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## Article

Novel insights into banking risk structure: Empirical evidence from nexus of financial, governance, and industrial landscape through nested tested modeling

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## BANKING & FINANCE | RESEARCH ARTICLE

# Novel insights into banking risk structure: empirical evidence from nexus of financial, governance, and industrial landscape through nested tested modeling.

Sabtain Fida<sup>1\*</sup> and Muhammad Naveed<sup>1</sup>

**Abstract:** The present study brings new insights to investigate the empirical estimation of banking risk behavior through advanced mechanisms. Consistent with the need to comply with the new age of finance, this study uniquely banks its case by employing nested tested modeling through a nexus of bank-specific parameters, governance mechanism, and industry dynamics. The panel estimation based on the data set of all listed Pakistani banks from 2004 to 2018 substantiates the relative significance of customized advanced econometric models to understand the banking risk structure in an integrative methodical manner. The findings manifest exacerbation of banking risk from bank-level parameters of equity investments and advances' maturity, whereas investments driving sovereign support abbreviate bank risk parametrically. The governance mechanism mainly stipulates the efficacious role of governance structures to abbreviate banking risk. Moreover, the multifarious influence of industry dynamics of concentration and munificence abridges standalone and asset return risk, whereas accelerating total risk. Industrial dynamism also

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## PUBLIC INTEREST STATEMENT

Banking risk structure is gauged employing three fundamental measures of standalone, total, and asset return risk. Knowing contributing factors of standalone risk helps financial institutions, investors, and depositors to devise risk divergence strategies. Moreover, total risk is an extensive measure, which frames all diversifiable and non-diversifiable risks to offer a complete risk picture of banks. Asset return risk particularly estimates risk posed to equity holders and assist them to take precautionary measures in the absence of deposit insurance protection mechanism available to deposit holders. The results disclose how the nature of banks' assets, corporate governance mechanism, and industry dynamics shape banking risk behavior. This study apprises a large group of stakeholders regarding the stability mechanics of the banking sector and offers a base to build a comprehensive risk framework.

adversely affects total bank risk. The applied perspective of study offers advanced working knowledge to risk managers, policymakers, and financial institutions to comprehend the risk management framework.

**Subjects: Economics; Finance; Business, Management and Accounting; Risk Management; Corporate Governance**

**Keywords: standalone risk; nested tested modeling; governance mechanism; industry dynamics**

## 1. Introduction

A resilient financial system is peculiarly associated with the persistent and prosperous economic structure. Resilience and stability of the financial system speak out its endurance to economic and noneconomic shock from the contiguous environment. In this connection, financial intermediaries are a pivotal constituent of the financial landscape, offering a framework to transmute savings into investments (International Monetary Fund, 2019). Banks; being one of the primary financial intermediaries; are involved in diverse business activities that stimulate revenues; however, consequently stability of banks and risk level gets affected (Nisar et al., 2018).

Risk is deservedly an integral component of the banking business, as banking without risk-taking is almost beyond the bounds of possibility. Bank and industry-level factors expose banks to a diverse range of risks but well-thought-out risk identification and management policy can alleviate the adverse consequences. Together with monitoring of factors from the financial environment affecting bank stability, the entrenchment of corporate governance structure yields equilibrium in bank stability and risk level. The State Bank of Pakistan (2010) risk management framework stressed the need for board oversight, risk management expertise, and risk governance culture to abbreviate banking risk behavior, indicating the earnest regulatory concern for risk governance mechanism.

The delicacy of the financial system can be avoided by meticulous scrutiny of risk exposures by financial institutions (Billio et al., 2012). Scrutiny of risk exposures requires a sound understanding of the theoretical foundation of bank risk structure. Theoretical support of a hierarchical multilevel model of the studies is based upon theories of market structure and risk-taking (Boyd & de Nicolò, 2005; Martínez-Miera & Repullo, 2010), theories of banking structure and behaviors (Acharya & Naqvi, 2012), agency theory, and modern portfolio theory. Drawing theoretical support from Modern Portfolio Theory, risks faced by banks can broadly be categorized into nondiversifiable market risk and diversifiable standalone risk. Standalone risk warrants more attention due to its diversifiable nature as compared to market risk. Moreover, recent literature stressed the need for unified and integrated bank risk measures in contradistinction to compartmentalize estimates. Estimation of banking risk through narrow windows of liquidity, credit, and operational risk, etc., underrates bank risk level (Basel Committee on Banking Supervision, 2011). Thus, standalone risk serves as a unified measure of a wide-ranging diversifiable risk landscape. Moreover, equity holders' risk is not at equal footing with risk faced by depositors. Depositors draw protection from deposit insurance mechanism and regulator interference for a smooth merger and acquisition to shield the depositors' money (Ahmed, 2018; Allen et al., 2015; Anginer & Demirci-Kunt, 2018). Therefore, the study uses Asset Return Risk (ARR); a hybrid measure combining market and accounting data to arrive at equity holders' risk and compares it with total bank risk.

To identify bank risk determinants, the study considers unique parameters of bank-level factors. Existing empirical evidences mainly remained centered around traditional parameters of bank size, profitability, off-balance sheet items, and loan provisioning, etc., ignoring advanced maturity structure and anatomy of investment dynamics (Ashraf et al., 2017; Ijtsma et al., 2017; Kharabsheh, 2019; Tan & Floros, 2014). Bank asset maturity and investments nature entails extensive investigation, as these constitute a major chunk of bank total assets.

The role of corporate governance mechanism in limiting bank risk structure is also taken into consideration, as merely robust fundamentals cannot secure a persistent banking system. One of the causes of the 2007–08 global financial crises and bankruptcies is the deficiencies of corporate governance systems (Kirkpatrick, 2009). The prevailing literature mainly evaluated governance mechanisms on a standalone basis, whereas the present investigation augments it with bank and industry-level factors (Felício et al., 2018; Otero et al., 2019). Moreover, existing empirical evidence mainly analyzed the influence of corporate governance practices over the narrow risk landscape of credit and default risk; ignoring broad and cohesive risk measures that comprehend all diversifiable risks (Luu, 2015; Moussa, 2019).

The study grasps one of the overlooked areas of banking risk literature i.e., sector's nature. The nature of the banking sector is crystalized through the level of concentration, munificence, and dynamism. Munificence represents persistent growth momentum of the sector and dynamism accounts for turbulence and uncertainty encompassing the banking sector. Existing literature mainly investigated the contribution of these parameters in capital structure, investment decisions, cash flow volatility, and profitability, etc., leaving bank risk-taking behavior unattended (Atinc & Ocal, 2014; Sun & Cui, 2015). In addition, the study invites novelty from a modeling perspective through employing Nested Tested Modeling Technique (NTMT). Companies operate in complex-structured environment where firm-level factors are nested into sector-level variables and in presence of these hierarchical variables, higher-level variables directly or indirectly affect the lower-level variables (Hanif et al., 2019; Kayo & Kimura, 2011).

