$$

The following equations (5,6,7,8,9,10,11&12) show a non-linear or asymmetric trend. It symbolizes all the partial dynamics of multipliers for the hidden positive and negative deviations in (i) monetary freedom (ii) political stability (iii) exchange rate, and their combined impact on the economic growth of republican of Pakistan. The following equations highlight non-linearities, as designated via partial dynamics sums for its *positive and negative* variations in MF, PSTAB, XRATE and their shared bi-variate impact on SMD (proxy used for equity growth) of Pakistan.

$$\sum_{i=1}^t MF^+ = \sum_{i=1}^t \Delta MF^+ = \sum_{i=1}^t MF * (\Delta MF_i, 0) \tag{5}$$

$$\sum_{i=1}^t MF^- = \sum_{i=1}^t \Delta MF^- = \sum_{i=1}^t MF * (\Delta MF_i, 0) \tag{6}$$

$$\sum_{i=1}^t PSTAB^+ = \sum_{i=1}^t \Delta PSTAB^+ = \sum_{i=1}^t PSTAB (\Delta PSTAB_i, 0) \tag{7}$$

$$\sum_{i=1}^t PSTAB^- = \sum_{i=1}^t \Delta PSTAB^- = \sum_{i=1}^t PSTAB (\Delta PSTAB_i, 0) \tag{8}$$

$$\sum_{i=1}^t XRATE^+ = \sum_{i=1}^t \Delta XRATE^+ = \sum_{i=1}^t XRATE (\Delta XRATE_i, 0) \tag{9}$$

$$\sum_{i=1}^t XRATE^- = \sum_{i=1}^t \Delta XRATE^- = \sum_{i=1}^t XRATE (\Delta XRATE_i, 0) \tag{10}$$

$$\sum_{i=1}^t SMD^+ = \sum_{i=1}^t \Delta SMD^+ = \sum_{i=1}^t SMD (\Delta SMD_i, 0) \tag{11}$$

$$\sum_{i=1}^t SMD^- = \sum_{i=1}^t \Delta SMD^- = \sum_{i=1}^t SMD (\Delta SMD_i, 0) \tag{12}$$

To apply NARDL estimation technique, the respective equations generated [Eq. 5 to Eq. 12] are substituted into equation [2] to crop equation [13]:-

$$\Delta SMD = \theta + \sum_{k=1}^{p_1} \theta \Delta SMD(t-k) + \sum_{k=1}^{p_2} \theta \Delta MF(t-k) + \sum_{k=1}^{p_3} \theta \Delta PSTAB(t-k) \sum_{k=1}^{p_4} + \sum_{k=1}^{p_5} \theta \Delta XRATE(t-k) + \sum_{k=1}^{p_6} \theta SMD * (+) + \sum_{k=1}^{p_7} \theta SMD * (-) + \sum_{k=1}^{p_8} \theta MF * (+) + \sum_{k=1}^{p_9} \theta MF * (-) + \sum_{k=1}^{p_{10}} \theta PSTAB * (+) + \sum_{k=1}^{p_{11}} \theta PSTAB * (-) + \sum_{k=1}^{p_{12}} \theta XRATE * (+) + \sum_{k=1}^{p_{13}} \theta XRATE * (-) + \lambda_1 * SMD * (t-1) + \lambda_2 * MF * (t-1) + \lambda_3 * PSTAB(t-1) + \lambda_4 * XRATE * (t-1) + \mu t \tag{13}$$

The equation [13] covers the long-run as well as the short-run dynamic forces to establish or elaborate equations [1, 2, 3 and 4], which now shall be labeled as asymmetric decompositions. To create a non-linear ARDL frame, Eq.5 to Eq.12 were fed into main equation [1], resulting in equation [13], that show the chosen NARDL equation for the given model. The above-mentioned model, depicted in the equation [13], actually encompasses both dynamics. These requirements are specified in equation [13], which is now labeled "asymmetric or bidirectional" ARDL.

5. Results and Discussions

As discussed earlier, the end goal of this study is to address the core transformations in the given policy recommendations, based upon the two comparative estimation techniques, to uncover the unaddressed hidden links of MF, PSTAB, and XRATE with SMD of Pakistan.

