Exploring the interwoven relationship: Property rights, financial freedom, government regulation, and stock market fluctuations in emerging economies - A novel system GMM perspective

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ABSTRACT

This study delves into the impact of formal institutions on stock market volatility within a selection of emerging economies. Specifically, it examines the role that formal institutions play in shaping this volatility. To accomplish our goal, we analyze panel data from 46 emerging nations spanning the years 2000–2019, utilizing system generalized method of moments (GMM), as well as random and fixed effect models for our estimations. The findings of this research validate the existence of a significant association between formal institutions and stock market volatility. Likewise, through dynamic panel estimation, we discover that formal institutions such as property rights, financial freedom, and government regulations have a notable negative effect on stock market volatility. Consequently, this study implies that formal institutions play a crucial role in reducing stock market volatility in emerging economies, fostering their development. The insights gained from this research encourage policymakers to view formal institutions as key influencers of stock market volatility. These results offer valuable guidance for emerging nations.

1. Introduction

In modern economy, stock market acts as a mediator for borrowers and lenders. A well-developed stock market helps a country develop by increasing saving and allowing individuals to use resources more efficiently. These are two important channels, and savings are thought to increase as the stock market gives households a chance to show their risk and liquidity preferences [1]. Well-developed stock markets increase companies' profits from the price mechanism idea. In a well-functioning stock market, the share price of a profitable company responds first. Stock market volatility is a well-studied phenomenon [2,3]. Volatility is "the rate at which a share or security price rises and falls quickly" [4]. If the share price or stock return has many moments over a day, week, month, or year, the market is highly volatile. Volatility is uncertainty or risk associated with stock market investment decisions [4,5].

Excessive volatility affects the economy's performance and the stock market's smooth operation. The Wall Street Crash in 1919, October 19, 1987, as Black Monday, 1997 the Asian Crisis, and 2008 the Global Financial Crisis are examples of how the stock market affects the country or internationally. Macroeconomists, financial analysts, and policymakers must understand stock markets' aggressive behavior. Each is interested in their own area as financial analysts and investors try to understand volatility nature and pattern in response to financial assets, and what factors can change and show volatility persistence over time [6]. Volatility affects investment decisions and use. Fischer & Merton (1984) argue that macroeconomists should focus on stock market development to forecast business activities and cycle [7]. Bernanke & Kuttner (2005) measure financial market volatility by the impact of monetary policy changes on one equity price [8].

Institutions are important and has an impact economic growth [9–11]. The formal institutions are structures of coded and clear rules and regulations that shape social communication [12]. Formal institutions provide authoritative behavioral guidelines by promoting order and stability, and empowering behavior expectations [13]. While [14] define formal institutions as "written or formally accepted rules and regulations". Political institutions, especially property rights, negatively affect investment [15]. The overall institutional quality is more important for financial market growth, especially in accounting procedures [16]. As [17] argues, measuring institutions is in its early stages but can be done. But institutions and volatility worry about financial industry policy instability. Financial openness has a greater positive impact on the economy when a country has high institutional quality [16]. Financial freedom is one of the primary sources and an instrument for market openness enhancement. Legal protection and the removal of unclear and cunning financial sector practices increase economic intermediary interest in the economy [18,19]. High legal protection reduces market volatility, which increases investor trust in the economy [20]. Market openness reduces volatility by increasing risk diversification [21]. Financial sector structures such as banking and stock market improvement and competency increase the government's ability to deal with market volatility and reduce the effect of economic failure [22].

From the above, it's clear that institutions affect stock market volatility specifically weak institutions. Political stability and property rights' influence on market stability [23]. Government institutions affect market stability [24,25]. Reducing autocratic decree in institutions would reduce the financial crisis's impact. Most studies show that developing economies have volatile markets [26]. Emerging market volatility is due to monetary policy support or instability [27]. Gopinath (2004) analyzed 104 emerging nations between 1960 and 2003, and found that low institutional quality causes high market volatility in developing countries [28]. Low-quality institution countries always struggle during economic crises [29]. Due to poor financial and political institutions, the 1990 financial crisis had severe effects on developing countries with open markets [30]. The financial stress index and governance indicators to study the relationship between institutional quality and market volatility; furthermore their findings are that Strong institutions reduce financial market volatility in developing economies [31,32]. Economic or political institutions are important for economic development because they increase investment rates and market operations [33–35]. Adding quality to institutions can reduce the risk of income increase failure [23]. Institutional quality encourages investment, according to Burda & Wyplosz (2013) good institutional quality is essential in emerging markets because it boosts financial development and economic productivity [36]. Institutional quality affects stock market volatility, and strong quality can mitigate it.