The contribution is not circumscribed to merely expending alternative measure of bank risk, but contribution lies in the analysis of unique industry-specific parameters that are not considered before in the banking risk context. Moreover, critical and crucial bank-level variables pertinent to the nature of banks' investments and maturity profile of advances bridge the gap in the context of bank-level variables. Besides, the governance mechanism is predominantly tapped on a standalone basis, whereas the study combines corporate governance practices in bank and industry level hierarchical variables.

It is really vital to study the risk features of the Pakistani banking industry as Pakistan is a developing economy where the financial industry is inconsistent development and evolution phase and exposed to various risk challenges. Moreover, in Pakistan mainly explored risk areas are credit and default risk, whereas banks face numerous risks including but not limited to exchange rate, equity prices, liquidity, operational, and reputational risk, etc. It is not another proxy of credit and default risk but a unified bank risk measure capturing the entire range of all diversifiable risks. Furthermore, the modeling aspect is another contribution using Nested Tested Modeling. Based on an earlier extensive discussion of banking risk structure, the following are the research questions:

- (i) How bank-level factors influence bank risk behavior?
- (ii) Whether corporate governance practices efficaciously influence bank risk level?
- (iii) Whether and how industry-level parameters affect bank risk structure?
- (iv) What is the preferred model that best explains bank risk behavior?

In the remaining paper, section two presents reviews of literature. Section three offers methodological aspects of research. Section four describes the results and section five concludes the study.

## 2. Literature review

### 2.1. Bank specific prospect

Banking is a conspicuous channel supporting economic development (Levine, 2005). Bank specific factors are the primary elements determining bank risk management efficiency to seamlessly carry out their intermediary role (Shijaku & Ismajli, 2017). Therefore, to enhance the risk

management landscape, the study comprehends bank-level variables. Bank specific variables encompass short-term advances, bank investment in private equity instruments, and investments in government debt securities. Short-term bank advances figure out advances maturity panorama. On account of the uncertain nature, empirical evidence advises close monitoring of short-term advances maturing in 1 year. Classification of bank advances based on maturity profiles into short and long-term loans and thorough analysis apprised stringent monitoring of short-term loans maturing within a year to dissuade bank credit risk. These loans fail to offer sufficient time for loan restructuring and recovery efforts, ultimately resulting in credit risk aggravation (Jiménez & Saurina, 2002). Kuvíková (2015) also insinuates that banks discourage risky borrowers to obtain short-term loans on grounds of their inability to combat financial dilemmas during a short period of time; contrary to long-tenured loans, offering adequate time to settle down the financial impediments. On the other hand, Ozsoz et al. (2014) pronounced banks' lower equity returns volatility by virtue of short-term bank loans. The plausible reason for the inverted relationship is the cautious approach of banks to align short-term advances with short-term deposits to avoid maturity mismatch.

Bank investments are the key component of total assets and can broadly be categorized into private equity scripts and government debt securities. With regard to equity investments, Park (2000) analyzed the risk repercussions of banks' equity investments. The study concluded that in the wake of equity stake, banks encourage firms to embark on risky ventures; that eventually amplify bank risk. Likewise, in the case of large equity holding by banks; firms force banks to finance their risky projects at expense of debt holders. Along the same lines, Lepetit and Strobel (2013) apprised higher bank activity and insolvency risk surfacing from equity investments. Banks holding higher stakes drive the firms to undertake excessive risk in the eagerness of higher return and superfluous risk-taking by firms inevitably leads to bank risk escalation.

Sleuthing banks' investment in government debt securities is equally essential as their participation in equity instruments. In this regard; Buch et al. (2016) documented the existence of a nexus between banks' government bond holding and bank risk structure. More importantly, the study submits the adversative influence of government bond holdings on bank credit and default risk from the German financial market which remained unaffected from sovereign debt crises. Likewise, D'Erasmus et al. (2019) also unveiled the common misconception regarding risk-free nature of government debt securities. These findings identified that the dual role of government as borrower and regulator overlooks the risk drivers, which adversely affect banking stability and risk landscape. The study underscored several evidence of Russian run-up and Eurozone crises where sovereign debt crises ultimately led to banking crises. Based on earlier discussed literature support, the following hypothesis is formulated for bank-level factors.

*H<sub>1</sub>: Bank level factors significantly affect bank risk framework.*

## **2.2. Risk governance**

The corporate governance system carries colossal implications for the endurance of banking companies, as banks carry high leverage in the form of deposits. Corporate governance is a prodigious domain; however, the governance landscape of the present investigation carves out the role of board attendance, board meeting frequency, and a number of board monitoring committees in disciplining bank risk behavior. Empirical evidences on the capacity of board monitoring committees predominantly contemplated performance implications leaving the risk domain unattended (Ammari et al., 2016; Shungu et al., 2014). The scant literature support concerning the nexus of board monitoring committees and bank risk-taking underpinned the need to look into this precinct. In this connection, Ibiam and Chinedu (2017) manifest the negative relationship of a number of board committees with liquidity risk.



Board attendance embodies the active participation of directors in board meetings to render policy decisions ensuring corporate stability and shielding rights of all stakeholders. Rose (2016) recognized the effect of governance system incapacity over bank credit risk. Inadequacy of governance system represented by attendance of directors and lack of expertise aggravated bank risk position. Similarly, conferring evidence from the developing Indian market, Amos Layola et al. (2016) notified that directors' sporadic participation in board meetings descended the board efficiency, causing credit risk aggravation. Moving forward; gauging the efficacy of directors Honey et al. (2019) explored credit risk dynamics of Pakistani banks in response to board attendance. The findings failed to substantiate any relationship between board attendance and credit risk. The extant literature articulated the relationship of board attendance with credit risk, which cannot adequately capture a diverse range of risks challenging the banking stability. Therefore, this study apprehends bank risk through unified risk measures of standalone, total, and asset return risk.