5.1. Descriptive Statistics, Unit Root Test, and Correlational Matrix

Descriptive statistics have been included in the Table-2. The table provides Mean/Median values, Maximum and Minimum values to calculate the range of dispersion, Kurtosis, S.D. and Skewness respectively. The highest Mean and lower range of deviation indicates the stability and predictability impact of MF on SMD. It is interesting to note the range of deviation for PSTAB and XRATE has been higher compared to the estimated deviation in MF (Ajala et al., 2021; Golder et al., 2020; Imran et al., 2023). The same can be cross-checked by the higher value of SD=0.47 for PSTAB, while SD for MF has been negligible (Ming and Jais, 2021). It denotes that the higher impact of two macro-economic variables than that of an institutional controlled variable.

The value of Skewness for the *explanatory variables* show the data is *fairly symmetrical*, but the data for monetary freedom is *moderately symmetrical*. The value of Kurtosis is slightly higher than 3.00, indicating that data has *heavier tails* than that of the standard distribution. The results also indicate that the dataset of PSTAB and XRATE have lighter tails with moderately symmetrical data. The range of dispersion for SMD is 0.87 [1.66-0.79]. The results also show that Mean < Median, which denotes *negatively skewed* data (Al-Maadid et al., 2020; Husnain, Islam, & Ali, 2020).

Table 2: Descriptive Statistics for SMD, MF, PSTAB, and XRATE

	LNSMD	LNMF	LNPSTAB	LNXRATE
Mean	1.337007	1.860831	0.594910	1.850767
Median	1.369611	1.866422	0.625993	1.777673
Maximum	1.670384	1.895316	1.201577	2.229208
Minimum	0.792015	1.788151	-0.328902	1.458817
Std. Dev.	0.238920	0.029562	0.474792	0.202365
Skewness	-0.595640	-0.592543	-0.311144	-0.094714
Kurtosis	2.613436	3.015908	1.758885	2.291888

Source: (author)

Table-03 covers the Covariance Correlational Matrix results which indicates significant positive links between MF and XRATE with SMD of Pakistan with p-values of 0.05 and 0.04. An interesting result must be investigated for the negative and highly significant nexus between PSTAB-SMD at 1% with coefficient of -0.46 (Raza et al., 2023). It shows that political stability acts as a facilitator on the basis of laissez-faire policy that shall facilitate the impact of sound monetary policy strategies and stable exchange rates (Imran et al., 2023; Rafique et al., 2023).

Table 3: Correlational Matrix for SMD, MF, PSTAB, and XRATE

	LNSMD_	LNMF	LNPSTAB	LNXRATE
LN_SMD	1.000000			
LN_MF	0.129033	1.000000		
	0.0516	-----		
LN_PSTAB	-0.456991	-0.156733	1.000000	
	0.0148	0.4246	-----	
LN_XRATE	0.388542	0.337980	-0.632249	1.000000
	0.0433	0.0717	0.0003	-----

Source: (author)

The proofs of significant asymmetries can be found between the XRATE-MF nexus with coefficient of +0.39, denoting sound monetary strategies can minimize the exchange rate fluctuations. The highly significant and negative coefficient of -0.63 indicates the presence of asymmetry between PSTAB and XRATE, indicating the occurrence of bi-directional/bi-variate causalities between variables resulting in a tight monetary mechanism.

Table-4 indicates the results of SD, Durbin Watson-stats, adj. R², the trend with intercept, Log likely Ratio, and unit root. Here, the DV, SMD (proxy used for stock market development) is I(0), having trend and intercept, with adj. R²=0.65<0.70, with DW-stats of 2.23 that shows negative serial correlation. The SD for SMD is only 0.18, with Log-likely value=16.68, indicating a stable model variables. All independent variables are I(1), with the normal intercept and having no trend. The adj. R² value for political stability is 0.75>0.70 with an excellent DW-Stats=1.84. The 2nd variable; exchange rate with DW-stats of 1.76 and adjusted R-squared of 0.71, become a good predictor of SMD in case of Pakistan, even with log likely stats of 56.86 (Akbar, 2023; Liu et al., 2020; Raza et al., 2023).

The main explanatory variable, MF with the undesirable value of DW=1.65 and adjusted R² of 0.68, indicates that MF alone has not been a vital predictor of SMD. The study of its related statutory, governing, institutional and regulatory actors is highly recommended to magnify the directional impact of MF on achieving the sustainable SMD (Ali, 2021; Ellahi et al., 2021). None of the variables is I(2) in this study, which statistically facilitates the application of ARDL and NARDL simultaneously (Allen and McAleer, 2020; Imran et al., 2023).

