Nexus between Governance Indicators & Sustainable Stock Market Development in Pakistan: Evidences from Symmetric and Asymmetric Analysis

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ARTICLE INFO	ABSTRACT
	The hidden non-linear association between governance indicators & stock market development (SMD) of Pakistan has been scrutinized in this study by using two comparative co-integrating techniques known as ARDL (Auto-regressive Distributed Lag) & NARDL (Non-linear ARDL). Empirical evidence suggests that misrepresented inferences arise by ignoring hidden non-linearity nexus between the variables. The ARDL results indicate that political stability & absence of violence/terrorism does not impact directly the SMD of Pakistan. Voice & accountability positively and significantly impact SMD, but rule of law does not impact SMD of Pakistan directly. The regulatory quality is highly significant and negatively impacts SMD. Contrarily, the NARDL frame indicates significant differences amid coefficients of components of governance index, denoting asymmetric links between variables. The Positive & Negative sums of partial decompositions of Rule of Law, Regulatory Quality, Political Stability & Absence of Violence/Terrorism (PS&AVT), and Voice & Accountability (V&A) significantly impact SMD. The impact of partial Negative multipliers of Regulatory Quality, and PS&AVT has a highly significant and negative impact, while V&A has a significant and positive impact on SMD. The impact of Positive partial multipliers of all variables is positive and significant except V&A. The comparative diagnostics extricate precariousness in policy moratorium. This study will add credence to the predictive power of governance indicators towards SMD of Pakistan by incorporating Positive and Negative decomposed multipliers.

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1. Introduction

The latest theoretical and scientific literature predicts that governance and growth of stock markets are closely associated and follow *hand in glove mechanism (Bilan, Vasilyeva, Lyeonov, & Bagmet, 2019; Ellahi et al., 2021; Yusuf & Solmaz, 2020)*. Governance efficiency refers to *institutional quality* in any *frontier economy*[1] like Pakistan is supposed to have a major impact on overall business growth (Al-Gasaymeh, 2020; Wang & Macy, 2021). Extensive research is undertaken to investigate the impact of various *governance indicators* like voice and accountability (V&A), government effectiveness (GE), regulatory quality (RQ), control of corruption (COC), rule of law (ROL), and political stability & absence of violence/terrorism (PS&AVT) respectively on the growth, liquidity & volatility of stock market development of Pakistan (Modugu & Dempere, 2020). Still, there is no agreement as to whether the hidden link is positive or negative, symmetrical/uni-directional or

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[1] The term Frontier Economy has been defined "the economy having distinct characteristics/features by the relative scarcities (and high prices) of capital assets like equipment, plant and skilled labor, and by the relative abundance (and low prices) of the natural resources. Due to these factors, the producers or the sellers look to utilize these natural resources instead of skilled labor or capital whenever possible.

asymmetrical/bi-directional between variables (M. A. Khan et al., 2020; Lakshmi, Saha, & Bhattarai, 2021; Ming & Jais, 2021; Sheikh, Shah, & Akbar, 2018; Umar & Nayan, 2018).

The last two decades indicate that *emerging-market economies* like Pakistan that have expanded into *frontier[2] economies,* the boom in the emerging economies' stock markets mostly attributes towards economic & financial growth, based upon good governance. The capital market growth (CMG) and boom in all emerging or frontier markets also led to *structural changes* in developed/advanced economies' financial systems (Bilan et al., 2019; Bogdan & Lomakovych, 2021). A number of macro-economic variables and *guidance metrics* have attributed the growth of stock markets (Hannah, 2019; M. A. Khan, Ilyas, & Hashmi, 2018; Ming & Jais, 2021; Modugu & Dempere, 2020).

Many reports have examined the macroeconomic effects on the growth of financial markets in less developed economies like Pakistan (Chaudhry, Faheem, Farooq, & Ali, 2021; Gulay, 2019). However, studies are still under way by testing the impact of *governance indicators* on stock market growth (Kwenda & Chinoda, 2019). There is general agreement that governance indices like (i) voice and accountability (V&A) (ii) rule of law (ROL) (iii) regulatory quality (RQ) (iv) control on corruption (COC) and (v) political stability and absence of violence and terrorism (PS&AVT) have uni-directional effect on stock market growth (Bilan et al., 2019; M. A. Khan et al., 2020). The studies highlight an important issue as how *governance* through its components has distinct effects the sustainable performance of stock market of Pakistan. It is also a critical issue as to whether economic or financial growth policies in the emerging countries can be modified and properly implemented through quality governance mechanism (Abduvaliev, 2021; Hussain, Rafique, Khalil, & Nawaz, 2013; Udoh et al., 2021).

A list of studies shows that governance indicators (GI) have a favorable impact on stock market growth (SMG). Different studies like Boadi and Amegbe (2017) and Choi, Chung, Kim, Kim, and Choi (2020) have shown good governance in the form of a sustainable stock market development and its role in economic & financial liberalization strategies. In the countries, with extremely weak enforcement of shareholders' rights and corporate level governance can be much more critical at micro-economic level. The same is true for country's dysfunctional justice system. The studies that wet this discussion include Chen, Hongo, Ssali, Nyaranga, and Nderitu (2020) and Reddy (2019). In an old study, Kaufmann, Kraay, and Mastruzzi (2011) stated that governance quality is the only variable that is essential for the growth of stock markets, but it can also jeopardize policy growth strategies, if it is badly tackled. It is also well recognized that quality of governance has significant impact on stock market volatility (SMV). The research work of Lee and Kim (2020) indicates that the indices of governance like (i) control on corruption (ii) regulatory quality & (iii) protection of ownership rights could build and improve trust in the investment of stocks. The claim that the growth of quality institutions has a major impact on financial markets' development is backed by many research endeavors like (K. Ahmed, Khan, & Ozturk, 2021; Atiq-ur-Rehman, Ditta, Nawaz, & Bashir, 2020; Kwenda & Chinoda, 2019; Nirola & Sahu, 2019). Extensive analyses indicate that the nexus of growth of stock market is closely linked to the studies on interaction of *regulatory system* with financial sector. According to Eichler and Plaga (2020) the weaker/underdeveloped financial markets appear to exist in the countries with weaker/lower law enforcement and law structures (Cho, Greenwood-Nimmo, & Shin, 2021; M. A. Khan et al., 2018; Mehmood, Mohd-Rashid, Aman-Ullah, & Zi Ong, 2021; Razi, Zahoor, & Abbas, 2021; Rysin et al., 2021).

To date, there are few quantitative studies in Pakistan that address/handle the impact of *governance indicators* on *SMD* by using ARDL & NARDL in a single study. Most of the studies and dissertations address these policy variables by incorporating uni-directional effect and ignore the bi-directional (joint impact of *Positive & Negative* Multipliers). This study is meant to investigate this discussion by comparing the results of ARDL & NARDL frame by incorporating the impact of *selected components* of governance indicators. The joint impact of ROL, RQ, PS&AVT and V&A on *SMD* of Pakistan in its true Positive & Negative partial multipliers

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[2] According to the Morgan Stanley Composite Index (MSCI) report 2021, recently published, Pakistan has been included in the list of "Frontier Market" that was previously classified as an "Emerging Market".

determines the significance of this Study and it constitute the real research gap. This study will provide new insights in policy formulation and implementation.

This paper addresses only selected institutional and governance indicators and ignores a list of related ones: like regulatory/government effectiveness, fiscal and monetary freedom, financial inclusion or liberalization, trade, fiscal and investment policies. The time and cost limitations highlight that in future research studies, these variables must be accommodated. The rest of the paper has been organized as: section 2 will deal with the review of literature. Section 3 will explain the brief comparative analysis of two methodologies and Section 4 will cover results, analysis and discussion. The last section of this paper will provide new insights and suggestions for proposed policy modification.

2. Literature Review

As discussed earlier, the focus of this study is to investigate the comparative analysis of asymmetric links between selected governance indicators (rule of law, regulatory quality, voice and accountability and government effectiveness) variables with SMD of Pakistan. The four selected governance indicators have been briefly discussed below: -

2.1. Rule of Law

Rule of law has been the first selected component of governance indicator (GI). Luong, Nguyen, and Nguyen (2020) stressed the effect of *relevant legislation* on stock market growth (SMG) and its implementation. Investors are encouraged to invest with the requisite financial support and well protected investors' rights through courts and business regulations. Though, countries with *poor legal regime* and *affected laws* would dissuade borrowers and lenders from financing (Dima, Barna, & Nachescu, 2018; Uzelac, Davidovic, & Mijatovic, 2020).