Board meeting frequency is equally important for bank stability as important are earlier discussed two parameters. Frequent board meetings assist in timely act upon the issues faced by the business. Felício et al. (2018) assessed the relationship of corporate governance practices, including board meeting frequency with the systematic and idiosyncratic risk of European banks, during financial crises. The findings figured out the significant positive influence of board meeting frequency over systematic risk. Frequent board interaction aligned shareholders' and managers' interest. Resultantly, banks took the excessive risk to maximize the benefit of both stakeholders. However, board meeting frequency remained failed to explain the diversifiable idiosyncratic risk. Similarly, on risk governance nexus, Calomiris and Carlson (2016) examined whether formal governance structure estimated through frequent board meetings and outside directorship contributes to restricting default risk or alternatively managerial ownership alleviates bank risk framework. The findings corroborate the lower default risk of banks holding a higher managerial stakes, weighted against banks acquainted with formal governance structure. Contrary to earlier evidence, Battaglia and Gallo (2017) narrated the benevolent role of board meeting frequency in abbreviating bank systemic risk. The study advised the proactive rather than the reactive role of directors to restrain the risk-taking behavior. Empirical evidence served valuable insights; however, these studies fail to terminate on a conclusive note. There is a need to comprehend a unified measure of all diversifiable bank risks, as these risks are controllable in contrast to risks that fall beyond the controlling bounds of banks. Taking into account empirical evidences on risk governance, the following hypothesis is formulated for corporate governance practices.

*H<sub>2</sub>: Corporate governance practices significantly influence banks risk level.*

### **2.3. Industry dynamics**

It is essential to explore that the sector's nature is affecting the banking risk landscape as sector characteristics act as drivers of firm dynamic capabilities (Van Uden et al., 2015). Banking industry dimensions included in the preview of this study are the level of concentration, industry munificence, and dynamism. Concentration signifies size distribution of firms; dynamism refers to environmental unpredictability and munificence denotes the ability of the environment to maintain persistent growth (Curry & George, 1983; Dess & Beard, 1984; Heavey et al., 2009). The empirical confirmations concerning the role of munificence and dynamism principally concentrate on performance implications and capital structure decisions (Carvalho et al., 2016; Haron, 2018; Okeyo, 2014; Simerly & Li, 2000). However, sparse studies on the association of industry dynamics with bank risk and stability include Mirzaei et al. (2016) investigation affirming the significant negative effect of munificence and dynamism on default probability. Munificence validates the helping hand of growth-oriented environment to flourish the firms, which eventually abbreviate default probability. Conceivable grounds for the detrimental influence of dynamism are lower leverage of firms during environmental incertitude. The environmental

uncertainty and turbulence is largely believed to be had pernicious effects on performance, yet there exists room for finding reasons for this phenomenon. In this regard, Boyne and Meier (2009) advise that firms suffer more from turbulence during attempts to translate structural changes in response to environmental uncertainty. Thus, structural stability assists to vanquish the deleterious effects of a turbulent environment. Whereas the level of concentration failed to explicate default probability. Going forward, Shijaku and Ismajli (2017) supporting the concentration fragility viewpoint advises pernicious outcomes of concentration level on banking stability. The nexus embraces the occurrence of systemic banking instability as a result of the concentrated banking market. Devotedly aiming to bank risk landscape, Hanif et al. (2019) attribute diminution of systemic risk in pursuant of the munificent banking environment. The amplification of the banking business expands the value of banks and to preserve that value; banks undertake fewer risks. Moreover, supporting the concentration stability viewpoint, a higher concentration level also attenuates systemic risk, whereas dynamism escalates systemic risk due to agitating environment. Empirical evidences on the effect of banks' concentration level over bank risk-taking remain indecisive and depending upon the dynamics of the financial market development stage, either support concentration stability or concentration fragility viewpoint (Ali et al., 2018; Karkowska & Pawłowska, 2017; Vardar, 2015). Based upon literature support, the following hypothesis is formulated:

*H<sub>3</sub>: Industry specific factors significantly influence bank risk structure.*

The aforesaid theoretical framework outlines quintessence of conceptual scheme, and in order to proceed for empirical verification, the subsequent section puts forward methodological aspect.

### **3. Research design**

#### **3.1. Data and data sources**

The study employs unbalanced data of 270-panel observations of all 20 listed banks on the Pakistan Stock Exchange (PSX) from FY2004 to FY2018. These banks include 18 conventional and two Islamic banks. Due to the fewer number of Islamic banks; a separate panel is not created, as it would create generalization and robustness issues. Although there are few other Islamic banks in Pakistan, due to the non-listed status of those banks on the Pakistan Stock Exchange, those banks could not be included in the sample, as share price data are needed for the calculation of bank risk measures. Due to earlier discussed data limitations, a number of observations could not be further stretched.

Data on bank-level financial variables and corporate governance practices are collected on an annual frequency from financial statements of banks. Moreover, industry-level variables are authors' computation employing data from financial statements. Dependent variables are figured out on an annual frequency using daily stock price data from PSX and financial statements. The research uses a fundamental approach against applied and the research design is empirical in nature as against conceptual.

#### **3.2. Variable measurements**

Bank risk contributing factors are divided into three broad categories; namely, bank-level financial factors, corporate governance practices, and industry level factors. The variable formulation supported is furnished in Table 1.

Bank risk is gauged through the instrumentation of three proxies; namely, standalone risk, total risk, and asset return risk. Standalone risk grasps diversifiable risks and total risk denotes the entire range of diversifiable and nondiversifiable risks faced by banks. ARR being a hybrid measure of bank risk combines accounting and market data to arrive at risk faced by bank equity holders.



**Table 1. Variable formulation**

Variable	Measurement	Empirical Evidence
Bank level Financial Factors		
Short Term Advances (STA)	Short Term Advances/Total Advances	Rajan and Dhal (2003), Constant and Ngomsi (2012), Cortina et al. (2018)
Private Securities Investments (PSI)	Private Securities Investments/Total Assets	Gonzalez (2005), Egesa et al. (2015), Adhegaonkar (2015)
Govt. Securities Investments (GSI)	Government Securities Investments/Total Assets	Buch et al. (2016), Egesa et al. (2015)
Corporate Governance Practices		
Board Attendance (ATN)	Sum of meetings attended by all directors/(Board members* meeting frequency)	Bhatt and Bhattacharya (2015), Chou and Buchdadi (2017)
Board Committees (COM)	Total Number of Board Committees	Baccouche et al. (2014), Chen and Wu (2016)
Meeting Frequency (FRQ)	Number of board meeting conducted during one financial year	Bhatt and Bhattacharya (2015), Felicio et al. (2018)
Industry Level Factors		
Level of Concentration (CON)	HH Index: $\sum_{i=1}^n MS_i^2$ . MS represents market share of advances	Jumono et al. (2017), Yuanita (2019)
Industry Munificence (MUN)	Regress time against revenues of industry over period of study and take ratio of regression gradient coefficient to average revenues over same period	Keramati et al. (2012), Sun and Cui (2015), Kayo and Kimura (2011), Hanif et al. (2019)
Dynamism (DYN)	Standard errors of munificent slope coefficient divided by average banking industry revenues	Keramati et al. (2012), Kayo and Kimura (2011), Hanif et al. (2019)
Bank Risk Measures		
Standalone Risk (SAR)	$Rit = \alpha it + \beta RMt + \epsilon it$ . RM represents market return of KSE100 index. Standalone risk is standard deviation of $\epsilon it$	Anderson and Fraser (2000), Konishi and Yasuda (2004), Haq et al. (2014), Strobl (2016)
Total Risk (TR)	Standard deviation of $(P_t/P_{t-1}-1)$	Felicio et al. (2018)
Asset Return Risk (ARR)	$(SD.(P_t/P_{t-1}-1))*(\text{Market value of equity}/\text{Book value of assets})*(\sqrt{250})$	Pathan (2009), Mathew et al. (2016)

Presents variable proxies together with their empirical support.