Table 4: Results of Unit Root Test, Adjusted R² and DW-Stats

Name of Variable	Unit Root Test	Trend/ Intercept	Adj. Squared	R- DW-Stats	LOG-Likely Ratio	S.D.
SMD	I (0)	with Trend & Intercept	0.6511	2.2300	16.6800	0.1877
MF	I (1)	With Intercept	0.6755	1.6500	64.6500	0.0300
PSTAB	I (1)	With Intercept	0.7566	1.8400	-6.9300	0.6800
XRATE	I (1)	With Intercept	0.70857	1.7600	56.8600	0.0300

Source: (author)

5.2. Granger Causality Results

Table-5 covers Pair-wise results of Granger Causality which shows that monetary freedom does granger cause the pace of SMD at 10%, but LNSMD does not granger cause MF, indicating uni-directional causality. Technically speaking, the LNMF Granger causes LNSMD significantly in the presence of related macro-economic actors (Uzelac et al., 2020). The results also show that LNPSTAB and LNXRATE, both variables do Granger cause LNSMD, at p-value of 0.10. Further, both macro variables do Granger cause each other at 10%, which indicates clear signs of asymmetries between the variables (Ajala et al., 2021; Alsamara & Mrabet, 2019; Phong, Van, & Bao, 2019; Rafique et al., 2023; Raza et al., 2023).

For improved predictions, the two-way causality is supported by its positive and negative partially decomposed variables, shown in Table-5.

Table 5: Results of Granger Causality for SMD, MF, PSTAB, and XRATE

Null Hypothesis:	Obs.	F-Statistic	Prob.
LNMF does not Granger Cause LNSMD	30	2.65379	0.0539
LNSMD does not Granger Cause LNMF		0.21255	0.8102
LNPSTAB does not Granger Cause LNSMD	30	0.37462	0.0592
LNSMD does not Granger Cause LNPSTAB		0.35765	0.7035
LNXRATE does not Granger Cause LNSMD	30	2.66164	0.0933
LNSMD does not Granger Cause LNXRATE		2.20951	0.1346
LNPSTAB does not Granger Cause LNMF	30	1.67637	0.2111
LNMF does not Granger Cause LNPSTAB		0.30524	0.7402
LNXRATE does not Granger Cause LNMF	30	0.70694	0.5045
LNMF does not Granger Cause LNXRATE		0.18087	0.8358
LNXRATE does not Granger Cause LNPSTAB	30	0.50565	0.0613
LNPSTAB does not Granger Cause LNXRATE		0.28717	0.0553

Source: (author)

5.3. Discussion on results for ARDL Bounds Testing

The ARDL statistical results are available in Table-6. The diagnostic of DW-stats=2.06 indicates an ideal result (absence of Multicollinearity) catering to the MF-SMD nexus. The table indicates the value of adj. $R^2=0.62$, less than 0.70, indicates no excellent 'prediction' of the model to clarify the pace of growth of equity market in Pakistan, but value of R^2 has been a good predictor (Economou, 2019; Imran et al., 2023; Islam et al., 2022).

Here, LNMF, showing a coefficient of 0.99, at p-value of 10%. It can be concluded that monetary freedom does not influence SMD in a vacuum. The effect of allied actors/components cannot be ignored (Behera & Dash, 2019). Further analysis shows, the impact of LNMF (-1) becomes highly significant with a p-value of 0.03 with a coefficient of 4.63. It refers that one-unit change in MF gives birth to a 4.63 unit increase in the sustainable SMD of Pakistan. The coefficient becomes -2.56 at LNMF (-2) with p-value=0.02. The value of coefficient becomes negative $[4.63-(-2.56)=7.19/4.63*100= -155.30\%]$. It refers that MF needs careful and delicate planning to play its key role in magnifying the equity market growth of Pakistan (Akbar, 2023; Behera & Dash, 2019; Husnain et al., 2020; Oduyemi et al., 2019).