This paper analyzes empirically the effects of regulations on stock market predictions due to the role of regulations in doing business. In the event of well-defined and implemented rules/regulations concerning financial sector growth, issues of asymmetry and poor financial disclosure can be significantly reduced (K. Ahmed et al., 2021; Kaufmann et al., 2011; Shang, Li-Bo, Han-Long, & Dong-Liang, 2021). However, it is argued that sound and efficient financial market regulations (FMR) are the prerequisites to stock market growth (SMG), but most of the studies do not focus less developed countries with little data availability for the emerging markets like Pakistan (Chiad & Sahraoui, 2021; M. A. Khan et al., 2018; Shaohua, Yahya, Pham, & Waqas, 2021; Sheikh et al., 2018; Sohail, Rasul, & Fatima, 2017).

Bilan et al. (2019) reported that corporate governance is essential to, or can substitute, country-wide judicial/regulatory reforms. This is because countries with poor legal structure often have lower corporate governance and lower equity market growth. This shows that the absence of effective rules and their non-compliance cannot promote financial development. Cross-country research of corporate governance focusses *ROL* as an essential component of economic and financial development (M. M. Ahmed, 2021; Bogdan & Lomakovych, 2021; Y. Dang, 2021; Jareño, Escribano, & Koczar, 2020; M. A. Khan et al., 2020; Phuong, 2020).

2.2. Regulatory Quality

There is Regulatory quality, being the second component of Governance. Since, there are no specific *predictive regulatory factors* for the variability of a stock market (Ming & Jais, 2021; Umar & Nayan, 2018). Hence, Manasseh, Mathew, and Ogbuabor (2017) pointed that proper *securities legislation* enhances financial reporting accuracy, clarity and trust of investors. In the same way, Emara and El Said (2021) stated that in countries with effective regulatory mechanism duly backed by the legal structure, the financial markets are well developed and efficient (Emara & El Said, 2021; Kamrana, Nawazb, & Rizwan, 2020; M. A. Khan et al., 2020; Ming & Jais, 2021; Modugu & Dempere, 2020; Nguyen, Chaiechi, Eagle, & Low, 2020; Shang et al., 2021; Zungu & Grelying, 2021).

Bilan et al. (2019) have reiterated that enhancing regulatory quality will boost interest, confidence & trust in equity investments. Hence, foreign investors could derive more returns from quality organizations. Kaufmann et al. (2011) echoed the implementation of good quality regulations/rules and re-affirmed that states with weak institutions will lead to immature financial markets with regard to its transparency, investors' security, liquidity and quality regulatory measures (Bilan et al., 2019; de Batz, 2020; Hilliard & Zhang, 2019; M. A. Khan et al., 2020; Manasseh et al., 2017; Ming & Jais, 2021).

Galindo-Manrique, Pérez-Calderón, and Rodríguez-García (2021) reignited the development of financial & regulatory markets are related to increased volume of transparency of information. The failure to disclose regulatory information about their quality operations will give bad signal to current and prospective investors, hence negative shock to equity market growth (D. Dang, Fang, & He, 2019; Hannah, 2019; Shaohua et al., 2021). Extensive studies indicate that the role of financial market regulations (FMR) in relation to *SMD* of Pakistan has been inverse though not highly significant one (Boadi & Amegbe, 2017). This shows that all government regulators make no strict/stringent attempts to ensure that new rules are complied with and enforced on the equity markets. If government and other related institutions perform its respective jobs effectively, they can promote more productive activity by mitigating market manipulations relating to the capital markets of the developed economies (Abeka, Andoh, Gatsi, & Kawor, 2021; Islam & Islam, 2020; Jareño et al., 2020; M. A. Khan et al., 2018; Uzum, Ikpefan, Omankhanlen, Ejemeyovwi, & EHIKIOYA, 2021).

Sheikh et al. (2018) reiterated that legislation relating to securities encourage capital & equity market growth in different ways to fuel economic pace by creating new quality productive investment opportunities. Further, stock market system (SMS) is sanitized with stringent equity legislations to handle asymmetric information (Bogdan & Lomakovych, 2021; Chien et al., 2021; Y. Dang, 2021; Eldomiaty, Al Qassemi, Mabrouk, & Abdelghany, 2016; Uzelac et al., 2020; Uzum et al., 2021).

2.3. Voice & Accountability

Voice & accountability (V&A) have been the third selected component of governance indicators. It plays an important role in every country's capital market stability, volatility, liquidity, growth and performance. Investors' vulnerability for market practices has risen with the persistence of global financial crises (GFC) affecting the leading firms (Boadi & Amegbe, 2017; Ming & Jais, 2021; Modugu & Dempere, 2020). Investors are looking more at the transparency and consistency of equity markets with quality corporate management policies (D. Dang et al., 2019; Sohail et al., 2017). In a financial era of modern times, firms are not operating in a vacuum but are instead influenced by their host ecosystem governance structures that is directly influenced by voice and accountability mechanisms (Kinsella, Mehrbani, Weiser, & Weiner, 2020; Lakshmi et al., 2021; Modugu & Dempere, 2020; Montes, Bastos, & de Oliveira, 2019; Shaohua et al., 2021).

Different reports have investigated the impact of V&A on stock market growth of grease-induced systemic vulnerability. Rather, it has created the possibility of stock market volatility (SMV) due to investor's risk mitigation mechanism (Luong et al., 2020; Nguyen et al., 2020). In addition, Lee and Chou (2020) extensively examined the link between legal environment, risk mitigation and stock market returns. The results indicate that efficient, transparent and legal system manifested by higher quality legal & political system, adequate protection of investors by significant increase in the performance of equity market portfolios (Kinsella et al., 2020; Mangal & Liu, 2020; Noshad, Amjad, Shafiq, & Gillani, 2019). Similarly, Chizema and Pogrebna (2019) followed by Shaohua et al. (2021) iterated that states with unbiased better transparent & accountable legal system tend to attract new investors and to retain the old investors to promote stock market development (SMD) and to improve overall financial system of countries of third world (Almaharmeh, Shehadeh, Iskandrani, & Saleh, 2021; Galindo-Manrique et al., 2021; Ming & Jais, 2021; Shi, Ahmed, & Paramati, 2021).

The study of Modugu and Dempere (2020) echoed that favorable association between the quality of institutions and risk-adjusted return on assets of the legal institutions has been investigated. They further extended that lawyer's quality can extend return on equity by reducing firms' expenses amid shareholders and management. Kinsella et al. (2020) recapped that poor accountability will prefer to finance more debt financing than equity financing. Sohail et al. (2017) shows that various businesses in those countries with poor governance indicators prefer to fund more debt financing than equity acquisitions. Since capital markets with a bad governance system have higher agency and transaction costs, while equity offers lesser level of control for investors than debt financing. So, the demand for equity in poorly regulated in financial markets resulting in lower returns on equity (Amjad, Ehsan, Amjad, & Gillani, 2021;

Chizema & Pogrebna, 2019; Diallo, Mendy, & Burlea-Schiopoiu, 2021; Gulyamov, 2021; Shaohua et al., 2021; Sheikh et al., 2018).

2.4. Political Stability and Absence of Violence/Terrorism

Political stability and absence of violence/terrorism is the 4th selected component of governance indicators. Studies have proved that it plays a pivotal role in the development of economic and financial growth of any country (Abdul Rahman & Saif, 2020; Husnain, Islam, & Ali, 2020; Ming & Jais, 2021). Both components: (i) political stability (PS) & (ii) absence of violence/terrorism (AVT) have positive, significant and major impact on the stock market returns (SMR) and economic development (ED) particularly in Pakistan. Pakistan has been a frequent victim of political instability and terrorism after 09/11/2001 attacks in USA (Abdul Rahman & Saif, 2020; Emara & El Said, 2021; Fareed, Meo, Zulfiqar, Shahzad, & Wang, 2018; Ming & Jais, 2021). In this paper, the researcher has discussed the distinct impact of political, violence and terrorism events on stock returns of Pakistan that how political news and acts of terrorisms had affected stock market. The research studies during the last two decades indicate that above mentioned factors are the *major contributory factors* of the variability in stock returns of Pakistan (Abdul Rahman & Saif, 2020; Haseeb, Wattanapongphasuk, & Jermsittiparsert, 2019; Husnain et al., 2020; Masood, Javaria, & Petrenko, 2020; Monsura & Villaruz, 2021; Uzelac et al., 2020).