Among bank's sources of funding, customer deposits enjoy support through deposit insurance mechanism and central bank sustenance, whereas equity holders are deprived of these precautionary measures; therefore, it is essential to distinctly analyze the risk challenges of equity holders.

### 3.3. Statistical analysis and econometric modeling

The study performs diagnostic tests of descriptive analysis, correlation matrix, and unit root tests to verify data health and reliability. Post-estimation tests include White's heteroscedasticity and Durbin Watson Autocorrelation test. In order to test the hypothesis, Pooled OLS is compared with Random Effect (RE) using Bruesh & Pagan LM test and then Pooled OLS is compared with Fixed Effect (FE) using the F test. If this examination recommends RE and FE, then the Hausman Test selects a suitable econometric model (Park, 2000). Furthermore, one step GMM is also performed to analyze the influence of historical risk values over banking risk

structure and to identify the dynamic nature of the relationship. Equation 1 presents an integrated model of the study:

$$BR_{it} = \alpha_0 + \alpha_1(STA_{it}) + \alpha_2(PSI_{it}) + \alpha_3(GSI_{it}) + \alpha_4(ATN_{it}) + \alpha_5(COM_{it}) + \alpha_6(FRQ_{it}) + \alpha_7(CON_t) + \alpha_8(MUN_t) + \alpha_9(DYN_t) + \varepsilon_{it} \quad (1)$$

BR denotes bank risk, to be gauged through standalone risk (SAR), total risk (TR), and asset return risk (ARR). Explanatory variables include short-term advances (STA), private security investments (PSI), government security investments (GSI), board attendance (ATN), board committees (COM), level of concentration (CON), munificence (MUN), and dynamism (DYN).

The study uses a unique Nested Tested Modeling Technique (NTMT), also referred to as hierarchical or multilevel modeling. It handles data structured at multiple levels and multiplex variables are combined through aggregation (Hox et al., 2010). The variables nested at different levels are joined to decipher their relative significance, the reason being that higher-level variables of industry and country-level directly or indirectly affects lower-level variables (Bilal et al., 2014; De Jong et al., 2008; Kayo & Kimura, 2011). Outcomes of the study not only discover the relative significance of variables but also recommend a preferred model that best explains the bank risk landscape. Model Equations 2-4 explain Nested Tested Models:

$$BR_{it} = \beta_0 + \beta_1(STA_{it}) + \beta_2(PSI_{it}) + \beta_3(GSI_{it}) + \beta_4(ATN_{it}) + \beta_5(COM_{it}) + \beta_6(FRQ_{it}) + \varepsilon_{it} \quad (2)$$

$$BR_{it} = \gamma_0 + \gamma_1(STA_{it}) + \gamma_2(PSI_{it}) + \gamma_3(GSI_{it}) + \gamma_4(CON_t) + \gamma_5(MUN_t) + \gamma_6(DYN_t) + \varepsilon_{it} \quad (3)$$

$$BR_{it} = \delta_0 + \delta_1(ATN_{it}) + \delta_2(COM_{it}) + \delta_3(FRQ_{it}) + \delta_4(CON_t) + \delta_5(MUN_t) + \delta_6(DYN_t) + \varepsilon_{it} \quad (4)$$

Model Equation 2 combine bank-level financial variables and corporate governance practices. Model Equation 3 coalesces bank-level financial and industry level variables. Model Equation 4 pools corporate governance practices and industry level variables. Nested Tested Modeling not only analyzes the relative significance of variables but also suggests a preferred model to best describe the banking risk framework using Akaike (AIC) and Hannan–Quinn Information Criterion (HQC).

## 4. Results and discussion

### 4.1. Descriptive statistics

Table 2 encompasses descriptive statistics depicts that on average banks' two-third advances are short-tenured having a maturity of less than 1 year. Banks' investments in government debt securities as a ratio of total assets hover around 30%, whereas average investments in private equity securities are merely 5%, suggesting that banks prefer to invest in low-risk sovereign instruments. The governance mechanism depicts a healthy average board attendance ratio of 85%. Moreover, banks have on average three board monitoring committees, and an average board meeting frequency of six times is an emblem of regular interaction between directors and shareholders. Moving to industry dynamics, a concentration level of 0.064 specifies a monopolistic situation, whereas other industry-level parameters and bank risk measures require further investigation to have the discernible nature of variables.

### 4.2. Correlation matrix

Table 3(a) presents statistics on the correlation matrix among variables. The significant correlation of bank risk measures with independent variables articulates the existence of the relationship. According to Gujarati (2009), a correlation of above 0.80 among explanatory variables creates a multicollinearity problem. The correlation of −0.797 between concentration and munificence is highest among all pairs, which is opposite in direction, and falls within the permissible spectrum.

**Table 2. Descriptive statistics**

Variable	Mean	Std.Dev.	Min	Max
Short Term Advances (STA)	0.674	0.132	0.241	0.981
Private Securities Investments (PSI)	0.047	0.037	0.000	0.267
Govt. Securities Investments (GSI)	0.300	0.140	0.006	0.662
Board Attendance (ATN)	0.858	0.101	0.451	1.000
Board Committees (COM)	3.385	1.667	1.000	8.000
Meeting Frequency (FRQ)	6.507	2.375	4.000	17.000
Level of Concentration (CON)	0.064	0.010	0.051	0.090
Industry Munificence (MUN)	0.120	0.082	-0.023	0.256
Dynamism (DYN)	0.021	0.013	0.009	0.058
Standalone Risk (SAR)	0.048	0.020	0.021	0.126
Total Risk (TR)	0.058	0.022	0.024	0.138
Asset Return Risk (TR)	0.099	0.092	0.001	0.737

Contains descriptive statistics of variables.

Moreover, Variance Inflation Factor (VIF) in Table A6 as appendix F also indicates that VIF statistics for all explanatory variables is less than five, which is the maximum acceptable ceiling level (Gujarati, 2009). Thus, VIF also validates the nonexistence of the multicollinearity problem.