Table 6: ARDL Results for MF, PSTAB, XRATE, and SMD

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LN SMD (-1)	0.522632	0.196301	2.662407	0.0170
LN SMD (-2)	0.253957	0.207868	1.221721	0.2395
LNMF	0.994639	1.913215	-0.520401	0.0609
LNMF (-1)	4.633051	1.909769	2.425974	0.0275
LNMF (-2)	-2.569347	1.561090	-1.645868	0.0193
LNPSTAB	-0.081203	0.092252	-0.880237	0.0118
LNPSTAB (-1)	0.136858	0.101916	1.342851	0.0898
LNXRATE	-2.891405	1.198815	-2.411887	0.0282
LNXRATE (-1)	3.315135	1.240462	2.672501	0.0167
LNXRATE (-2)	-3.909822	2.209877	-1.766981	0.0909
LNXRATE (-3)	3.130440	1.449981	2.159874	0.0486
C	-2.407745	2.547368	-0.945189	0.3586
R-squared	0.757493	Mean dependent var		1.32233
Adjusted R-squared	0.621083	S.D. dependent var		0.23712
S.E. of regression	0.145993	Akaike info criterion		-0.72674
Sum squared resid	0.341024	Schwarz criterion		-0.24294
Log-likelihood	19.44829	Hannan-Quinn criteria.		-0.58742
F-statistic	5.553059	Durbin-Watson stat		2.06202

Source: (author)

Political stability has shown an unusual response for SMD. The ARDL results indicate immediate significant negative impact of PSTAB on SMD of Pakistan, as the weak form of stock market to absorb sudden political shocks. It can be concluded that PSTAB has nominal positive effect on the pace of SMD in (Emara & El Said, 2021; Yusuf et al., 2020). The 2nd variable is XRATE, which shows prompt and mixed results. XRATE indicates a significant but a negative effect on SMD with a -2.89 coefficient. It refers to one unit change in XRATE has a 2.89 decrease in SMD of Pakistan. The results go into opposite direction with +3.32 coefficient at the p-value=0.02 $[3.32-(-2.89)= +6.21]$, referring to 6.21 unit increase in SMD, as number of Lags increase (Emenyi, 2020). But, it again turns into -3.91 at 10% $[3.32-(-3.91) = -7.04]$, referring to a 7.04 unit decrease in the growth for equity market of Pakistan at Lag (-2). Lastly, at LNXRATE (-3), the coefficient becomes positive with +3.13 from -3.909 at LNXRATE (-2). The above discussion indicates that while investigating the MF-SMD nexus, the impact of XRATE cannot be left unaddressed (Azeez & Obalade, 2018; Golder et al., 2020; Okere et al., 2021).

The above discussion indicates, when lags increase, the sway of stability of XRATE shows the hybrid effect on the sustainable SMD. It shows the supportive role of variables included in the model, while launching monetary regulations (Emenyi & Effiong, 2020; Husnain et al., 2020; Islam & Bilal, 2021; Lee & Kim, 2020; Malik et al., 2020; Raza et al., 2023).

5.4. Results of NARDL

Table-7 shows the main comparative discussion of this research endeavor under Non-linear ARDL framework. The discussion can be started with MF, that is decomposed into its positive and negative partial dynamic totalities. The significant value the coefficient of POS

disintegrated dynamic multiplier, LNMF_ (POS) has come up -1.88 which shows a decrease in MF index in the financial system will have a significant positive impact on SMD. The NARDL results indicate that LNMF_POS (-1) shows a positive and larger coefficient of 12.65, compared to its previous value of coefficient. It mentions the proper statutory amendments that become further productive for strengthening *SMD strategies* (Barra & Ruggiero, 2021). It is worth mentioning that SMD of Pakistan is a *Negative Function* of Positive and Negative partial dynamic sums of dynamic disintegrated asymmetries of MF (Allen & McAleer, 2021; Caraianni & Călin, 2020; Lee & Kim, 2020; Rafique et al., 2023).