This study contributes to existing literature in different ways first the by bring stock market volatility and formal institutions together to investigate their impact on the volatility of emerging economies stock markets: (A) To know how property rights affect the stock market volatility of emerging economies and our finding suggest that countries where there is strong property rights there markets are less volatile. Furthermore, these findings are in line with previous studies [37–39]. (B) To examine the role of financial freedom in stock market volatility of emerging economies. According to Refs. [21,40,41] high financial freedom mitigate the volatility of stock market. Our findings also suggest that high level of financial freedom reduces the stock market volatility by efficient regulations and effective law enforcement. (C) To explore how stock market volatility responds to government regulations. Government regulations, fair disclosure and policy play significant role in the development of stock market [42]. Our finding are in line with previous studies [25,43,44]. Secondly, this study incorporates the institutional variables to the Engle et al. (2013) model [45], which explains that macroeconomics variables significantly affect stock market volatility. Third, to achieve this objective, we employed pooled regression, fixed and random effect followed by system GMM method for the period of 2000–2017. To the best of our knowledge, the present research is the first to use system GMM in the context of emerging countries for stock market volatility and formal institutions.

The rest of paper is as follow: the next section discus relevant literature related to formal institutions and hypothesis development. Section 3 describes data and methodology; Section 4 provides the results of different models with detailed interpretation; Section 5 proposes concluding thoughts with policy recommendations and future research.

2. Literature and hypothesis development

2.1. Property rights and stock market volatility

The protection of property rights is the most important formal institution for growth. De Soto's hypothesis suggests that property rights security affects economic performance across countries [46]. Improper property rights do not define a person's ability to invest capital and assets, delaying the country's capital formation and growth. In developing countries, well-defined property rights can lead to capital formation and economic growth. High quality institutions (property rights) lead to high quality growth [29]. Property rights are key to economic performance [47]. This study analyzes formal and informal property rights components. Individuals can decide their labor supply, physical and human capital, and goods and services [12]. Exclusive ownership is a key investment incentive [37]. examined property rights, financial development, and economic growth. Authors found that firms with more secure property rights

grow faster and protect their assets from competitors. Property rights improve financial development's sectorial value. The impact of formal institutions on capital accumulation and found that securing property rights improves panel countries' capital accumulation [39,48].

Property rights define contractual relationships in an economy, so higher levels mean less risk of noncompliance. Property rights encourage investment, which helps the financial sector develop as firms seek better financing vehicles to capitalize on market opportunities [38]. Formal institutions like property rights affect European financial investment and economic growth [49]. Johnson et al. (2002) surveyed post-communist countries and found that secure property rights encourage firm owners to reinvest profits, while weak property rights discourage this [19]. Weak property rights lead to bank loans. Well-developed political institutions have more reliable firm information. Hasan, Song, & Wachtel [50] studied China's 20-year institutional change in different provinces. Stock prices are less volatile where property rights and rule of law are emphasized. Chen & Sophie Huang [51] found that stock market return is less related to economic freedom. Economic freedom reduces stock market volatility. Furthermore, High economic freedom countries have good investment incentives. From above discussion, we propose the following hypothesis.

H1. Property rights and stock market volatility have an inverse association in the context of emerging economies.

2.2. Financial freedom and stock market volatility

Financial freedom measures bank efficiency and independence from government control and interference. Economic freedom brings prosperity to countries because it affects stock market returns and volatility. Financial freedom improves mean-variance investment efficiency [51]. The rate of increase in economic freedom is directly related to better stock market returns [52]. Liberalization of the market, which often comes with economic changes, is a famous cause of financial market volatility. The quantitative and empirical relationship between economic freedom, a proxy for institutional quality, and stock market volatility in MENA countries and found financial freedom and efficient regulations can reduce market volatility [41]. Liberalizing stock markets in the late 20th century increased economic growth by 1%. It reduces consumption volatility [21,53]. The results of economic development in the emerging markets benefit more from financial sector restructures, i.e. investment and capital flow, than market release [40]. This is why countries with high-quality institutions can achieve more economic growth.

Blau, Brough, & Thomas [54] consider the Fraser Institute's Economic Freedom of the World Index for developed and developing countries with American Depository Receipts (ADRs). They conclude that index components are linked to ADRs. The link between finance and growth at the provincial level in China was studied by Ref. [55]. Financial freedom and development boost growth, especially in poor provinces. This increase is due to government marketization and legal reforms. The effect of economic freedom index on equity market volatility for emerging economies from 1990 to 2010 was studied [43]. The author found that the economic freedom index has significant effects on equity market volatility, especially the financial and business freedom categories. These factors explain market volatility. Countries with debt crises, banking crises, etc. have higher volatility. Both channels point out the following hypothesis.

H 2. High level of financial freedom leads to decreased stock market volatility in emerging economies.

2.3. Government regulation and stock market volatility

Government regulations are important for country growth, technology, and stock markets. Fiscal and monetary policies impact the stock market directly. Government bills and laws affect the market and its functions. The securities laws in 49 developing economies was studied by Ref. [56] and found evidence that disclosure laws benefit stock markets through liability rules. The microstructure of 316 pair of listed matched U.S. and non-U.S. stocks on the New York Stock Exchange was compared by Ref. [57], and found that Regulation Fair Disclosure (FD) has improved the U.S stock information system and reduced spread and adverse-selection costs. Well-developed institutions lead to three times better market performance. This gain is also due to efficient regulations and rule of law, which influence capital flows [21]. The impact of government regulations on stock return volatility on the Indian stock market [42]. He found that corporate governance legislation reduced the volatility of the Indian stock market. Those with more accounting transparency had lower stock volatility. Pastor & Veronesi [58] analyzed stock market volatility and policy change. The correlation between stock returns and policy changes increases volatility. On average, policy decisions increase risk premiums.