#### 4.3. Data stationarity

Table A1 in Appendix A represents data stationarity results. Augmented Dicky Fuller-Fisher Chi-Square panel unit root test examines the consistency of statistical properties of data over time. The data statistics together with relevant properties describe data stationarity at the level.

#### 4.4. Bank risk assessment using

The study performs the F test and Bruesh & Pagan LM test to compare Fixed Effect (FE) and Random Effect (RE) with Pooled OLS panel estimator. These tests acclaim either random or fixed effect, thereafter Hausman arrives at a suitable econometric technique. Feasible Generalized Least Square and Autoregressive models address the heteroscedasticity and autocorrelation challenges. Table A2 in Appendix B offers model selection details.

##### 4.4.1. Standalone risk estimation

**Table 4.1** estimation of standalone risk (SAR) using an integrated model and Nested Tested Modeling Technique. Short-term advances exhibit a significant positive effect over bank SAR in an integrated model, whereas the relationship proves insignificant in nested models. A positive relationship is well aligned with earlier studies suggesting that short-term advances aggravate bank risk on account of weak security structure and fewer time to restructure the loan (Rajan & Dhal, 2003). Moreover, in line with empirical evidences, private security investments escalate bank risk framework due to the volatile nature of the Pakistani stock market, whereas government debt security investments attenuate banking risk on account of sovereign backing (Buch et al., 2016;

**Table 3. (a) Pairwise correlations**

	STA	PSI	GSI	ATN	COM	FRQ	CON	MUN	DYN	SAR	TR	ARR
STA	1.000											
PSI	-0.166 ***	1.000										
GSI	0.154 **	-0.330 ***	1.000									
ATN	-0.018	-0.159 ***	0.288 ***	1.000								
COM	-0.157 ***	-0.137 **	0.227 ***	0.131 **	1.000							
FRQ	-0.247 ***	-0.017	0.003	-0.121 **	0.141 **	1.000						
CON	-0.040	-0.221 ***	-0.112 *	0.035	-0.004	-0.055	1.000					
MUN	-0.023	0.384 ***	-0.151 **	-0.051	-0.077	0.048	-0.797 ***	1.000				
DYN	-0.042	0.257 ***	-0.394 ***	-0.198 ***	-0.158 ***	-0.039	0.147 **	0.025	1.000			
SAR	0.067	0.160 ***	-0.233 ***	-0.265 ***	-0.272 ***	0.042	-0.124 **	0.206 ***	0.001	1.000		
TR	0.041	0.264 ***	-0.375 ***	-0.288 ***	-0.233 ***	0.089	-0.161 ***	0.343 ***	0.126 **	0.897 ***	1.000	
ARR	0.044	0.266 ***	-0.298 ***	-0.204 ***	-0.149 ***	-0.098	0.099	-0.044	0.492 ***	0.277 ***	0.359 ***	1.000

Presents correlations among all variables. Variables include short term advances (STA), private securities investments (PSI), government securities investments (GSI), board attendance (ATN), board committees (COM), meeting frequency (FRQ), level of concentration (CON), munificence (MUN), dynamism (DYN), standalone risk (SAR), total risk (TR) and asset return risk (ARR).  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

**Table 4.1 Standalone Risk estimation using random/fixed effect**

Variable	INTEG	M1: BLF + BLG	M2: BLF + IND	M3:BLG + IND
Short Term Advances	0.075* (0.044)	0.066 (0.047)	0.069 (0.050)	-
Pvt. Securities Investment	0.701*** (0.153)	.548*** (0.154)	0.850*** (0.159)	-
Govt. Securities Investment	-0.112*** (0.042)	-0.159*** (0.041)	-0.167*** (0.041)	-
Board Attendance	-0.045 (0.051)	-0.103* (0.056)	-	-0.095* (0.052)
Monitoring Committees	-0.007** (0.003)	-0.007** (0.003)	-	-0.011*** (0.003)
Meeting Frequency	-0.0003 (0.002)	-0.002 (0.002)	-	-0.001 (0.002)
Level of Concentration	-1.612** (0.761)	-	-1.974*** (0.765)	-0.692 (0.741)
Munificence	-0.384*** (0.095)	-	-0.450*** (0.096)	-0.154* (0.088)
Dynamism	2.593*** (0.352)	-	2.568*** (0.350)	3.182*** (0.355)
Model	RE	RE	FE	RE
R-Squared	0.291	0.146	0.283	0.250
F-Statistic	-	-	32.050	-
Wald Chi Sq.	135.760	78.780	-	135.760
P-Value	0.000	0.000	0.000	0.000

Table 4.1 presents Standalone Risk estimation of model equations 1, 2, 3 and 4. Equation 1 represents integrated model (INTEG) combining all variables, whereas equation 2, 3 and 4 represent Nested Tested Modeling Technique (NTMT). NTMT comprises of three models, where M1: BLF+BLG combines bank level and governance variables, M2: BLF+ IND pools bank and industry level variables and M3: BLG+IND groups governance and industry level variables. Parenthesis contain standard errors. RE and FE denote random effect and fixed effect respectively. \*\*\* p<0.01, \*\*p<0.05, \* p<0.10.

**Table 4.2 Total Risk estimation using random/fixed effect**

Variable	INTEG	M1:BLF + BLG	M2:BLF + IND	M3:BLG + IND
Short Term Advances	0.031*** (0.011)	0.031*** (0.011)	0.038*** (0.013)	-
Pvt. Securities Investment	0.073* (0.039)	0.141*** (0.036)	0.111*** (0.042)	-
Govt. Securities Investment	-0.036*** (0.010)	-0.043*** (0.009)	-0.046*** (0.011)	-
Board Attendance	-0.035*** (0.013)	-0.028** (0.013)	-	-0.047*** (0.014)
Monitoring Committees	-0.001** (0.001)	-0.001** (0.001)	-	-0.003*** (0.001)
Meeting Frequency	0.001* (0.001)	0.001** (0.001)	-	0.001 (0.001)
Level of Concentration	0.448** (0.199)	-	0.405** (0.204)	0.664*** (0.191)
Munificence	0.101*** (0.024)	-	0.091*** (0.025)	0.138*** (0.022)
Dynamism	-0.106 (0.092)	-	-0.068 (0.093)	0.017 (0.092)
Model	RE	RE	FE	FE
R-Squared	0.290	0.225	0.225	0.247
F-Statistic	-	-	17.870	14.960
Wald Chi Sq.	126.630	101.640	-	-
P-Value	0.000	0.000	0.000	0.000

Table 4.2 presents Total Risk estimation of model equations 1, 2, 3 and 4. Equation 1 represents integrated model (INTEG) combining all variables, whereas equation 2, 3 and 4 represent Nested Testing Modeling Technique (NTMT). NTMT comprises of three models, where M1: BLF+BLG combines bank level and governance variables, M2: BLF+ IND pools bank and industry level variables and M3: BLG+IND groups governance and industry level variables. Parenthesis contain standard errors. RE and FE denote random effect and fixed effect respectively.  
 \*\*\* p<0.01, \*\*p<0.05, \* p<0.10.