Table 7: Results of Non-linear ARDL for MF, PSTAB, XRATE, and SMD

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LN SMD _ (-1)	-0.480490	0.179908	-2.670748	0.0443
LN SMD _ (-2)	-0.584354	0.195221	-2.993294	0.0303
LNMF_POS	-1.879719	3.331993	-0.564142	0.0507
LNMF_POS (-1)	12.654611	5.967234	2.120682	0.0448
LNMF_NEG	-2.160186	3.631168	-0.594901	0.5778
LNMF_NEG (-1)	-8.760250	4.674390	-1.874095	0.1198
LNMF_NEG (-2)	-4.783674	5.076965	-0.942231	0.3893
LNPSTAB_POS	0.162798	0.160308	1.015528	0.0364
LNPSTAB_POS (-1)	-0.154814	0.230722	-0.670998	0.5320
LNPSTAB_POS (-2)	0.720457	0.265367	2.714947	0.0420
LNPSTAB_NEG	0.020506	0.406249	0.050477	0.9617
LNPSTAB_NEG (-1)	1.130641	0.298020	3.793841	0.0127
LNPSTAB_NEG (-2)	-0.146568	0.106083	-1.381643	0.2256
LNXRATE_POS	-2.290156	2.094166	-1.093589	0.3240
LNXRATE_POS (-1)	-1.469679	2.241526	-0.655660	0.5410
LNXRATE_POS (-2)	-1.698363	1.621059	-1.047687	0.3428
LNXRATE_NEG	-13.17332	8.009968	-1.644616	0.1610
LNXRATE_NEG (-1)	-17.42015	8.418001	-2.069393	0.0933
LNXRATE_NEG (-2)	-16.76753	7.632609	-2.196829	0.0794
C	2.037027	0.375440	5.425699	0.0029
R-squared	0.87782	Mean dependent var		1.32729
Adjusted R-squared	0.841355	S.D. dependent var		0.20456
S.E. of regression	0.058257	Akaike info criterion		-2.85733
Sum squared resid	0.016970	Schwarz criterion		-1.88223
Log-likelihood	55.71663	Hannan-Quinn criteria.		-2.58687
F-statistic	21.27593	Durbin-Watson stat		2.28891

Source: (author)

Table-7 presents the decomposed positive and negative partial asymmetric cumulative dynamic multipliers (ACDMs) of political stability. There has been no significant impact of LNPSTAB_NEG on SMD, but LNPSTAB_POS has a significant impact on the sustainable SMD with a minor positive coefficient of 0.16. SMD has been a *Positive function* of its *positive and negative* partial decomposed graphical sums of asymmetric cumulative dynamic multipliers (Imran et al., 2023; Islam et al., 2022; Raza et al., 2023).

The 2nd variable is foreign exchange rate (FER), which is also decomposed in its partial sums of LNXRATE_POS and LNXRATE_NEG, and SMD is a *Negative Function* of its POS and NEG ACDMs (Alsamara & Mrabet, 2019; Jareño, Escribano, & Koczar, 2020). The systematic decrease in the interchange rate has shown a significant impact on the SMD of Pakistan, though significant at p-value of 0.10 at LNXRATE_NEG (-1) and LNXRATE_NEG (-2) with coefficient of -17.42 and -16.76 respectively (M. A. Khan et al., 2020; Okere et al., 2021; Phong et al., 2019).

5.5. Comparative Analysis

The statistical findings of ARDL frame and Non-linear ARDL frames have been covered in Table-6 and Table-7 in its descriptive terms. Table-6 indicates Mean of 1.33, SD of 0.237, SE of regression=0.15, Log Likely of 19.45, Adj. R² = 0.62 and DW-statistics of 2.06. The results are matched with Table-7. The comparative inquiry designates a higher Mean of 1.33, lower SE of regression of 0.06, higher Log likely=55.72, lower SD of 0.20 and higher Adjusted R²=0.84 indicate that NARDL has been comparatively superior than the results of ARDL framework.

The conversation in sections 5.3 and 5.4 above, shows the relationship between variables is asymmetrical that necessitate further investigation before signifying any modified strategy recommendations (Meo et al., 2018). The need for extensive study on the macro-economic

actors is desirable that shall amplify the influence of partially decomposed *positive/negative* partial asymmetric dynamic C.I. (plot), called asymmetric cumulative dynamic multipliers, denoted by ACDMs (Alqaralleh, 2020; Imran et al., 2023; Islam et al., 2022).

5.6. Long Run Estimations

Long run Bound testing is also called 'F-stats' in case of ARDL and NARDL, presented in Table-8. The F-statistics of ARDL is 1.56 shows that the model has only short-run "predictive power" to affect the pace of stock market growth of Pakistan. Contrarily, the F-statistics of NARDL is 12.96 reveal the long-run "*predictive power*" of the model for guiding the sustainable growth of equity market. It necessitates a thorough examination of the *ancillary macro-level* as well as country-level components in the due course for a more consistent, and progressive operation of the stock market of Pakistan to entice more institutional and individual investors (Alqaralleh, 2020; Golder et al., 2020; M. A. Khan et al., 2020; Lee & Kim, 2020; Modugu & Dempere, 2020).