Newspaper-based S&P 500 equity market volatility (EMV) with VIX and realized return volatility were examined [59]. Policy changes in a major source of volatility and policy fluctuations in specific areas contribute over time. Information asymmetry in trading costs at the time of earnings announcement decreased after the SEC passed regulation fair disclosure (FD) [60]. It reduces firm return volatility. The impact of fiscal and monetary policy on China's stock market and its shocks were examined [44]. Both boost stock market performance. Transaction costs and share price volatility of London Stock Exchange's emerging markets are studied [61]. Transaction costs affect market volatility, measurement, and regulatory regime. Emerging market stock market volatility is related to economic freedom during the financial crisis [25,43]. The author explains that financial freedom and government spending are linked to stock market volatility. Based on the discussion and findings of different researchers, we hypothesize that.

H 3. Government regulations significantly impact stock market volatility in the context of emerging economies.

3. Methodology and data source

3.1. Sample selection and data source

To achieve the study's goal, we include in the final sample 46 emerging economies with available data on stock market volatility. The list of economies, also known as emerging markets, has not been defined previously [62]. Emerging economies are "low income, rapid growth countries that use economic liberalization as their primary engine of growth." They provide a list of 64 countries with emerging economies [63]. Emerging economies, are all countries other than those classified as developed economies by the International Monetary Fund in 2000 [64]. In this study, we initially included 60 countries to study of interest, but the country was reduced to 46 due to data availability and a balanced sample. Appendix A contains a list of countries. From 2000 to 2019, this study examined country-level data for emerging economies. The study's detail variables, their categories, and descriptions can be found in Appendix B.

3.2. Theoretical model and method

Institutions change, and these shifts have a significant impact on stock market volatility. According to (Engle et al., 2013) [45], stock market volatility is determined by macroeconomic variables; however, in our opinion, both macroeconomic and institutional variables have a significant impact on emerging market stock market volatility. The augmented model will take the following general form after the addition of institutional variables to Ref. [45].

$$SMV_{it} = \beta_i + \beta_1 MAC_{it} + \beta_2 F.INS_{it} + \varepsilon_{it} \tag{1}$$

Where, β_i = Unobserved country specific effect SMV= Volatility of Stock Market. MAC = Macro-economic variables. $F.INS_{it}$ = Formal Institutional variables ε_{it} = Error term.

The following models have been planned for empirical specifications. Form the above model MAC is macroeconomic variables in this study and we took them as control variables which is same for each three models explained below. Whereas F·INS is formal institutional variable. In this study for each model, we use separate institutional variables while other controls variable remains the same and unchanged in order to get the best results for every institutional variable.

Model 1 Property rights and stock market volatility

$$SMV_{it} = \beta_0 + \beta_1 SMV_{t-1} + \beta_2 PR + \beta_3 GGDP + \beta_4 XR + \beta_5 INF + \beta_6 INCM + \beta_7 RIR + \beta_8 BSD + \beta_9 POP + \varepsilon_{it} \tag{2}$$

Where, *SMV = Stock market volatility, SMV_{t-1} = lagged stock market volatility, PR = Property rights, GGDP = GDP growth, XR = exchange rate, INF = Inflation, INCM = GDP per Capita, IR = Interest rate, POP = population, ε_{it} = Disturbance term*

Model 2 Financial Freedom and stock market volatility

$$SMV_{it} = \beta_0 + \beta_1 SMV_{t-1} + \beta_2 FIFR + \beta_3 GGDP + \beta_4 XR + \beta_5 INF + \beta_6 INCM + \beta_7 RIR + \beta_8 BSD + \beta_9 POP + \varepsilon_{it} \tag{3}$$

Where, *SMV = Stock market volatility, SMV_{t-1} = lagged stock market volatility, FIFR = Financial freedom, GGDP = GDP growth, XR = exchange rate, INF = Inflation, INCM = GDP per Capita, IR = Interest rate, POP = population, ε_{it} = Disturbance term*

Model 3 Government regulations and stock market volatility

$$SMV_{it} = \beta_0 + \beta_1 SMV_{t-1} + \beta_2 GREG + \beta_3 GGDP + \beta_4 XR + \beta_5 INF + \beta_6 INCM + \beta_7 RIR + \beta_8 BSD + \beta_9 POP + \varepsilon_{it} \tag{4}$$

Where, *SMV = Stock market volatility, SMV_{t-1} = lagged stock market volatility, GREG = Govt Regulations, GGDP = GDP growth, XR = exchange rate, INF = Inflation, INCM = GDP per Capita, IR = Interest rate, POP = population, ε_{it} = Disturbance term*

We used OLS regression and one-step GMM estimations to investigate stock market volatility and formal institutions. GMM is a powerful and often-used panel data technique. It's an exploratory tool because OLS and IV are special cases of GMM estimations. Dynamic panel data estimators are used to remove bias from fixed and random effect parameter values. Dynamic panel model was introduced by Refs. [65,66] as difference GMM estimator. Difference GMM is used after first differencing variables by using lagged values as an instrument for present values. Three problems with the estimation method have been identified [67]. First, signal-to-noise ratios reduce test power after differencing because the conceptual model is level by Ref. [68]. Variables in level form can be weak difference equation instruments [66]. Third, measurement error effects on dependent variables may degenerate after differentiation [69]. The above discusses shortcomings of the first differencing GMM estimator, solved by System GMM estimator by using first differenced variables as an instrument for level equations in a system of equations that includes both level and difference equations. Fixed and random methods produce biased results with endogeneity and autocorrelation; GMM solves these issues in panel data [70].