There has been a considerable investigation of possible correlational levels of stable political environment and terrorism with the bond or equity market of Pakistan, and still no agreement on the background, methods, methodology and strategies has ever been reached in literature (Ajide, 2019; H. Khan, Khan, & Zuojun, 2020). Economic growth and political stability are perceived to be directly proportional i.e., if political conditions are stable, then economic growth will boost and vice versa. For example, politically instable governments spend lavishly and indulge in certain social evils like grafting, expropriation, embezzlement of funds, nepotism, favoritism, political victimization and fraudulent activities to pay off illegal rewards/bonuses to their allies and generate illegitimate revenues to handle their opponents and ultimately, they impact economic policy (EP) negatively (Gulyamov, 2021; Lepore, Paolone, & Cambrea, 2018; Modugu & Dempere, 2020; Montes et al., 2019).

Numerous empirical studies have found in the literature to investigate the influence of terrorism activities on the stock market around the world. In general, growth of stock market declines from terrorist activities and it makes investors unwilling to retain their business in case of unpredictable future events (Asaad & Marane, 2020; Masood et al., 2020). Moreover, terrorism events produce extreme level uncertainty and high risk for new investment projects and operational risks for the existing projects that adversely influence financial markets. Hence, ultimate decrease in economic and financial development (Abeka et al., 2021; Bhatti, Chaudhry, & Bashir, 2021; Boadi & Amegbe, 2017; Fareed et al., 2018; Mirza, Abbas, & Nawaz, 2020; Tag, 2021).

3. Data Collection, Methodological Framework & Econometric Modelling

The annual time series data of Pakistan Stock Exchange (PSX) of last twenty-five years (1996-2020) has been used to investigate the impact of selected governance indicators *(ROL, RQ, V&A, & PS&ATV)* on SMD of Pakistan. The data of governance indicators has been downloaded from the official web site (info.worldbank.org. /governance/wgi) produced by Daniel Kaufmann, president emeritus NRGI and Aart Kraay. This study uses annual time series data of PSX for twenty-five years (1996-2020). The annual time series data of stock market development (*SMD*) has been downloaded from the official World Development Data web site (https://databank.worldbank.org/).

Table 1: List of Dependent & Independent Variables

Description of Variables	Variables	Unit of Measurement	Data Sources
Stock Market Development	**SMD**	Stock Market Turnover as % of Total GDP	World Development Indicators (WDI, 2020)
Rule of Law	**ROL**	1st Component of Index	World Governance Indicators
Regulatory Quality	**RQ**	2nd Component of Index	World Governance Indicators
Voice & Accountability	**V&A**	3rd Component of Index	World Governance Indicators
Political Stab. & Absence of Violence/Terrorism	**PS&AVT**	4th Component of Index	World Governance Indicatorss

To measure SMD, *stock market turnover (percentage of GDP)* has been used as proxy (Ajide, 2019; M. A. Khan et al., 2020). The proxies like (i) total value of shares traded on market, (ii) number of shares traded on market (iii) market capitalization (percentage of GDP) (iv) number of listed companies on per annum basis (v) market capitalization (as US dollar) has been used in a large number of research papers and dissertations. The proxy (*stock market turnover as a percentage of GDP)* has been finalized with an extensive deliberation by using E-views-10 in order to run the analysis of ARDL & NARDL framework respectively.

3.1 Methodological Frame

At present literature, the linear models completely dominate and consider a symmetric link (uni-directional link) between various components of GI and SMD. The experts have studied linearity but have ignored its non-linearity aspect. To fill this gap with respect to Pakistan, Non-linear auto regressive distributed lag (NARDL[3] model) has been applied to capture two forms of relationships i.e., unidirectional and bi-directional short-run as well as long-run dynamics at disaggregate levels. NARDL technique has been developed by Shin, Yu & Greenwood-Nimmo in 2014. NARDL is a new technique for detecting nonlinearities amid Financial & Economics variables. This methodology can be applied even if variables are integrated at *I(o) or I(1).* The results of ARDL become invalid when I(2) variable is included in analysis. The results become robust regardless of its nature of sample, and it adjusts lags in its models to deliver unbiased estimates with valid estimated *t-statistics' (Chen et al., 2020; Cho et al., 2021; Jareño et al., 2020).*

ARDL framework for cointegration, was developed by Pesaran et al. (2001). This is an OLS model that enjoys greater statistical authority compared to classical cointegration techniques called CLRM. It can handle *mixed order integration* for time series data. But it does not handle *Positive and Negative shocks* in the variables that occur due to its *Positive & Negative decomposed multipliers* to tackle spurious regressions. NARDL is the advanced version of ARDL[4]. It works effectively for small samples (Nkoro & Uko, 2016). Error Correction Model (ECM) has been used to capture the short-run and long-run dynamics (Ghardallou & Boudriga, 2014). Further, ARDL & NARDL with ECM is useful to disentangle 'long-run' links from short-run dynamics. These methods also deal with diagnostics (like *endogeneity, serial correlation & heteroscedasticity)* in the time series data. The paper covers the comparison of two econometric techniques (ARDL & NARDL) to suggest more accurate inferences. This helps to formulate future policy making strategy recommendations in a better way by pointing out unscratched nonlinearities (known asymmetries), that cover *Positive & Negative* shocks in the explanatory variables, due to diverse dynamics of ever- changing macro-economic predictors.

3.2 Econometric Model

The following equations have been formulated to test the hidden long-run & short- run uni-directional and bi-directional impact of the selected governance indicators (GI) on Stock Market Development (SMD) of Pakistan.

$$SMD = \beta 0 + \beta 1(GI) + \mu \qquad (1)$$

$$SMD = \beta 0 + \beta 1(ROL) + \beta 2(RQ) + \beta 3(V\&A) + \beta 4(PS\&ATV) + \mu \qquad (2)$$

The long run parameters are, namely $\beta 0 \& \beta 1$ for governance indicators index [GI], in equation [1]. In Equation [2], $\beta 1, \beta 2, \beta 3, and \beta 4$[5] denote *ROL* for rule of law, *RQ* for regulatory quality, *V&A* for voice and accountability and 4th variable, selected from the Index is *PS&ATV* for political stability and absence of violence/terrorism respectively. To cover bi-directional dynamics in the model, the equation (1) has been remodeled by using ECM parameters that has been developed by Smith, Shin, and Pesaran (2001). The proposed equation [04] will be:

$$\Delta SMD = \theta + \sum_{k=1}^{p1} \theta \Delta SMD(t-k) + \sum_{k=1}^{p2} \theta \Delta ROL(t-k) + \sum_{k=1}^{p1} \theta \Delta RQua(t-k) \sum_{k=1}^{p1} \theta \Delta V\&A(t-k) + \sum_{k=1}^{p1} \theta \Delta PS\&ATV(t-k) + \lambda 1ROL(t-1) + \lambda 2RQ(t-1) + \lambda 3V\&A(t-1) + \lambda 4PS\&ATV(t-1) + \mu \qquad (3)$$

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[3] NARDL covers the bi-directional impact between independent and dependent variables
[4] ARDL methodology is an appropriate modification of orders of ARDL frame (p, q), that is necessary to rectify the problem of 'endogenous regressors' & residual 'serial correlation' simultaneously (Pesaran and Shin, 1999). But, NARDL model decomposes every series into positive and negative values that are not I(1). The degree of persistence will correct any endogeneity, e.g., if the variables are I(d), the correction is better for the values of 'd' closer to1.00.
[5] Beta is a measure of Stock Price Volatility (SPV) w.r.t. overall stock market. Higher Beta means higher potential returns with higher riskier security. If a stock moves less than market, the stock's beta will be less than 1.00.