Table 8: Long-run Form & F-Bounds Testing under ARDL & NARDL

ARDL					NARDL				
Test- Stats	Value	Sig.	I (0)	I (1)	Test- Stats	Value	Sig.	I (0)	I (1)
F-Stats	1.560053	10%	2.72	3.77	F-Stats	12.95581	10%	2.12	3.23
K	4	5%	3.23	4.35	K	8	5%	2.45	3.61
		2.50%	3.69	4.89			2.50%	2.75	3.99
		1.00%	4.29	5.61			1.00%	3.15	4.43

Source: (author)

5.7. Diagnostic Inspection for MF, PSTAB, XRATE and Economic Growth

The compulsory diagnostic trials for ARDL testing and NARDL framing are recorded in Table-9, which designates the outcomes of certain diagnostics as: (i) diagnostics for residual (ii) diagnostics for stability (iii) diagnostics for coefficient (Islam et al., 2022).

1. Serial-I points LM test brings out the absence of autocorrelation under ARDL frame while in NARDL it does exists.
2. Serial-II of the table highlights the "*normality of residuals*" by using *Jarque-Bera Test* having no serious issues for *data normality*, The *p-values* of Breusch-Pagan-Godfrey statistic reveals the absence of hetroscedasticity in the model.
3. The 1st stability measure in Table-9 under Serial-IV shows *p-values* (0.23 and 0.78)for t-stats as given by Banerjee et al. (1998) and F-stats given by Pesaran, Shin, and Smith (2001) for *Ramsey RESET* (a tool of model stability). It signifies a valid and accurate specification of the given model, as a *p-value*>0.05 (Chen & Chiang, 2020; Malik et al., 2020). The second stability statistical measure is CUSUM and CUSUMQ for symmetrical graphs, and ACDM graphs for asymmetrical graphs have been deliberated in next section 5.8.

Table 9: Results of Selected Diagnostics under ARDL & NARDL

Diagnostic Tests	Problem Addressed	ARDL		NARDL	
		P-Value = [X2]	Decision	P-Value = [X2]	Decision
Breusch-Godfrey LM Test	Serial Correlation	0.844 > 0.05	No correlation Exist	Serial Does are	0.0003 < 0.05 Serial correlation Does Exist
Jarqu-Bera Test	Data Normality	0.99 > 0.05	Residuals Normally Distributed		0.16 > 0.05 Residuals are Normally Distributed
Breusch-Pagan-Godfrey Test	Heteroskedasticity	0.759 > 0.05	No Hetero Exist		0.25 > 0.05 No Hetero Exist
Ramsey RESET Test	Model Specification	0.23 > 0.05	Model is Correctly Specified		0.78 > 0.05 Model is Correctly Specified
Variance Inflation Factor [VIF]	Multicollinearity	All VIF < 10	No Serious Issues of Multicollinearity		All VIFs are > 10 Multicollinearity Does Exist
Wald Test	Coefficients Test	0.067 > 0.05	Coefficients are EQUAL to ZERO		0.010 < 0.05 ALL Coefficients are NOT EQUAL to ZERO
CUSUM & CUSUMSQ and ACDM Graphs	Stability Test	N.A.	Model is NOT Stable		N.A. Model is NOT Stable Due to Asymmetries

Coint-Equa for Err. regression	(-1) * Corr.	Long Run Bound Tests	-0.223	SOA is toward the Mean	22.30%	-0.3495	SOA is toward the Mean	34.95%
Durbin Watson Statistics	Watson	Issue of Auto Correlation	2.06 < 2.30	Issue of Serial/Auto Correlation Not Exist	Does	2.38 > 2.30	Issue of Serial or Auto Correlation Exists	

Source: (author)

The third diagnostic measure “*coefficient diagnostics*” is recorded in Serial V, VI, and VIII indicates the absence of multicollinearity under ARDL frame but it exists in NARDL. The parity of coefficients under both methods has been designed by *Wald Test* which reveals that the coefficients are equal in ARDL while unequal in NARDL frame. Serial-VIII deliberates the Coint-Eq (-1)* at the long-run testing. It specifies the speed of adjustment which has been 22.30% and 34.95% under ARDL and NARDL frames. The speed of adjustment under Non-linear ARDL designates 12.65% better convergence speed towards its mean.