Baltagi & Wu [71] introduced an instrument in the model to address residual autocorrelation and endogeneity. Generalize method of moment is the best method for panel estimation and is used as a robust estimator for violations of heteroskedasticity and normality in the underlying data generation process. The proposed GMM technique is best for shorter time periods and when the independent variable is not strictly exogenous. Roodman [72] introduced two-step GMM to overcome this shortcoming. This study uses one-step GMM regression for robust results.

4. Empirical results and discussion

We start our analysis by descriptive statistics and correlation among the formal institution's property rights, financial freedom, government regulations, and stock market volatility variables. Table 1 reports the descriptive statistic for the variables used in this study in terms of the mean, standard deviation, maximum and minimum values of all the variables. The results reported in Table 2 reveal the information on the strength of stock market volatility, formal institutions, and macroeconomic variables relationship. We use the Pearson coefficient of correlation in order to measures the degree of linear relationship among the variables. It is seen from the correlation coefficient among the variables generally reveals on average low and moderate correlations.

Overall, among all the independent variables we could not find any problem of multicollinearity issue and therefore we can conclude that correlation are not likely to bias our analysis. The results reported in Table 3 shows variance inflation test that supports the correlation test indicating that our results are free from multicollinearity problems. The averages of all the VIF is below the threshold of 10 as [73].

We applied pooled OLS regression to start our panel analysis for the formal institutions that are expected to affect stock market volatility according to our proposed hypothesis for emerging economies. The results panel regression is presented in Table 4. There is a negative relationship between property and dependent variable stock market volatility in the first regression model. Financial freedom and stock market volatility results of our second regression model are shown in the second column. The OLS regression confirms that there is a significant and negative link between the dependent variable and independent variable of formal institution financial freedom. Our third and final regression model shows the link between the volatility of stock market and government regulations and results are shown in column 3. For heterogeneity we also check the LM (Lagrangian multiplier) test which is in support of Random effects. For robustness, we used all formal institutions variables in one equation and investigate the fixed effects. The results for all REs regression and FE's overall variables are shown in Table 5.

The findings of REs models are same as OLS regression models for property rights, financial freedom and, for government regulation the significance level reduce from 1% to 5% level. Overall, the control variables show same trend as OLS regression results. On the other hand, we run the Fixed effect model in which all formal variables are put into one model and the results are little bit change and property right show positive relationship with stock market volatility. The other two financial freedom significance level from 1% to 5% and government regulation moves from 5% to 10% significance level. Whereas, most of the control variables show significance at 1% level. We further investigate our hypothesis by a dynamic panel model. We may think that there might be a problem of endogeneity in our variables.

The generalized method of moments (GMM) is technique which design for few time periods with many individual units (with small T and large N panels) where linear functional relationship between left hand dynamic variable depending upon the past realizations, and right hand variables that are not strictly exogenous means correlated with past realizations or possibly with current realization error, either heterogeneity or heteroskedasticity or within individual units errors autocorrelation but not across [74]. As a generalized method of the moment has two major types one is difference GMM approach (Arrelano – Bond) and its extension to system GMM. The data set used in our study in dynamic in nature and to deal with possible problems relates to dynamic panel data the system GMM is the most suitable choice. Considering the endogeneity problem that might exist in our panel regression model because of the relationship between the dependent and independent in both ways. We use one-step system GMM proposed by Ref. [66].

4.1. Formal institution and stock market volatility system GMM

The GMM based dynamic models result of stock market volatility and formal institutions variables for emerging economies are reported in Table 6. Model (1) shows the role of first institutional variables property rights and stock market volatility for the emerging economies. The effects of property right on stock market volatility is that a percentage change in property right is associated with −0.306 % decrease in stock market volatility at 5% significance level. This denotes that a higher level of property rights reduces the stock market volatility in emerging economies.

Table 1
Descriptive statistics.

Variables	N	Mean	SD	Minimum	Maximum
SMV	757	20.75	9.381	4.022	67.98
PR	828	49.89	18.90	10	97.10
FIFR	828	53.13	16.71	10	90
GREG	760	6.924	0.944	4.090	9.440
XR	758	2.795	2.496	−1.314	10.02
INF	799	5.250	5.968	−4.863	54.92
BSD	790	3.805	0 .695	−1.683	5.45
GGDP	827	4.237	3.898	−14.81	26.17
INCM	827	2.993	3.884	−14.79	15.95
LnPOP	828	17.01	1.667	13.29	21.06
RIR	554	5.472	8.693	−20.13	48.50

SMV= Stock market volatility, PR= Property right, FIFR= Financial freedom, GREG = Government regulations XR = Exchange rate, INF= Inflation, BSD= Banking sector development, GGDP = Growth of GDP INCM = GDP per capita Ln POP = log of Population RIR = real interest rate.