The equation [03] here, is parallel to statistical study conducted by Engle and Granger (1987). The proxy in equation above is a linear form of the under-study variables that shows its *lagged values*. Further, in equation [3], the long-run coefficients are denoted by λ1, λ2, λ3, & λ4 respectively, while short-run coefficients are reflected by θ. The presence of cointegration between GI & SMD of Pakistan is substantiated by F-Bounds test stats. The test is recommended by Pesaran et al., (2001). The equation [3] assumes symmetrical hidden links amid GI and SMD of Pakistan. The second objective of this research is to test non-linear/asymmetric impact of selected components of governance index on SMD of Pakistan. Here, non-linear/asymmetric regression shown as:

$$\iota x_t = \delta^+ y_t^+ + \bar{} \; \delta^- y_t^- + \mu_t, \text{ where } \delta^+ and \; \delta^-$$

This equation links long-run coefficients, here y_t shows the *vector of explanatory variables* that is disintegrated as; The following equations [4,5,6,7,8,9,10,11] show non-linear trend denoted by partial multipliers of hidden Positive and Negative changes in rule of law, regulatory quality, voice & accountability and the 4th selected component of governance index political stability and absence of violence/terrorism respectively.

$$\sum_{i=1}^{t} ROL+ = \sum_{i=1}^{t} \Delta ROL+ = \sum_{i=1}^{t} ROL \max(\Delta ROLi, 0) \quad (4)$$

$$\sum_{i=1}^{t} ROL- = \sum_{i=1}^{t} \Delta ROL- = \sum_{i=1}^{t} ROL \min(\Delta ROLi, 0) \quad (5)$$

$$\sum_{i=1}^{t} RQ+ = \sum_{i=1}^{t} \Delta RQ = \sum_{i=1}^{t} RQ \max(\Delta RQi, 0) \quad (6)$$

$$\sum_{i=1}^{t} RQ- = \sum_{i=1}^{t} \Delta RQ = \sum_{i=1}^{t} RQ \min(\Delta RQ, 0) \quad (7)$$

$$\sum_{i=1}^{t} V\&A+ = \sum_{i=1}^{t} \Delta V\&A \sum_{i=1}^{t} V\&A \max(\Delta V\&Ai, 0) \quad (8)$$

$$\sum_{i=1}^{t} V\&A- = \sum_{i=1}^{t} \Delta V\&A \sum_{i=1}^{t} V\&A \min(\Delta V\&Ai, 0) \quad (9)$$

$$\sum_{i=1}^{t} PS\&AVT+ = \sum_{i=1}^{t} \Delta PS\&AVT = \sum_{i=1}^{t} PS\&AVT \max(\Delta PS\&AVTi, 0) \quad (10)$$

$$\sum_{i=1}^{t} PS\&AVT- = \sum_{i=1}^{t} \Delta PS\&AVT = \sum_{i=1}^{t} PS\&AVT \min(\Delta PS\&AVTi, 0) \quad (11)$$

In order to develop non-linear/asymmetric ARDL framework *(called NARDL)*, here the equations generated above (from Eq.4 to Eq.11) have been put into equation [4] to produce equation [12], that represents *desired NARDL equation* for the model under-study.

$$\Delta SMD = \theta + \sum_{k=1}^{p1} \theta \Delta SMD(t-k) + \sum_{k=1}^{p2} \theta \Delta ROL(t-k) + \sum_{k=1}^{p3} \theta \Delta RQ(t-k) + \sum_{k=1}^{p4} \theta \Delta V\&A(t-k)) +$$
$$\sum_{k=1}^{p5} \theta \Delta PS\&AVT(t-k) + \sum_{k=1}^{p6} \theta \, ROL(+) + \sum_{k=1}^{p7} \theta \, ROL(-) + \sum_{k=1}^{p8} \theta \, RQ(+) + \sum_{k=1}^{p9} \theta \, RQ(-) +$$
$$\sum_{k=1}^{p10} \theta \, V\&A(+) + \sum_{k=1}^{p11} \theta \, V\&A(-) + \sum_{k=1}^{p12} \theta \, PS\&AVT(+) + \sum_{k=1}^{p13} \theta \, PS\&AVT(-) + \lambda1 \, ROL(t-1) + \lambda2 RQ(t-1) + \lambda3 V\&A(t-1) + \lambda4 PS\&AVT(t-1) + \mu t \quad (12)$$

Here, the above developed model shown in equation [12][6] covers the short-run and long-run dynamics to make specifications given in equations [1, 2 & 3] labelled as asymmetric or non-linear ARDL.

4.   Results & Discussions
In this paper, two methodologies (ARDL & NARDL) have been used to test the linear & non-linear/bi-directional links between the selected components of GI and SMD of Pakistan for better and relevant decisions. The analysis, its results and relevant discussion begin as;

4.1.   Descriptive Statistics, Correlation Matrix & Unit Root Test
Table 2 covers descriptive statistics. It provides information about Mean and Median values of all variables in the model. The maximum Mean/Median values on the basis of *log*

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[6] For extensive derivation of the model, see the methodology used by Shin, Yu, and Greenwood-Nimmo (2014)

values are for *regulatory quality (RQ)* with 1.45 &1.46 respectively, while maximum *range of variation* is observed in *LPS&AVT* that is 1.38. Higher range of dispersion indicates that *political stability and absence of violence/terrorism* plays a key role in economic and financial development of Pakistan. The other two variables *(ROL & RQ)* have almost similar variations i.e., 0.39. while, *V&A* indicates value of dispersion at 0.58. The range of *SMD* is 0.87, it shows higher variation rate in this statistical model. Same is true and can be tested in case of *S.D.* The Skewness values for *RQ, PS&AVT* and *V&A* indicate *fairly symmetrical* data, while *ROL & SMD* indicate that data is *moderately skewed (Emara & El Said, 2021)*. The Kurtosis values of *ROL, RQ & V&A>3.00*, that indicate data set has *heavier tails than a normal distribution*, while *SMD and PS&AVT* indicate *lighter tails* than normal distribution as kurtosis <3.00 (Jareño et al., 2020; Masood et al., 2020; Modugu & Dempere, 2020).

Table 2: Descriptive Statistics for Governance Indicators & SMD of Pakistan

	LSMD	LROL	LRQ	LPS_AVT	LV_A
Mean	1.327291	1.395351	**1.448364**	0.553000	1.387769
Median	1.331486	1.389507	**1.459458**	0.484300	1.404014
Maximum	1.660384	1.647464	1.636609	**1.358508**	1.682747
Minimum	0.790215	1.250138	1.248806	**-0.02325**	1.111777
Std. Dev.	0.240567	0.091946	0.080666	**0.486045**	0.125018
Skewness	-0.566818	0.975252	-0.212787	0.338631	-0.05808
Kurtosis	2.410399	3.770697	4.093131	1.736420	3.544671

Table 3 shows the *covariance correlation matrix*. The matrix indicates negative link of all independent variables with *SMD* of Pakistan except *V&A*. Interestingly, *PS&AVT* is the only variable that shows negative & significant impact on *SMD* of Pakistan with coefficient = - 0.4956. The negative relationship between variables indicates that certain *other factors* exist that impact this link between *WGI & SMD.* The analysis extends further that *RQ* significantly impact *ROL* with positive coefficient=0.54 and *PS&AVT significantly impacts ROL (coefficient=0.69),* while *V&A* significantly impacts *ROL & RQ* with respective coefficients of 0.49 & 0.83 respectively. It is also worth-mentioning that ROL significantly & positively impacts *RQ, PS&AVT and V&A (Ming & Jais, 2021).* The discussion indicates *bi-directional causality* between explanatory variables in case of Pakistan. The latest studies that support and wet this discussion include (Husnain et al., 2020; Lakshmi et al., 2021; Ouedraogo & Sawadogo, 2020; Uzum et al., 2021).