5.8. CUSUM and CUSUMSQ and ACDM Graphs

A stability measurement tool as discussed in the previous section, advanced by Brown, Durbin & Evans in 1975 is CUSUM/CUSUMSQ, that was used for MF, PSTAB, and XRATE with the SMD of Pakistan. Figure-1 and Figure-2 show two-line standard charts. Which indicate no abnormality and macro-economic shocks absorbed in the coefficients. The given blue line lies within 5% standardized critical lines in the above portion of the zero line for ARDL. It indicates no abnormality found in the data. The blue line in Figure-1 & Figure-2 touches the higher bound acute red-line. This extensive analysis of related studies argues any hidden asymmetry or bi-directional behavior (Chen & Chiang, 2020; Jareño et al., 2020; Okere et al., 2021; Raza et al., 2023).

Figure 1: CUSUM Graph

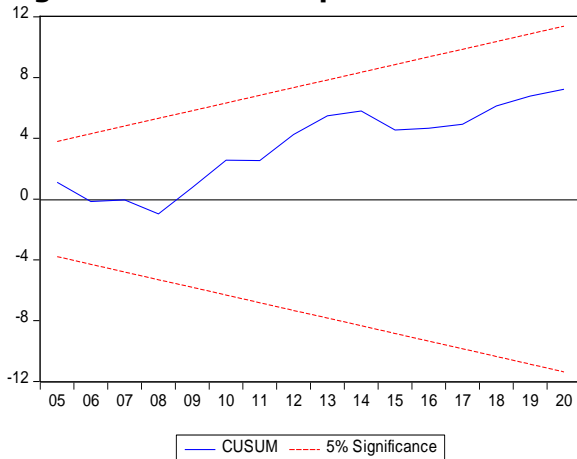


Figure 2: CUSUM of Square Graph

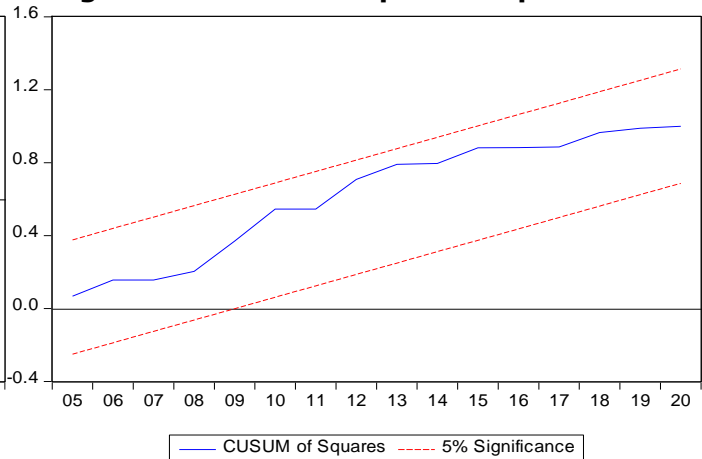


Figure-3 again designates the blue line that represents *recursive residuals* based upon the model. Though the ‘blue line’ lies within higher bounds and lesser critical bounds. The fluctuations displayed by the red-line cover a high range. It indicates all the residuals are independently and identically dispersed. But unlike normal residuals, there is no deficiency issue (Imran et al., 2023; Islam & Bilal, 2021; Islam et al., 2022).

Lastly, Figure-4 is the ultimate evidence of asymmetric association between the core nexus (MF and SMD) under NARDL. Here, MF is decomposed into *positive and negative* values in dark-bold-black line and dark-bold-dashed red line. Almost both the lines lie below the zero-line, denote SMD is a *Negative Function* of both Positive/Negative partial dynamic decomposed asymmetric multipliers. Both the multipliers started below the base-line, but the POS (C.I.) asymmetric plot went down with a sharp slope. The NEG (C.I.) plot follows the zero line (Alqaralleh, 2020). But asymmetric (C.I.) plot, revealed by red-dotted-line, with a sharp decline lies even below the POS decomposed multipliers. This indicates the impact of unaddressed macro-economic, regulatory, institutional, or governance issues, that create hurdles to correctly magnify the impact of monetary freedom on sustainable growth of the equity market. The above mentioned factors must be incorporated to strengthen the direct impact of monetary freedom on sustainable stock market development of Pakistan (Emara & El Said, 2021; Malik et al., 2020; Okere et al., 2021).