**Table 4.3 Asset Return Risk estimation using random/fixed effect**

Variable	INTEG	M1:BLF + BLG	M2:BLF + IND	M3:BLG + IND
Short Term Advances	0.028 (0.030)	0.076 (0.051)	0.052* (0.029)	-
Pvt. Securities Investment	0.597*** (0.130)	0.600*** (0.180)	0.650*** (0.128)	-
Govt. Securities Investment	-0.096*** (0.033)	-0.065 (0.051)	-0.114*** (0.031)	-
Board Attendance	-0.049 (0.035)	-0.064 (0.051)	-	-0.054 (0.049)
Monitoring Committees	-0.007*** (0.002)	-0.005 (0.004)	-	-0.008** (0.003)
Meeting Frequency	-0.001 (0.001)	-0.002 (0.002)	-	-0.002 (0.002)
Level of Concentration	-1.559** (0.636)	-	-1.566** (0.637)	-1.394 (0.880)
Munificence	-0.396*** (0.082)	-	-0.394*** (0.082)	-0.264** (0.110)
Dynamism	1.638*** (0.281)	-	1.719*** (0.284)	2.490*** (0.402)
Model	FGLS	AR(1)	FGLS	AR(1)
R-Squared	-	0.135	-	0.240
F-Statistic	-	-	-	-
Wald Chi Sq.	125.610	26.490	115.140	55.410
P-Value	0.000	0.000	0.000	0.000

Table 4.3 presents Asset Return Risk estimation of model equations 1, 2, 3 and 4. Equation 1 represents integrated model (INTEG) combining all variables, whereas equation 2, 3 and 4 represent Nested Tested Modeling Technique (NTMT). NTMT comprises of three models, where M1: BLF+BLG combines bank level and governance variables, M2: BLF+ IND pools bank and industry level variables and M3: BLG+IND groups governance and industry level variables. Parenthesis contain standard errors. RE and FE denote random effect and fixed effect respectively. \*\*\* p<0.01, \*\*p<0.05, \* p<0.10.

Rahman et al., 2018). These findings accept  $H_1$  suggesting that bank-level factors influence bank risk structure.

Board attendance, an important constituent of governance mechanism exhibits a weak negative relationship with standalone risk at 10% significance. The findings drive support from Gontarek (2017) suggesting risk abbreviation as a result of close monitoring through higher board attendance. Similarly, a number of board monitoring committees significantly negatively influences standalone risk. Empirical support advises bank risk diminution through dedicated monitoring of challenges posed to banking institutions (El-Chaarani, 2017). Board meeting frequency attributed an insignificant relationship with SAR. Furthermore, in accordance with Vardar (2015) findings, industry dynamics support a concentration stability standpoint which abridged the bank risk spectrum (the Vardar, 2015). Industry munificence also specifies a significant negative relationship with SAR. In line with Almazan and Molina (2005) outcomes, a munificent industry environment offers higher opportunities for banks, leading to selective choices, which ultimately abridge risk level. Industry dynamism significantly positively affects SAR at 1% suggesting that industry turbulence makes it harder for borrowers to meet obligations that aggravate bank risk level. The dynamism results are aligned with the findings of Chen, Zeng, Lin, and Ma (2015). These findings in general suggest acceptance of  $H_2$  and  $H_3$  signifying the influence of governance mechanism and nature of the banking industry over bank risk structure.

#### 4.4.2. Total risk estimation

The second section of Table 4.2 presents the total risk estimation employing integrated and nested models. In harmonization with Jiménez and Saurina (2002) manifestations, short-term advances significantly positively affect total risk at 1%. Weak security support and meager time slack for loan restructuring turn short-term advances perilous. Likewise, private equity security investments significantly positively affect total risk at 1%. Earlier studies advised that Pakistani equity market volatility and risky dynamics adversely affect banks, which aggravates risk position (Geyfman & Yeager, 2009; Ghufuran et al., 2016). Consistent with research outcomes, government security investments significantly negatively affect total risk at 1%. It is worth noting that findings of bank-level factors for the total risk (TR) are consistent with standalone risk (SAR) and accept the  $H_1$  proposing influence of bank-level factors over bank risk-taking behavior.

Moving to governance mechanism; board attendance and a number of board monitoring committees scale down the total risk. These findings corroborate with standalone risk results and besides it, board attendance significance level ameliorates to 1% from 10% for SAR. Moreover, board meeting frequency substantially positively affects total risk. Frequent board interaction is generally assumed to restrict bank risk-taking behavior; however, as underlined by Felício et al. (2018), frequent board meetings align shareholders' and managers' interests, resultantly banks take excessive risk. Thus, governance factors advise acceptance of  $H_2$ .

Industry-level parameters, the third stratum of the hierarchical model supports concentration fragility theory; therefore, industry concentration level significantly positively affects total risk. On account of market, concentration banks acquire market power and charge a higher markup, resulting from loan defaults and bank total risk escalation (Fu et al., 2014; Pawlowska, 2016). Similarly, munificence also exacerbates the total risk at 1%. Moreover, elucidating munificence and bank risk nexus; Ghosh (2010) identifies that during accelerated industrial pace banks aggressively advance and compromises on credit quality aggravate bank risk structure. Industry dynamism remains inefficacious to explain bank total risk. In general findings of industry-level factors accept  $H_3$  and conclude that the nature of banking sectors plays a key role in shaping banking risk behavior. Concentration and munificence abridge standalone risk, whereas escalating total risk. Total risk comprehends the entire range of diversifiable and nondiversifiable risks; therefore, findings of total risk contradict with standalone risk.

#### 4.4.3. Asset return risk estimation

The third section of Table 4.3 characterizes results of risk faced by equity holders, i.e., asset return risk (ARR). Short-term advances report a positive, however weak relationship with ARR at 10%. Moreover, investments in private equity security scale-up bank risk, whereas investments in government debt security limit bank risk-taking. These outcomes are empirically aligned and also corroborate with SAR and TR estimation (Buch et al., 2016; Jiménez & Saurina, 2002; Rahman et al., 2018). Furthermore, the governance mechanism depicts the insignificant relationship between board attendance and board meeting frequency with ARR. However, a number of board monitoring committees significantly negatively affects ARR and abridge equity holder interest.