Table 3: Correlation Matrix for Governance Indicators & SMD of Pakistan

Correlation	LSMD	LROL	LRQ	LPS&AVT	LV&A
LSMD	1.000000				
LROL	-0.303930	1.000000			
	0.1397	-----			
LRQ	-0.079736	0.538775	1.000000		
	0.7048	**0.0055**	-----		
LPS_AVT	-0.495671	0.687324	0.065141	1.000000	
	0.0117	**0.0001**	0.7571	-----	
LV_A	0.006495	0.491427	0.827851	0.052010	1.000000
	0.9754	**0.0126**	**0.0000**	0.8050	-----

Table 4: Unit-Root Test, Durbin-Watson Stats and Adjusted R^2 Statistics

Name of Variable	Unit Root Test	Trend/ Intercept	Adj. R-Squred	DW-Stats	LOG-Likely Ratio	S.D.
SMD	I(0)	with Trend & Intercept	0.4400	2.1700	15.3700	0.1800
PS&ATV	I(1)	With Intercept	0.6000	1.9500	**-0.2100**	0.4000
RQ	I(0)	With Intercept	0.6200	**1.6800**	37.3800	0.0756
ROL	I(0)	With Intercept	**0.3600**	2.1700	34.7400	0.1100
V&A	I(0)	With Intercept	0.6400	1.9700	38.8900	**0.0732**

Table 4 discusses the results of unit root test, values of adjusted R^2, values of DW-stats, *S.D.*, Log-likely ratios and intercept with trends. The dependent variable, *SMD* is I(0), with trend & intercept, having adjusted R^2=0.44, with negative auto-*correlation* as shown by *DW-stats=2.17*. The *S.D.* for *SMD* is 0.18 with higher *Log-likely value=5.37*. All *dependent variables* are *I(0)* except *PS&ATV*, that is *I(1)*, with *intercept & no trend*. None of the variables

in model is *I(2)*. All explanatory variables with positive *serial-correlation* as shown by the values of *DW-statistics* except *ROL (Risal & Koju, 2021)*. The *S.D*. indicates maximum deviation in *PS&ATV*, as already tested in Table-2 and it also suffers from negative *Log-likelihood ratio.* The other *three variables* having higher *Log-likelihood values* indicate the *goodness of fit*. The *predictive power* of four variables as shown by Table-4 has not been significant, as *adjusted R-Squared <0.70* (Hue et al., 2019).

4.2.   Results of Pair-wise Granger Causality

Table 5 discusses pair-wise results of Granger causality. Table shows *ROL* does not Granger cause *SMD* of Pakistan, but it does Granger cause *RQ & V&A* at 10%. ROL also Granger cause *PS&AVT* at p-value=0.05. It denotes that *ROL* provides a basis to different variables that directly affect SMD of Pakistan (Uzelac et al., 2020). The 2nd variable, *RQ* does Granger cause *SMD* of Pakistan *bi-directionally* at highly significant *p-values.* It does not Granger cause *ROL & V&A*, but it does Granger cause *PS&AVT* at p-value=0.05 (Modugu & Dempere, 2020). The 3rd variable, *PS&AVT* does not Granger cause *SMD*. It gives opposite results against the result of Table-3. It also does not Granger cause *RQ and V&A.* Though it Granger cause *ROL* at 10% uni-directionally (Saeed Meo, 2017). The 4th variable *V&A* does Granger cause *SMD and PS&AVT* at 10%, it does not Granger Cause *regulatory quality & rule of law (H. Khan et al., 2020; Ming & Jais, 2021).*

The brief discussion on Table-5 demands an in-depth investigation to find out hidden association between variables, as this can be further tested by using *ARDL* (uni-directional) and *NARDL* (bi-directional) frame to address asymmetries. For better predictions, the results of bi-directional causality & low values of *adjusted R²*, must be investigated into its *POS & NEG* partial sums of decomposition of variables to enhance the *predictive power* of selected components of GI and to develop *graphical asymmetric multipliers* for cumulative dynamics called *AMCD* graphs (Allen & McAleer, 2020; Okere, Muoneke, & Onuoha, 2021; Phong, Van, & Bao, 2019).

Table 5: Results of Granger Causality

LROL does not Granger Cause LSMD	23	1.25637	0.3085
LSMD does not Granger Cause LROL		0.98823	0.3915
LRQ does not Granger Cause LSMD	**23**	**4.91301**	**0.0198**
LSMD does not Granger Cause LRQ		**7.12761**	**0.0052**
LPS_AVT does not Granger Cause LSMD	23	0.52822	0.5985
LSMD does not Granger Cause LPS AVT		0.30050	0.7441
LV_A does not Granger Cause LSMD	**23**	**3.29754**	**0.0602**
LSMD does not Granger Cause LV_A		**4.24329**	**0.0309**
LRQ does not Granger Cause LROL	23	0.85436	0.4421
LROL does not Granger Cause LRQ		**2.61519**	**0.1007**
LPSAVT does not Granger Cause LROL	**23**	**2.89073**	**0.0815**
LROL does not Granger Cause LPS AVT		**3.63217**	**0.0473**
LV_A does not Granger Cause LROL	23	2.18986	0.1409
LROL does not Granger Cause LV_A		**3.35107**	**0.0579**
LPS_AVT does not Granger Cause LRQ	23	0.48505	0.6235
LRQ does not Granger Cause LPS_AVT		**3.79858**	**0.0420**
LV_A does not Granger Cause LRQ	23	0.46957	0.6327
LRQ does not Granger Cause LV A		0.95898	0.4020
LV_A does not Granger Cause LPS_AVT	**23**	**3.31048**	**0.0597**
LPS_AVT does not Granger Cause LV_A		2.23292	0.1361

4.3.   Results of ARDL

Table 6 shows the results of *ARDL* framework. Starting from *DW Statistics*, it shows the presence of *negative auto-correlation in residuals* as DW-stats lies outside the upper range (1.70<DW-Stats<2.30). Table shows adjusted R² statistics=0.91, denoting an excellent 'predictive power' of the model to explain *SMD* of Pakistan. The first explanatory variable is *ROL,* showing coefficient value=0.77, but insignificant p-value=0.11. It extends the results of Table-3 & Table-5 that *ROL* is a *supportive/complementary factor* that facilitates the impact of *'other variables'* on *SMD* of Pakistan (M. A. Khan et al., 2020; Luong et al., 2020). The 2nd variable, regulatory quality *(RQ),* though highly significant but impacts *SMD* of Pakistan with

negative *coefficient=-3.65*. It denotes those extra ordinary stringent regulations; complex or complicated procedures do not promote *SMD* of Pakistan. The role of *RQ* remains significant over the years but its impact decreases with lower coefficient values as increase in number of Lags occurs (Nguyen et al., 2020; Umar & Nayan, 2018).

Table-6 shows interesting result of 3rd variable i.e., *PS&AVT,* that shows insignificant impact on SMD. Its impact becomes significant/relevant with the performance of *institutional factors (Abdul Rahman & Saif, 2020; Uzelac et al., 2020)*. The 4th variable is V&A (*voice and accountability).* It shows highly significant impact on SMD of Pakistan with coefficient value of +1.40. Voice and accountability along with regulatory quality and *PS&AVT* and supported by *ROL* jointly affect *SMD* of Pakistan and the variables suggest effective synchronization of the model variables that will facilitate a sustainable development in the equity market of Pakistan (Boadi & Amegbe, 2017; Ming & Jais, 2021; Modugu & Dempere, 2020).

Table 6: Results of ARDL for Governance Indicators & SMD of Pakistan

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LSMD(-1)	-0.074759	0.148536	-0.503307	0.6256
LSMD(-2)	0.430902	0.137392	3.136292	0.0106
LSMD (-3)	0.434118	0.177112	2.451098	0.0342
LROL	0.769947	0.441212	1.745074	0.1116
LRQ	-3.654123	0.529262	-6.904179	0.0000
LRQ (-1)	-0.227028	0.395351	-0.574244	0.5785
LRQ (-2)	-1.468477	0.295616	-4.967512	0.0006
LRQ (-3)	-1.814894	0.313267	-5.793450	0.0002
LPS AVT	0.208164	0.118710	1.753546	0.1100
LPS AVT (-1)	-0.199332	0.098762	-2.018310	0.0712
LV A	1.401140	0.347309	4.034276	0.0024
C	7.696882	1.193406	6.449506	0.0001
R-squared	0.955628	Mean dependent var		1.350013
Adjusted R-squared	0.906820	S.D. dependent var		0.241156
S.E. of regression	0.073614	Akaike info criterion		-2.077513
Log likelihood	34.85264	Hannan-Quinn criter.		-1.937322
F-statistic	19.57907	Durbin-Watson stat		2.477134

4.4. Results of Non-linear ARDL

The core rationale of this research paper has been covered in Table-7 to show results under NARDL frame. The discussion starts from *rule of law,* decomposed into *POS & NEG* partial sums*.* Its shows that by increasing one unit in *ROL, SMD* of Pakistan increases by 2.43 unit. It also denotes *LROL_NEG* has significant impact on *SMD* at 10%, denoting that one unit decrease in ROL will increase SMD of Pakistan by 1.45 units. Hence, *SMD is a POSITIVE Function* of both *POS & NEG* changes in *ROL* as both the coefficients (2.43 & 1.45) are positive *w.r.t.* direction and magnitude. Rather, *systematic decline* in prevailing *rule of law* has positive and significant impact on equity market, but deterioration is not desirable. Statistically speaking, SMD of Pakistan is a *POSITIVE function* of ROL. The results of Table-7 & Table-6 under *NARDL & ARDL* bound testing for *ROL* almost show same direction, that better, relaxed and relevant *law and order* situation promotes stock market performance in Pakistan (Bilan et al., 2019; M. A. Khan et al., 2018; Uzelac et al., 2020).