Figure 3: Recursive Residual Graph

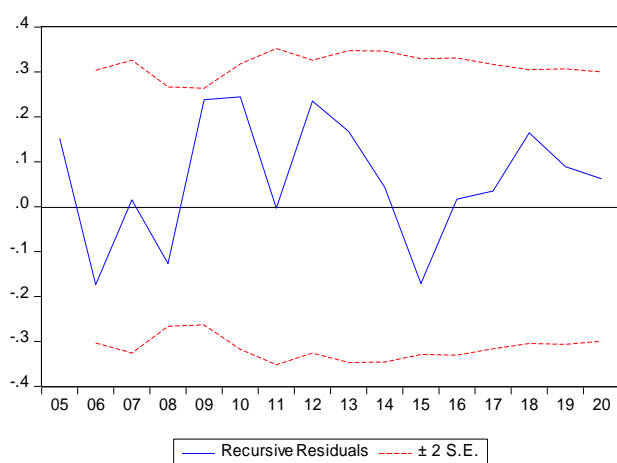
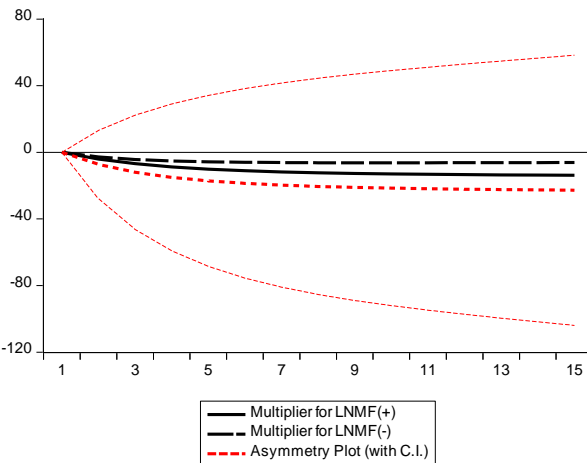


Figure 4: Asymmetries of Monetary Freedom



6. Conclusion and Modified Recommendations

The range of this study was to investigate the *directional (symmetric)* as well as *hidden and complex non-directional (asymmetric) dynamics* between monetary freedom and sustainable stock market development (SMD) in Pakistan in the presence of two selected macro-economic variables. The empirical results do affirm the hidden asymmetric association in the given econometric model and *recursive measurements*. The asymmetric testing will facilitate economic growth by a sound stock market development and it shall also mitigate the *undue institutional volatility and required financial stability*. Overlooking the *intrinsic asymmetries* shall provide clues to an overall misrepresentative, or invalid implications for a sustainable financial as well as economic structural growth pattern for Pakistan in the current unstable political and ever changing exchange rate volatility.

Monetary freedom has significant consequences for financial development and sustainable SMD for Pakistan. The bi-directional causality between political stability and exchange rate delivers the foundation for comparative analysis under NARDL and ARDL. The results specify if a country sustains the lowest MF, its institutions, governance as well as regulatory authorities shall be intelligent enough to manage an excellent pace of business activity. The ARDL bounds testing research results specify that the best quality of the institutions, freedom of trade and business, systematic control of exchange rate, political stability and balanced accountability has a direct impact on sustainable equity development in future decision making. Institutional supervisory excellence enables *the financial system* to support economic system. It can be observed that in ARDL frame, MF significantly impacts economic performance of Pakistan. It points out streamlining the link between economic and financial entities, exchange rate demands a delicate handling to consolidate sustainable SMD in Pakistan.

The results under Non-linear ARDL frame point at bearing no abrupt positive bearing of MF on SMD. The negative partial sums of asymmetric (C.I.) multipliers of MF do not impact SMD. Contrarily, politics plays a positive role in consolidating equity growth. Political instability hinders monetary freedom to promote SMD in the short-run. Lastly, a highly positive and significant impact of a stable exchange rate is found on SMD and it helps to reduce operational and production costs. The NARDL estimation technique has come up as valid, scientific and more practical because it shows that *increase and decrease* in MF, both have a momentous positive effect on sustainable SMD. It suggests a significant divergence in future policy recommendations. It argues the magnitude of MF is necessary to accelerate equity growth of Pakistan. The decline in the volume of monetary freedom is also harmful to long-term financial development. From the standpoint of future research, this comparative study will deliver a line of clues regarding *new thinkable measurements*. The short as well as long run asymmetries in numerous dimensions of MF have a joint impact to achieve a sustainable pace in SMD in Pakistan. As a result, policy makers must consider the forces that impede to achieve SDG-8 of United Nations under *“decent work and economic growth”* positively. To have a better understanding for these implications, future studies ought to include other aspects of economic freedom as (i) trade freedom (ii) fiscal freedom (iii) investment freedom. As a result, it shall

become a delicate/tactful tool to achieve long-term economic growth, financial sustainability and financial liberalization through a sustainable stock market.

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