Table 2
Pairwise correlations coefficient.

Variables	SMV	PR	FIFR	GREG	XR	INF	BSD	GGDP	INCM	lnPOP	RIR
SMV	1										
PR	−0.081**	1									
FIFR	−0.211***	0.605***	1								
GREG	−0.301***	0.470***	0.499***	1							
XR	0.025	−0.197***	−0.192***	−0.166***	1						
INF	0.288***	−0.187***	−0.249***	−0.299***	0.023	1					
BSD	−0.026	0.264***	0.197***	0.283***	−0.033	−0.337***	1				
GGDP	−0.168***	−0.133***	−0.152***	−0.010	0.028	0.028	−0.121***	1			
INCM	−0.152***	−0.151***	−0.077**	−0.083**	0.102***	−0.007	−0.072**	0.846***	1		
lnPOP	0.208***	−0.400***	−0.496***	−0.537***	0.374***	0.224***	−0.167***	0.111***	0.149***	1	
RIR	0.119***	0.107**	0.042	−0.268***	−0.113**	−0.072*	0.063	−0.184***	−0.182***	0.054	1

***p<0.01, **p<0.05, *p<0.1 SMV= Stock market volatility, PR= Property right, FIFR= Financial freedom, GREG = Government regulations XR = Exchange rate, INF= Inflation, BSD= Banking sector development, GGDP = Growth of GDP INCM = GDP per capita Ln POP = log of Population RIR = real interest rate.

Table 3

Variance inflation test formal institutions.

Variables	VIF Values		
	Model 1	Model 2	Model 3
PR	1.33	–	–
FIFR	–	1.71	–
GREG	–	–	2.21
XR	1.21	1.14	1.13
INF	1.18	1.21	1.17
BSD	1.10	1.15	1.09
GGDP	2.88	3.13	4.50
INCM	3.20	3.39	4.61
lnPOP	1.34	1.73	1.90
RIR	1.07	1.07	1.33
Mean VIF	1.66	1.82	2.24

Source: Author own calculations

Table 4

Pooled OLS regression models.

VARIABLES	OLS 1	OLS 2	OLS 3
PR	−0.0105		
	(-0.44)		
FIFR		−0.0811	
		(-2.62)***	
GREG			−1.953
			(-2.87)***
XR	−0.0000	−0.0000	−0.0000
	(-0.65)	(-0.89)	(-0.34)
INF	0.2872	0.2395	0.1919
	(2.94)***	(2.45)**	(1.94)**
BSD	0.0074	−0.0002	0.0080
	(0.55)	(-0.02)	(0.58)
INCM	−0.1115	−0.2641	−0.4984
	(-0.57)	(-1.48)	(-2.11)**
GGDP	−0.1339	0.0209	0.1137
	(-0.78)	(0.10)	(0.48)
lnPOP	1.0946	0.7431	0.8971
	(4.40)***	(2.66)***	(2.90)***
RIR	0.1239	0.1321	0.0451
	(2.65)***	(2.84)***	(0.86)
Constant	0.6906	11.3838	18.9951
	(0.15)	(1.89)**	(2.09)***
Observations	414	414	383
R-squared	0.116	0.130	0.173
F-statistic	6.70	7.64	9.78
F-statistic P	0.0000	0.0000	0.0000

Stock market volatility is Dependent variable, t statistic in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Model (2) shows the results of our second model the financial freedom, stock market volatility, and macroeconomic variables. It is found that there is a significant and negative relationship between financial freedom and stock market volatility at a 1% of significance level.

The role of institutions in stock market volatility by capturing government regulations variable is shown in model (3). We found a negative and significant relationship between Government regulation and stock market volatility in the context of emerging economies at a 5% significance level and a percentage change in government regulation is linked with a −8.66 decrease in stock market volatility.

The necessary diagnostic of GMM methodology is explain as, that given the choice of one lag length the value of AR (2) in all the model of this study is not statistically significant which make clear that in all models there is an absence of autocorrelation of second order. The Hansen test results show that the instrument used in our model are not over-identified while the results of Sargan test also shows that the instruments are valid and were not over identified. Thus, the above confirmation supports our results and denotes that well conjecture inferences can be made from it.

Some important features can be deducted from the results of this study. Firstly the negative but significant relationship of all the formal institution's variables with stock market volatility of emerging economies. The second point is that by institutions' quality we can improve and abate the volatility in stock market. As a way of comparison, our results of property rights seem in line with the analysis of [19,37,38] for their finding that higher level of property right decrease the volatility of stock market. While the results of financial freedom are similar to previous studies like [21,40,41] that stock market volatility is mitigated and reduced with a high level

Table 5

Panel Regression of Random effects and fixed effects models.