The 2nd variable is regulatory quality *(RQ),* decomposed into *LRQ_POS* that shows a significant and positive impact on *SMD* of Pakistan at 10%, while *LRQ_POS_(-1)* supports that consistent improvement in the *quality of regulations* will facilitate *SMD* on long-run basis with higher & positive coefficients while *LRQ-NEG* with highly significant p-value and negative coefficient (-7.33) shows that when *regulatory quality* decreases by one unit for the institutions, the performance of *SMD* decreases by 7.33 units. Hence, the link is *positive.* The results in Table-6 have opposite recommendations that indicate *RQ* does promote *SMD* of Pakistan, though its role decreases due to lower coefficient values, as number of lags increase but remains highly significant. This again is a major bone of difference while formulating any new policy or modifying any old strategy (M. M. Ahmed, 2021; Bilan et al., 2019; Ellahi et al., 2021; M. A. Khan et al., 2020; Naseer, Khan, Popp, & Oláh, 2021; Umar & Nayan, 2018).

The 3rd explanatory variable that is most relevant to present circumstances of Pakistan is *PS&AVT.* The political stability and control on violence and terrorism has significant and

positive impact on *SMD* of Pakistan with coefficient value of 1.10, but the impact of decrease in *PS&AVT* has been highly significant and a prompt on *SMD* with minimum standard errors, indicating decline in *PS&AVT* creates immediate shocks to SMD (Abdul Rahman & Saif, 2020; M. A. Khan et al., 2018). The discussion ends with the 4th variable i.e., voice and accountability. Here, *LV&A_POS* has been highly significant with negative coefficient (-4.80). It refers to strict accountability rules does not support *SMD* of Pakistan. It denotes when *V&A* increases by one unit, *SMD* decreases by 4.80 units, hence relationship is negative (Boadi & Amegbe, 2017; Modugu & Dempere, 2020). While, *LV&A_POS(-1)*, also wetted previous discussion. At the same time, *LV&A(NEG),* positively & significantly impacts *SMD* with coefficient of **+**3.98. It refers relaxed regulations/rules that directly promote financial markets in Pakistan with minimum government intervention (M. A. Khan et al., 2018). As with one unit decrease in *V&A, SMD* will increase by 3.98 units. Hence, the association between *SMD* of Pakistan and *V&A* is negative. The results in Table-7 are again in opposite direction compared to the results of ARDL frame in Table-6 due to significant differences in coefficients & standard error estimates as discussed in next section (H. Khan et al., 2020; Modugu & Dempere, 2020).

Table 7: Results of Non-Linear ARDL For GI and SMD of Pakistan

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LSMD (-1)	-0.124390	0.149550	-0.831760	0.4271
LROL_POS	2.428809	0.836291	2.904264	0.0175
LROL_NEG	1.449286	0.740405	1.957425	0.0820
LROL_NEG (-1)	2.234572	0.861794	2.592930	0.0291
LRQ_POS	1.812455	0.877853	2.064646	0.0690
LRQ_NEG	-7.326588	1.242622	-5.896073	0.0002
LRQ_NEG (-1)	-2.587893	1.327618	-1.949275	0.0831
LPS_AVT_POS	1.098912	0.166958	-0.292963	0.0062
LPS_AVT_NEG	-3.052139	0.176308	0.295726	0.0091
LPS_AVT_NEG (-1)	-0.299001	0.214481	-1.394067	0.1968
LV_A_POS	-4.800608	1.059303	-4.531856	0.0014
LV_A_NEG	3.977683	0.580490	6.852280	0.0001
LV_A_NEG (-1)	0.600564	0.656357	0.914996	0.3841
C	1.016333	0.187209	5.428864	0.0004
R-squared	0.968567	Mean dependent var		1.382193
Adjusted R-squared	0.943164	S.D. dependent var		0.220632
S.E. of regression	0.054473	Akaike info criterion		-2.216627
Log likelihood	39.49121	Hannan-Quinn criter.		-2.042800
F-statistic	21.33276	Durbin-Watson stat		2.321213

4.5. Comparative Analysis of ARDL & NARDL in Descriptive Terms

The lower section of Table-6 indicates *adjusted R^2* =0.91, SD=0.24, S.E. of regression of 0.07, Mean value of 1.35, and Log-likelihood=34.85 compared to the results of Table-7, that indicates better adjusted R^2 =0.94, lesser values of S.D. & S.E. of regression (0.22 & 0.05 respectively), higher Mean=1.38 & higher Log-Likelihood=39.49 under NARDL frame. It demands an extended investigation of *auxiliary macroeconomic* country-specific factors in due course of time for more consistent, progressive and smooth operations of stock market of Pakistan (Eldomiaty et al., 2016; Ullah & Jan, 2020).

The discussion in Section 4.4 and 4.5 helps to conclude that the link between selected components of Governance Index and *SMD* of Pakistan is not of rather symmetrical nature (Bhuiyan & Chowdhury, 2020; Ellahi et al., 2021). This shows that the Index components do not impact *SMD* significantly and symmetrically, rather it depends on synchronized & well-connected macro-economic variables that magnify the impact of decomposition of *POS & NEG* partial changes in multipliers of various components of *Governance Index* as shown in graphical ACDM (asymmetric cumulative dynamic multipliers) in section 4.8 (Allen & McAleer, 2020; Jareño et al., 2020; Meo, Chowdhury, Shaikh, Ali, & Masood Sheikh, 2018; Saeed Meo, Hafeez, Shaikh, & Shahid, 2018).

4.6. ARDL & NARDL Long Run Form & Bounds Test

Bound-testing/F-statistics for ARDL & NARDL have been shown in Table 8 in parallel form. The F-statistics for ARDL and NARDL is 6.6956 & 10.4105 respectively, that shows a

strong cointegration (long-run bound testing), as F-stats value is well above tabulated upper-bound[7] values of I(1) @ 10%, 5%, 2.50% & 1.00% respectively. It indicates that model has *predictive power* to influence *SMD* of Pakistan for long-run under both techniques.

Table 8: Symmetric and Asymmetric F-Bounds Test Results

ARDL					NARDL				
Test- Stats	Value	Sig.	I (0)	I (1)	Test- Stats	Value	Sig.	I (0)	I (1)
F-Stats	6.6957	10%	2.45	3.52	F-Stats	10.4105	10%	1.95	3.06
K	4	5%	2.86	4.01	K	8	5%	2.22	3.39
		2.50%	3.25	4.49			2.50%	2.48	3.77
		1.00%	3.74	5.06			1.00%	2.79	4.11

4.7. Diagnostic Inspection for ARDL & NARDL Frames

Table-9 covers the necessary diagnostic measures for ARDL & NARDL. The Table shows the results of selected diagnostics under three heads (i) residual diagnostics (ii) stability diagnostics (iii) coefficient diagnostics. The S*erial-1* of Table-9 shows the results of *Breusch-Godfrey Serial Correlation LM* test with respective *p-values* for *ARDL* [0.0004< 0.05], while *p-value* for *NARLD* is 0.008<0.05. It denotes presence of *serial-correlation.* It denotes the absence of *efficient OLS estimator*, hence, no *BLUE* coefficients for *OLS*. It indicates that any two given variables are *inter-dependent &* confirms *bidirectional causality*. The S*erial-2* in the Table shows *normality of residuals* under *Jarque-Bera test* with no issue regarding *data normality.* Under *ARDL & NARDL* frame as respective *p-values* for Breusch-Pagan-Godfrey Test are greater than 0.05 as shown in Table-9 under Serial-3 indicate no issue of heteroskedasticity in the model (Chaudhry et al., 2021). Table-9 (Serial-4) also shows the *p-values* for t-stats (Banerjee & Urga, 2005) and F-stats (Pesaran, Shin, & Smith, 2001) for *Ramsey RESET* Test. The respective *p-values* under *ARDL & NARDL* are 0.2399 & 0.4041 respectively, that are greater than 0.05. The values denote correct and valid specification of the model (Chen et al., 2020; Ibrahim & Alagidede, 2018).