Industry insights apprise asset return risk abbreviation as an upshot of industry concentration, which corroborates with advocates of concentration stability theory (Karkowska & Pawłowska, 2017; Uhde & Heimeshoff, 2009). Likewise, in conformity with Hanif et al. (2019), industry munificence level also significantly negatively affects ARR at 1%. Industry munificence tenders a higher set of opportunities for banks, resulting in selective loaning to restrict bank risk level. Furthermore, industry dynamism significantly positively affects ARR at 1%, advising equity holders' risk escalation, due to disruptions in an industrial environment. Findings of bank-level, corporate governance, and industry-specific factors for asset return risk accept all three hypotheses. Differences in risk implications of ARR and TR signify considerable disparities in risk posed to equity holders and overall fund providers, especially industry dynamics favorably affect ARR and SAR, whereas adversely to TR. Thus, as concentration and industry munificence rises, the risk of equity holders reduces and depositors' money is put at stake.

#### 4.5. Bank risk estimation using SGMM1

Table 4(a) represents one step System Generalized Method of Moments estimations. Some literature from advanced economies pinpoints that previous year risk affects the subsequent year risk, justifying the dynamic relationship (Jabra et al., 2017; Trenca et al., 2015). Thus, to verify the dynamic nature of banking risk structure, the study also employs SGMM. The findings of all three bank risk measures reported in Table 4(a) pinpoint the nonexistence of dynamic relationship, as the lagged value of bank risk measures are not significantly affecting respective bank risk measures. The post-estimation statistics AR(2), Sargan and Hansen statistics are supporting model validity. The possible reason for insignificant coefficients of explanatory variables can be attributed to the nonexistence of dynamic behaviors.

#### 4.6. Key findings

Banks' investments in private equity securities escalate bank risk structure, whereas government debt security investments scale down the bank risk landscape. Short-term advances aggravate total risk (TR), however prove ineffective to explain standalone (SAR) and asset return risk (ARR). Board committees truncate bank risk-taking behavior and board attendance only lowers SAR and TR. Moreover, board meeting frequency exacerbates TR, while it fails to explain SAR and ARR. Finally, industry level parameters, concentration level, and munificence significantly negatively affect standalone and asset return risk, whereas total risk deteriorates from market concentration and munificence. Furthermore, industry dynamism causes to surge standalone and total risk.

Nested Tested Modeling Technique specifies that from bank-level parameters, a significance level of private security investment upgrades from 10% to 1% in model M1, and M2 of total risk. In the governance aspect, board attendance turns from insignificant in an integrated model to 10% significant in model M1 and M3 of standalone risk. The significance level of board committee upgrades from 5% to 1% in model M3 of standalone and total risk. Moreover, board meeting frequency observed improvement from 10% to 1% in model M1 of total risk. Similarly, a significance level of industrial concentration upsurges from 5% to 1% in model M2 of standalone and model M3 of total risk. However, NTMT remains futile to ameliorate asset return risk. Akaike Information Criterion (AIC) and Hannan–Quinn Information Criterion (HQC) selects the preferred model that best explains bank risk-taking behavior. The particulars of AIC and HQ are provided in Appendix E. The model comparison tests advise M2 as an optimum model for standalone and total risk, whereas M3 turns up appropriate for asset return risk explanation.

## 5. Conclusion

Intimate knowledge of risk contributing factors facilitates risk diversification. Therefore, the study explores the effect of bank-level factors, governance mechanism, and industry dynamics over bank risk structure. The findings from bank-level factors advise that investments of banks in private equity securities and short-term advances aggravate banking risk due to the risky nature of the Pakistani stock market and feeble security support, respectively. Whereas investments in government debt securities abbreviate bank risk-taking behavior on account of sovereign support. In order to strengthen banking stability, the regulator should further restrict investment ceilings in equity scripts and security support guidelines for short-term advances also need to be improved.

Together with financial regulations, governance mechanism is the most emphasized area of local and international regulatory bodies. The study pinpoints that board monitoring committees and attendance abridge banking risk through dedicated monitoring of challenges faced by the banking companies. Moreover, surprisingly frequent board meetings intensify the total risk by aligning interests of shareholders and managers. In order to ameliorate risk governance, Prudential Regulations (PRs) for banking companies by State Bank of Pakistan should increase board minimum attendance requirement and stipulate the minimum number of board monitoring committees.

One of the least explored areas, industry dynamics reveals that concentration and munificence scale down standalone and asset return risk. The rise in concentration level enables banks to reap higher margins, which strengthen financial standing; thereby curtailing risk level. However, total risk augments from market concentration and industrial dynamism also adversely affects bank risk behavior. The policymakers and regulators should offer a conducive environment to reduce the fragility of the banking system. The novel contribution of Nested Tested Modeling specifies that private security investments, board attendance, board committees, meeting frequency, and concentration level are the most influential risk explanatory factors. In brief, to enhance the endurance of the banking system, regulatory authorities, national policymakers and the board of directors should rationalize these insights to devise risk mitigation strategies.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author Sabtain, upon reasonable request.

## Disclosure statement

In accordance with Taylor & Francis's policy and our ethical obligation as researchers, there is no potential conflict of interest in our research.

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## References

- Adhegaonkar, V. R. (2015). Long run determinants of investment portfolios in commercial banks: Comparative analysis of Indian scheduled commercial banks. *Chanakya International Journal of Business Research*, 1(2), 89–94. <https://www.semanticscholar.org/paper/Long-Run-Determinants-of-Investment-Portfolios-in-Adhegaonkar/544a19fd05b4ba41f1f35023f978e1436d5efd6d>
- Ahmed, M. B. (2018). KASB Bank Limited: Capital shortage. *Asian Journal of Management Cases*, 15(1), 1–22. <https://doi.org/10.1177/0972820117744685>
- Ali, M. S. B., Intissar, T., & Zeitun, R. (2018). Banking concentration and financial stability. New evidence from developed and developing countries. *Eastern Economic Journal*, 44(1), 117–134. <https://doi.org/10.1057/eej.2016.8>
- Allen, F., Carletti, E., Goldstein, I., & Leonello, A. (2015). Moral hazard and government guarantees in the banking industry. *Journal of Financial Regulation*, 1(1), 30–50. <https://doi.org/10.1093/jfr/fju003>
- Almazan, A., & Molina, C. A. (2005). Intra-industry capital structure dispersion. *Journal of Economics & Management Strategy*, 14(2), 263–297. <https://doi.org/10.1111/j.1530-9134.2005.00042.x>
- Ammari, A., Amdouni, S., Zemzem, A., & Ellouze, A. (2016). The effect of monitoring committees on the relationship between board structure and firm performance. *Journal of Risk and Financial Management*, 9(4), 14. <https://doi.org/10.3390/jrfm9040014>
- Amos Layola, M., Sophia, S., & Anita, M. (2016). Effect of corporate governance on loan loss provision in