VARIABLES	RE (1)	RE (2)	RE (3)	FE (4) All variables
PR	−0.0058			0.0345
	(-0.31)			(1.55)
FIFR		−0.0632		−0.0684
		(-2.71)***		(-2.39)**
GREG			−1.222	−1.1493
			(-2.14)**	(-1.93)*
XR	−0.0000	−0.0000	−0.0000	−0.0000
	(-0.48)	(-0.76)	(-0.33)	(-0.21)
INF	0.2737	0.3443	0.1966	0.1719
	(3.49)***	(3.00)***	(2.45)**	(2.12)**
BSD	0.0150	0.0087	0.0102	0.0043
	(1.43)	(0.82)	(0.93)	(0.39)
INCM	0.0572	0.1600	0.4282	0.6026
	(0.37)	(1.02)	(2.30)**	(3.11)***
GGDP	−0.1752	−0.2766	−0.6044	−0.7395
	(-1.34)	(-2.05)**	(3.33)***	(-3.96)***
lnPOP	1.0848	0.8087	1.0176	0.7839
	(5.60)***	(3.73)***	(4.05)***	(2.93)***
RIR	0.1103	0.1170	0.0626	0.0686
	(3.09)***	(3.31)***	(1.53)	(1.67)*
Constant	0.3108	8.8993	11.0064	17.082
	(0.08)	(1.89)*	(1.44)	(2.14)**
Observations	414	414	383	383
R-squared	0.118	0.125	0.163	0.172
LM-test (p-value)	0.00	0.00	0.00	–
Wald Chi^2	85.35	94.28	112.34	–
Prob > Chi^2	0.00	0.00	0.00	–
F-value	–	–	–	12.15
Prob > F	–	–	–	0.000

Stock market volatility is Dependent variable, t statistic in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 6

One step System GMM based regression models.

Variables	GMM (1)	GMM (2)	GMM (3)
Stock market volatility L1	0.945	0.882	0.503
	(5.53)***	(6.83)***	(2.66)**
Property right	−0.306		
	(-2.73)**		
Financial freedom		−0.349	
		(−3.60)***	
Government Regulations			−8.665
			(−2.42)**
Exchange rate	0.0002	−0.0002	0.003
	(1.30)	(−0.55)	(2.29)**
Inflation	−2.052	0.0001	−4.186
	(−2.37)**	(0.00)	(−2.47)**
Banking sector development	−0.028	0.014	−0.139
	(-0.97)	(1.40)	(−2.66)**
GDP growth	−0.181	−0.686	−0.876
	(−0.64)	(−2.71)**	(−1.50)
GDP per capita	−0.467	0.963	−0.132
	(−1.49)	(2.24)**	(−0.24)
Population	−2.081	−2.879	−2.921
	(−1.74)*	(−2.77)**	(−1.33)
Real interest rate	−1.740	0.0693	−0.689
	(−2.42)**	(0.74)	(−1.70)*
Constant	71.631	69.831	150.793
	(2.35)**	(3.00)***	(2.25)**
No of Obs.	392	392	361
Ar2 (p)	0.844	0.808	0.743
F Statistic	6.92	18.84	4.19
F Statistic P	0.000	0.000	0.005
Sargan test	0.138	0.122	0.468
Hansen test	0.236	0.235	0.229

t statistic in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

of financial freedom by efficient regulations and effective law enforcement. Our third hypothesis results are in parallel with [42,57]. Their finding that fair disclosure and policy has resulted in reduction of the stock market volatility.

This study has following implications for policymakers in emerging economies. Firstly This research identifies specific relationships between property rights, financial freedom, government regulation, and stock market fluctuations and policymakers might consider to implement the targeted policies to promote growth and stability in the economy. Secondly the study may offer financial institutions and investors valuable insights that may guide how to develop of their investment strategies. Understanding property rights, financial freedom, government rules, and fluctuations in the stock market affect each other which can help people in decisions making related to assets allocation and handle risks. Thirdly furthermore, this study has the potential to provide insights into the significance of property rights and financial independence in promoting economic development within emerging economies. This indicates that implementing changes aimed at enhancing property rights and financial institutions. Fourthly the findings from this research may be useful for companies operating in developing economies. In order to better navigate risk and uncertainty in these markets, companies should understand how government regulation impacts stock market fluctuations and financial freedom. Fifthly the study presents a novel perspective on System GMM and may contribute to the academic literature by providing new approaches and tools to analyze the complex relationships in emerging economies. GMM may provide more robust estimations and that can applied for better policy directions.

The relationships in diverse emerging economies may face limitations due to the heterogeneity of economic structures, regulatory environments, and cultural contexts across these regions. Therefore This study has following limitations; firstly the study only focuses on the emerging economics, future studies may expand and analyze the comparison of both emerging and developed economics. The study applies GMM method for the data analysis, future studies applies some more advance techniques in the study. Thirdly regional disparities in political structure has not included in this study this study may applied political stability variable in the model and construct the analysis.

4.2. Robustness test

In order to verify the consistency of our results, we further estimate our data to check the robustness tests. For robustness we used two steps procedure, first we reduce our sample size from 2000 to 2017 to 2005–2017 and in the second step we reduce some control variables real interest rate and population and re-estimate the same equation with system-GMM methodology as System GMM is most suitable for small sample with large number observations. Table 7 demonstrates the findings of SGMM. The diagnostic test shows that the values AR (2) are statistically not significant for all the models and this clear that our robustness results are free from second order of auto-correlations. The over identification test of Sargan, (1958) [75], suggested that instruments are valid and not over identified while the Hansen test showed that number of instruments used in this study is not over identified.