Table 9: Diagnostic Inspection for GI and SMD of Pakistan

Diagnostic Tests	Problem Addressed	ARDL		NARDL	
		P-Value =[X2]	Decision	P-Value =[X2]	Decision
1. Breusch-Godfrey LM Test	Serial Correlation	0.0004< 0.05	Serial correlation Does Exist	0.0018 < 0.05	Serial correlation Does Exist
2. Jarqu-Bera Test	Data Normality	0.5934> 0.05	Residuals Normally Distributed	0.2628 > 0.05	Residuals are Normally Distributed
3. Breusch-Pagan-Godfrey Test	Heteroske-dasticity	0.5761 > 0.05	No Hetero Exist	0.866 > 0.05	No Hetero Exist
4. Ramsey RESET Test	Model Specification	0.2399>0.05	Model is Correctly Specified	0.4041 > 0.05	Model is Correctly Specified
5.Variance Inflation Factor [VIF]	Multicolli-nearity	All VIF<10 Except PS&AVT	No Issues of Multicollinearity	All VIF are >10	Multicollinearity Does Exist
6. Wald Test	Coefficients Test	0.07>0.05	Variables jointly and statistically NOT Significant	0.008 <0.05	Variables jointly and statistically Significant
7. CUSUM & CUSUMSQ Test	Stability Test	N.A.	Model is Stable	N.A.	Model is NOT Stable Due to Shock
8. Coint-Eq (-1) * for EC regression	Long Run Bounds	-0.3234	SOA is 32.34% towards Mean	-0.6402	SOA is 64.34% towards Mean
9. Durbin Watson Statistics	Issue of Auto Correlation	2.47>2.30	Issue of Serial/Auto Correlation Exist	2.32>2.30	Issue of Serial/Auto Correlation Exist

The value of *variance inflation factor (VIF)* shown in Serial-5 for ARDL is: VIF< 10, except *PS&AVT*. It illustrates no series issue of *multicollinearity (MC)* in the statistical model. But, in case of *NARDL, VIF>10*, it indicates existence of multicollinearity issue amid the

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[7] In this model, conservative approach w.r.t. the selection of critical values as recommended by Shin et al., (2011) has been used, hence selected k=3.

variables (Sutton, Vasnev, & Gerlach, 2019). Again, refer to Table-9 (Serial-6), it shows results of *Wald test*. It covers *multiple restrictions* on hypothesis. The Wald results under *ARDL* indicates acceptance of Ho that shows the coefficients, being equal and show uni-directional trend. But, in case of NARDL, *p-value* denotes *rejecting Null hypothesis* that *coefficients are not equal to zero* w.r.t. its magnitude, size, direction, degree of strength and intensity. Hence, bi-directional causality exits between variables as they do not jointly impact SMD (Cho et al., 2021; Nkoro & Uko, 2016). Serial-7 of Table indicates *model stability* as graphed by using *CUSUM & CUSUMSQ graphs*. The graph under *NARDL* shows abnormal shocks while results of DW-Statistics under Serial-9 of Table-9 indicate the presence of serial/auto correlation under both approaches as DW-statistics>2.30.

Lastly, discussing ECM *(Error Correction Model)*, table-9 shows respective values of cointeg-Eq (-1)*. The significant *p-values* show *speed of adjustment (SOA)*. The absolute values show that *SMD* of Pakistan is converging towards its *statistical equilibrium* (mean value). The convergence rate *(SOA),* in case of *NARDL*, is worth-mentioning, 64.02% *Per Annum* compared to 32.34% per annum convergence rate in case of *ARDL.* Hence, *NARDL* has better *predictive power* accordingly (K. Ahmed et al., 2021; Bist, 2017; Phong et al., 2019; Shin, Yu, & Greenwood-Nimmo, 2012).

4.8. CUSUM & CUSUMSQ and Asymmetric Cumulative Dynamic Multipliers
In 1975, Brown, Durbin & Evans, developed a *stability measurement tool CUSUM & CUSUMSQ,* used for the components of *GI & SMD* nexus. Figure-1 & Figure-2 denote the two charts. The charts show market ups and downs (abnormality in market as a result of any macro-economic shock) in the form of regression coefficients. The *blue line* is within lower and upper 5% critical lines in case of *ARDL,* hence showing *no data abnormality* in time series data (Chen et al., 2020).

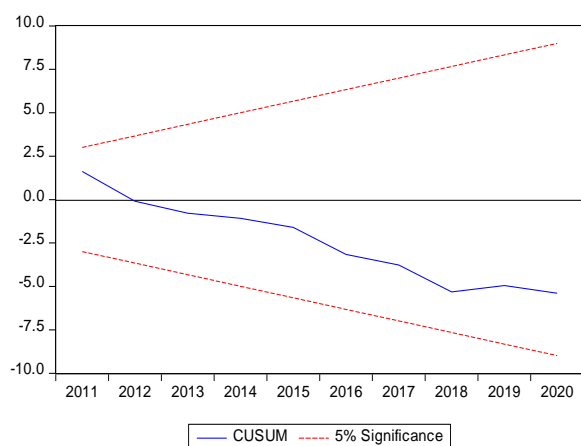**Figure 1: Graph of CUSUM**   **Figure 2: Graph of CUSUMQ**
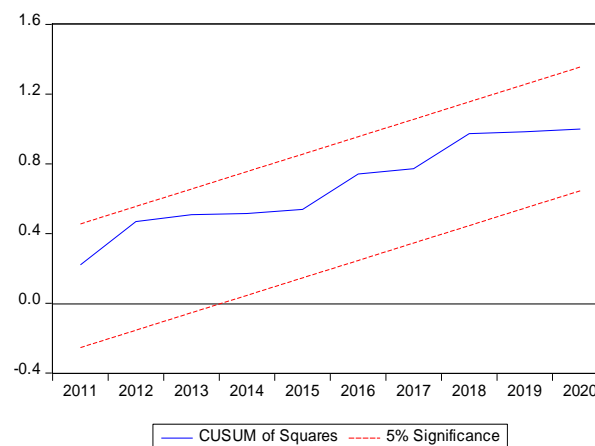

Figure-3 to figure-06, in this study are the proof of asymmetric link amid the variables under *NARDL* that is basically an asymmetric dynamic graphical presentation of this study. Figure-3 shows bi-directional causality of *rule of law* into its *POS & NEG* partial sums in *dark-bold-black* line & *dark-bold-dashed* line above & below the zero line. Both *LROL-(+) and LROL(-),* started from zero-line, show *steep increase* and then become parallel to *base line* and show asymmetry to *SMD*. While *C.I. asymmetric plot* remains parallel to base-line, denoting asymmetric behavior of *rule of law* in predicting *SMD* of Pakistan (M. M. Ahmed, 2021; M. A. Khan et al., 2020; Phuong, 2020; Uzelac et al., 2020).