Furthermore, system GMM also deals with problem of omitted variables and reverses causality. The system GMM has the ability to account for the reverse causality by valid instrument producing having the supposition that the independent variables past period

Table 7
One step System GMM based regression models.

Variables	GMM (1)	GMM (2)	GMM (3)
Stock market volatility L1	0.488	0.429	0.563
	(4.43)***	(10.88)***	(6.07)***
Property right	−0.657		
	(−2.45)**		
Financial freedom		−0.088	
		(−4.50)***	
Government Regulations			−6.940
			(−2.43)**
Exchange rate	−0.0008	0.0004	−0.0001
	(−1.86)*	(2.31)**	(−1.13)
Inflation	−0.289	0.160	0.216
	(−1.05)	(2.13)*	(0.77)
Banking sector development	0.289	−0.005	0.075
	(2.15)*	(−0.67)	(1.98)*
GDP growth	7.939	0.682	−0.876
	(2.43)**	(0.72)	(10.620)*
GDP per capita	−7.109	−1.284	−9.635
	(−2.45)**	(−1.01)	(−1.90)*
Constant	25.697	15.463	35.245
	(3.99)***	(9.14)***	(3.19)***
No of Obs.	443	443	399
Ar2 (p)	0.829	0.749	0.121
F Statistic	14.07	27.24	36.37
F Statistic P	0.000	0.000	0.000
Sargan test	0.588	0.691	0.547
Hansen test	0.447	0.331	0.428

t statistic in parentheses ***p < 0.01, **p < 0.05, *p < 0.1.

shocks affects the dependent variables presents values. Whereas the independent variables cannot affect the dependent variables past periods values. System GMM also suggested that any correlation between unobserved fixed effect and endogenous variables are constant for a time and this can be eliminated with lagged difference equation. Moreover, it also allowed to include both difference and level equation. As independent variables are used as lagged ones instrument in difference equation and the difference of independent variables are used as instrument in level equation due to this the weak instrument in difference GMM model is avoided.

Similar to our primary findings the results of System GMM for all the formal institutions show a negative and significant association with stock market volatility. However, the coefficient of all the model has been improved and showed that our results are more robust by decreasing the sample size. In model (1), It is manifested that 1 % change in property rights reduces the stock market volatility by −0.65 % whereas, the control variables also showed more robust and significant association with stock market volatility. The control variable exchange rate also negative and significant link with stock market volatility while banking sector and GDP growth show positive and significant link with stock market volatility and in line with [76]. The income and stock market show negative but significant relationships while full sample only negative association is found. The model (2) demonstrates the findings of financial freedom and stock market volatility for reduced sample size and findings also shows that our results are robust. The control macro-economic variable exchange rate shows positive and significant impact on the stock market volatility at 5 % significance level. Inflations also show significant and positive association with stock market volatility as [77]. The other control variable banking sector development and income show negative while GDP growth shows positive relationship with stock market volatility, overall, the results are robust.

The third model of Sys GMM show more robust results as stock market significance level increase from 5 % to 1 %, the association between stock market volatility and government regulations show negative and significant showing that our results are robust. Any effective changes in government regulations significantly reduce the volatility in stock market by −6.94 %. The macroeconomic control variables show different results such as exchange rate show negative and inflation show positive relationship with stock market volatility.

On the other hand banking sector development has positive and significant relationship while the GDP growth and income both show negative but significant association at 10 % significance level. Regarding all the control variable in all models shows different trend and association with stock market volatility. The outcomes of reducing sample size and removal of some control variables also prove that our results are robust.

5. Conclusion

This study has examined the long run relationship between formal institutions and stock market volatility for sample of emerging economies. To achieve this objective the present study used different econometric techniques such as fixed and random effect and one step system GMM and annual data from 2000 to 2019. The empirical findings from system GMM confirmed that there is negative and significant relationship between formal institutional variable property rights and stock market, also financial freedom and government regulations shows negative and significant association with stock market volatility.

Within the context of emerging economies, this study report that there is a strong negative relationship between property right and stock market volatility. It also finds that those countries where property right level is high shows less volatility in their stock market as compared to the low level of property rights. Financial freedom and stock market volatility also shows negative and significant association that high level of financial freedom can reduce the stock market volatility in the emerging economies whereas, our last hypothesis that government regulation has significant relationship with stock market volatility. Our findings are consistent with our constructed hypothesis. Furthermore, the result of our robustness test also supports the findings of system GMM full sample results and proves that our results are robust.

This study before considering its content and nature it is intended for a wide range of countries to get benefited from it such as investor portfolio managers and government policy makers. More importantly, Institutions and stock markets together are the backbone of any economy and they show the performance and future path of the country or any region. The findings of the formal institutions and stock market volatility variables are important for policymakers because due to institutional quality policymakers can not only reduce the stock market volatility for the home country but can devise policy for cross countries effectively to deal with volatility and influence stock markets and economy. Policy action that requires to reduce the volatility because the opportunistic managers in individualistic society's behaviors should be monitored and restrained by the regulator. The results also shed light that a regulations fair disclosure can reduce the information asymmetry and this can improve the stock market quality of emerging economies. It is also suggested that countries with low institutions quality, poorly developed financial sector and delicate economies than the volatility in stock market will increase not reduces. This research focuses on the motivation and needs of market participants that the results can be helpful to the rethinking, regulations, and institutions which can be used for well-functioning markets to reduce volatility. Finally, Future research may be conducted on building on the existing findings and explore other factors of this area, and this study also provides some new insights for policy makers and practice.

Availability of data

The datasets use for analysis in the current study are available from the corresponding author on reasonable request.

Additional information

No additional information is available for this paper.

CRediT authorship contribution statement

Muhammad Haroon Shah: Writing – original draft, Resources, Investigation, Conceptualization. **Nianyong Wang:** Writing – review & editing, Supervision. **Huang De Chun:** Writing – review & editing, Supervision. **Ke Zhang:** Writing – review & editing, Writing – original draft, Supervision. **Irfan Ullah:** Validation, Software, Resources, Methodology. **Assad Ullah:** Validation, Software, Methodology. **Kashif Iqbal:** Validation, Software, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Appendix A
Emerging economies and World Bank classification based on region and income groups

Region	country	Income group
East Asia & Pacific	China	Upper middle income
	Hong Kong SAR, China	High income
	Indonesia	Lower middle income
	Korea, Rep.	High income
	Malaysia	Upper middle income
	Philippines	Lower middle income
	Singapore	High income
	Thailand	Upper middle income
	Vietnam	Lower middle income
Europe & Central Asia	Bulgaria	Upper middle income
	Croatia	High income
	Czech Republic	High income
	Estonia	High income
	Greece	High income
	Hungary	High income
	Latvia	High income
	Lithuania	High income
	Poland	High income
	Portugal	High income
	Russian Federation	Upper middle income
	Slovak Republic	High income
	Slovenia	High income
	Turkey	Upper middle income
	Ukraine	Lower middle income
Latin America & Caribbean	Argentina	High income
	Brazil	Upper middle income
	Chile	High income
	Colombia	Upper middle income
	Ecuador	Upper middle income
	Mexico	Upper middle income
	Peru	Upper middle income
Middle East & North Africa	Egypt, Arab Rep.	Lower middle income
	Jordan	Upper middle income
	Kuwait	High income
	Morocco	Lower middle income
	Qatar	High income
	Saudi Arabia	High income
	United Arab Emirates	High income
South Asia	Bangladesh	Lower middle income
	India	Lower middle income
	Pakistan	Lower middle income
	Sri Lanka	Lower middle income
Sub-Saharan Africa	Ghana	Lower middle income
	Namibia	Upper middle income

Appendix A (*continued*)

Region	country	Income group
	Nigeria	Lower middle income
	South Africa	Upper middle income

Appendix B
variables, definition, sources

Variable/Description	Definition/Calculation	Sources
SMV/Stock market volatility	Volatility of stock price index is the 360-day standard deviation of the return on the national stock market index. It is calculated as Stock price volatility is the average of the 360-day volatility of the national stock market index.	Global Financial Development Database https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database
Independent Variables		
PR/Property Right	The property rights component assesses the extent to which a country's legal framework allows individuals to acquire, hold, and utilize private property, secured by clear laws that the government enforces effectively. The score for this component is derived by averaging scores for the following five sub-factors, all of which are weighted equally: • Physical property rights, • Intellectual property rights, • Strength of investor protection, • Risk of expropriation, and • Quality of land administration.	The Heritage Foundation https://www.heritage.org/index/explore?view=by-regioncountry-year
FIFR/Financial Freedom	Financial freedom is an indicator of banking efficiency as well as a measure of independence from government control and interference in the financial sector. The Index scores an economy's financial freedom by looking at five broad areas: • the extent of government regulation of financial services, • the degree of state intervention in banks and other financial firms through direct and indirect ownership, • Government influence on the allocation of credit, • the extent of financial and capital market development, and • Openness to foreign competition. These areas are used to measure economy overall level and it has the following score on a scale of 0–100.	-do-
GREG/Government Regulations	When Regulation restricts entry into markets and interfere with the freedom to engage in voluntary exchange, they reduce economic freedom. This area of the Fraser index focuses on regulatory restraints that limit the freedom of exchange in credit, labor, and product markets. Regulation is divided into following components A. Credit market regulations B. Labor market regulations C. Business regulations.	Fraser Institute https://www.fraserinstitute.org/
Control Variables		
XR/Exchange Rate (Official exchange rate)	The exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages.	International Financial Statistic https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b&sid=1409151240976
BSD/Banking Sector Development	Domestic credit to private sector % of GDP	World Bank Indicator https://data.worldbank.org/indicator
INF/Inflation,	Consumer prices (annual %)	-do-
GGDP/GDP growth (annual %)	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U S. dollars.	-do-
Ln RIR/Real Interest Rate	The lending interest rate adjusted for inflation as measured by the GDP deflator.	-do-
Ln POP/Total Population	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	Global Financial Development Database https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database
INCM/Income	(GDP per capita growth (annual %). Aggregates are based on constant 2010 U S. dollars.	World Bank Indicator https://data.worldbank.org/indicator

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