Figure-4 shows that both *Positive and Negative* multipliers of *regulatory quality (RQ)* lie above base/zero line. Both multipliers started from zero line, but *LREGQUAL(-)* shows a steep upward trend with *dark-dashed-black* line & it remains above *LREGQUAL(+),* that denotes partial NEG sums have significant impact on *SMD*. While *LREGQUAL(+)* shows its normal direction with *dark-black-bold* line. The *asymmetric plot with (C.I.),* shows a steep upward trend and it crosses both *POS & NEG* dynamic cumulative multiplier, showing higher level of asymmetric impact of its *NEG* decomposition on *SMD* of Pakistan with a significant negative coefficient value of -7.32 as already discussed in Table-7 (M. A. Khan et al., 2020).
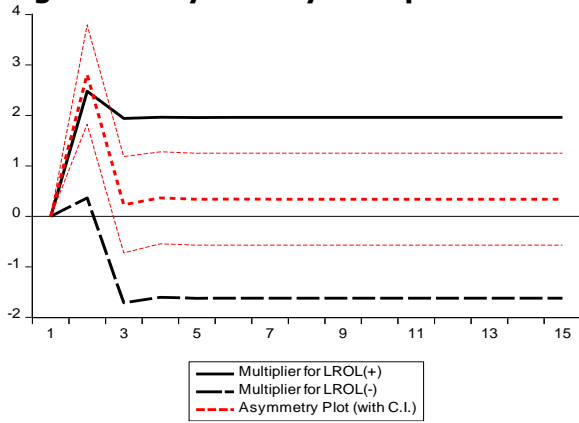
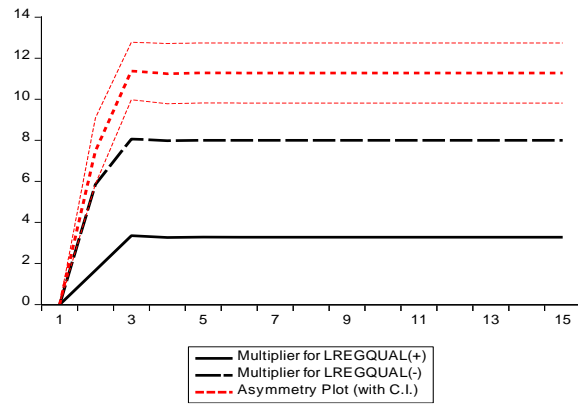**Figure 3: Asymmetry Multipliers for ROL**   **Figure 4: Asymmetry Multipliers for RQ**

Figure-5 is opposite in direction compared to figure-4 that deals with 3rd variable, *voice and accountability (V&A)*. Both *POS & NEG* multipliers of voice and accountability lie below base line, referring to abnormal reactions of *ACDM* (asymmetric cumulative dynamics multipliers) of *V&A for SMD*. The positive multiplier shows *steep downward trend* and it goes below the negative multiplier. It is interesting to note that *asymmetric plot (with C.I.)*, denoted by *dashed-red-color dotted* line shows a strait steep downward started from base-line and it went outside the range of *LV&ACC(+)*, denoting significant signs of asymmetry amid SMD & *voice and accountability* that extend the discussion of Table-7 (Ming & Jais, 2021; Modugu & Dempere, 2020). The asymmetric C.I. plot of *LV&A-POS* shows significant impact that Granger because *SMD* compared to *LV&A-NEG.* The 5% lower & upper bound critical *dotted-red-lines* are also well below the base line to show graphically the effects of asymmetries of *voice and accountability* on stock market development of Pakistan. The asymmetric *plot* shows a continuous and significant *increased non-linearity (Charfeddine & Barkat, 2020).*

Figure-6 shows asymmetries of *PS&AVT* into its *POS & NEG* partial decomposition. The behavior of multipliers for *PS&AVT (+)* has been denoted by *dark-bold-black* line that lies below in a negative area, i.e., below the zero line, while *PS&AVT (-)* lies above the zero line. Figure-6 also indicates, both lines started from below the *zero line* and went into opposite directions showing inverse link of *PS&AVT* with SMD. The asymmetric plot (with C.I.), also started from below the zero/base line. After deep downward trend, it shows a parallel trend to zero line but went above the base-line. The decision rule is asymmetric plot (with C.I.) must follow base-line to avoid asymmetry, but it lies above the base line, though it lies in between the *POS & NEG* multipliers (Abdul Rahman & Saif, 2020; Haseeb et al., 2019; Uzelac et al., 2020).

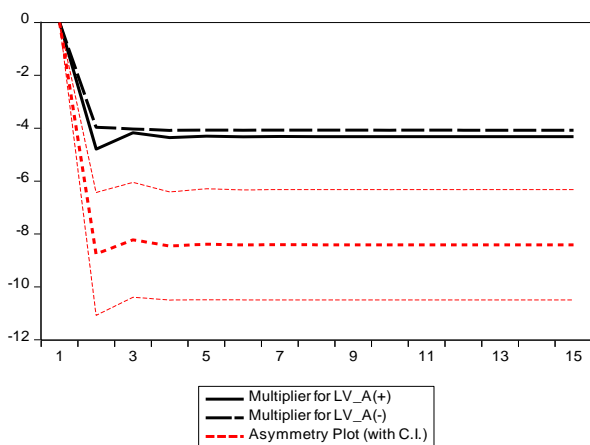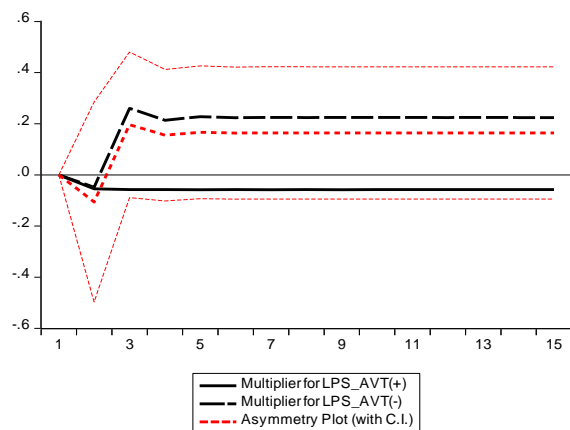**Figure 5: Asymmetry Multipliers for V&A**   **Figure 6:** Asymmetry Multipliers for **PS&AVT**

6. Conclusion and Recommendations

The scope of this research has been to investigate and elaborate the *complex and hidden symmetric and asymmetric dynamics* amid the selected components of governance indicators and sustainable *SMD* of Pakistan by using annual time series data (1996-2020) for 25 years. Governance indicators are actually *proxies* for various financial and non-financial institutions. The empirical calculations affirm asymmetric associations framed in models and *recursive measurements*. The asymmetrical investigation shall facilitate sound stock market and mitigate *undue volatility* and prevailing risks. Ignoring the *intrinsic hidden asymmetries* will lead to misrepresentative implications regarding sustainable stock market growth of Pakistan. Governance indicators directly matter for *stock price volatility/liquidity* to promote sustainable *SMD* of Pakistan. The study indicates that rule of law does not impact *SMD* under *ARDL* frame. Regulatory quality of institutions *and voice & accountability* significantly impact sustainable *SMD*. While, political stability has no direct and immediate impact on the stock market performance. Under *ARDL frame,* regulatory quality indicates better *predictive power* to test the performance of stock market of Pakistan. It denotes the extra ordinary stringent regulations; complex or complicated procedures do not promote *SMD* of Pakistan. It is worth-mentioning that ROL alone does not impact SMD, rather the joint impact of related regulatory and financial institutions is the pre-requisite for developing equity market. Further, V&A does not work in vacuum, rather it needs support from the other three components. It is advisable for portfolio managers and government agencies to take into consideration the individual behavior of components of governance indicators.

The recommendations given by NARDL frame have been more practical, scientific and valid. It refers that both increase/decrease in rule of law have significant and positive impact on *SMD* of Pakistan, indicating a significant contrast in policy recommendations. It suggests that magnitude of strictness of laws is not always desirable to flourish financial markets. It can be seen that impact of deterioration in *RQ* is more harmful to the sustainable financial growth than its improvement. The desirable/technical relaxed quality of regulations is helpful to recruit new investors in the short-run. One of the distinct and vital policy recommendations is *PS&AVT* has an immense underlying role in reshaping the performance of stock market of Pakistan. The impact of political instability is prompt & highly significant on the sustainability of equity market in Pakistan due to extreme chaos among investors. No doubt, the role of voice and accountability in policy formulation cannot be ignored, but relaxed, formal and scientific methods of accountability also play a positive role in achieving sustainable equity market development in Pakistan.

The findings of this study are helpful for regulators and policymakers to recommend stringent reforms pertaining to sustainable improvement in different institution's quality that would significantly affect sustainable stock market returns and liquidity. From future research perspective, the results provide a line of hints of possible dimensions due to *POS & NEG* shocks in explanatory variables. The short-run and long-run asymmetries or non-linearities do arise in four components/dimensions of GI, which create joint sustainable increment for SMD. These study further points out the relevant and irrelevant market forces to achieve sustainable *SMD* in Pakistan. Therefore, policymakers must pay consideration directly to the forces and powers that hinder sustainable performance of local stock market. To better understand these implications of the results, future studies must incorporate all the components of GI. It will be a good tool to magnify the overall sustainable economic growth of Pakistan. This study will practically contribute in policy-making at various operational or strategic level. The findings of this study can be used for designing an 'investment analytical software' that will help to enhance economic sustainability and financial decisions accordingly.

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