- Indian public banks. *Amity Journal of Corporate Governance*, 1(1), 1–15. <https://amity.edu/UserFiles/admaa/183Paper%201.pdf>
- Anderson, R. C., & Fraser, D. R. (2000). Corporate control, bank risk taking, and the health of the banking industry. *Journal of Banking & Finance*, 24(8), 1383–1398. [https://doi.org/10.1016/S0378-4266\(99\)00088-6](https://doi.org/10.1016/S0378-4266(99)00088-6)
- Anginer, D., & Demircuc-Kunt, A. (2018). Bank runs and moral hazard: A review of deposit insurance. *WBG Working Paper No. 8589*. <https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-8589>
- Ashraf, B. N., Arshad, S., & Yan, L. (2017). Trade openness and bank risk-taking behavior: Evidence from emerging economies. *Journal of Risk and Financial Management*, 10(3), 15. <https://doi.org/10.3390/jrfm10030015>
- Atinc, G., & Ocal, Y. (2014). The moderating effect of organizational environment on Post-IPO corporate governance changes and firm performance relationship. *Journal of Leadership & Organizational Studies*, 21(3), 286–298. <https://doi.org/10.1177/1548051814529824>
- Baccouche, S., Hadriche, M., & Omri, A. (2014). Multiple directorships and board meeting frequency: Evidence from France. *Applied Financial Economics*, 24(14), 983–992. <https://doi.org/10.1080/09603107.2014.920475>
- Basel Committee on Banking Supervision. (2011). Messages from the academic literature on risk measurement for the trading book. *BCBS Working Paper No. 19*. [https://www.bis.org/publ/bcbs\\_wp19.pdf](https://www.bis.org/publ/bcbs_wp19.pdf)
- Battaglia, F., & Gallo, A. (2017). Strong boards, ownership concentration and EU banks' systemic risk-taking: Evidence from the financial crisis. *Journal of International Financial Markets, Institutions and Money*, 46(1), 128–146. <https://doi.org/10.1016/j.intfin.2016.08.002>
- Bhatt, R. R., & Bhattacharya, S. (2015). Board structure and firm performance in Indian IT firms. *Journal of Advances in Management Research*, 12(3), 232–248. <https://doi.org/10.1108/JAMR-07-2014-0042>
- Bilal, A. R., Ramakrishnan, S., Naveed, M., Abu Talib, N. B., Anuar, M. A., & Khan, M. N. A. A. (2014). Effects of internal and environmental factors on firm's financial behavior: A comparative study of developed, emerging and developing economies. *World Applied Sciences Journal*, 30(10), 1283–1293. [https://www.idosi.org/wasj/wasj30\(10\)14/15.pdf](https://www.idosi.org/wasj/wasj30(10)14/15.pdf)
- Billio, M., Getmansky, M., Lo, A. W., & Pelizzon, L. (2012). Econometric measures of connectedness and systemic risk in the finance and insurance sectors. *Journal of Financial Economics*, 104(3), 535–559. <https://doi.org/10.1016/j.jfineco.2011.12.010>
- Boyd, J. H., & De Nicolo, G. (2005). The theory of bank risk taking and competition revisited. *The Journal of finance*, 60(3), 1329–1343. <https://doi.org/10.1111/j.1540-6261.2005.00763.x>
- Boyne, G. A., & Meier, K. J. (2009). Environmental turbulence, organizational stability, and public service performance. *Administration & Society*, 40(8), 799–824. <https://doi.org/10.1177/0095399708326333>
- Buch, C. M., Koetter, M., & Ohls, J. (2016). Banks and sovereign risk: A granular view. *Journal of Financial Stability*, 25(C), 1–15. <https://doi.org/10.1016/j.jfs.2016.05.002>
- Calomiris, C. W., & Carlson, M. (2016). Corporate governance and risk management at unprotected banks: National banks in the 1890s. *Journal of Financial Economics*, 119(3), 512–532. <https://doi.org/10.1016/j.jfineco.2016.01.025>
- Carvalho, C. E., Rossetto, C. R., & Verdinelli, M. A. (2016). Strategic orientation as a mediator between environmental dimensions and performance: A study of Brazilian hotels. *Journal of Hospitality Marketing & Management*, 25(7), 870–895. <https://doi.org/10.1080/19368623.2016.1130668>
- Chen, H., Zeng, S., Lin, H., & Ma, H. (2015). Munificence, Dynamism, and Complexity: How Industry Context Drives Corporate Sustainability. *Business Strategy and the Environment*, 26(2), 125–141. <https://doi.org/10.1002/bse.2017>
- Chen, K. D., & Wu, A. (2016). *The structure of board committees*. Harvard Business School.
- Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, 20(2), 249–272. [https://doi.org/10.1016/S0261-5606\(00\)00048-6](https://doi.org/10.1016/S0261-5606(00)00048-6)
- Chou, T. K., & Buchdadi, A. D. (2017). Independent board, audit committee, risk committee, the meeting attendance level and its impact on the performance: A study of listed banks in Indonesia. *International Journal of Business Administration*, 8(3), 24. <https://doi.org/10.5430/ijba.v8n3p24>
- Constant, F. D., & Ngomsa, A. (2012). Determinants of bank long-term lending behavior in the Central African Economic and Monetary Community (CEMAC). *Review of Economics & Finance*, 2(5), 107–114. <http://www.bapress.ca/Journal-7/1923-7529-2012-02-107-08.pdf>
- Cortina, J. J., Didier, T., & Schmukler, S. L. (2018). Corporate debt maturity in developing countries: Sources of long and short-termism. *The World Economy*, 41(12), 3288–3316. <https://doi.org/10.1111/twec.12632>
- Curry, B., & George, K. D. (1983). Industrial concentration: A survey. *The Journal of Industrial Economics*, 31(3), 203–255. <https://doi.org/10.2307/2097885>
- D'Erasmo, P., Livshits, I., & Schoors, K. (2019). Banking regulation with risk of sovereign default. *FRBP Working Paper No. 19-15*. <https://doi.org/10.21799/frbp.wp.2019.15>
- De Jong, A., Kabir, R., & Nguyen, T. T. (2008). Capital structure around the world: The roles of firm and country specific determinants. *Journal of Banking & Finance*, 32(9), 1954–1969. <https://doi.org/10.1016/j.jbankfin.2007.12.034>
- Dess, G. G., & Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, 29(1), 52–73. <https://doi.org/10.2307/2393080>
- Egesa, K. A., Ocaya, B. M., Atuhaire, L. K., Mwanga, Y., Makumbi, T. N., & Mugisha, X. (2015). Determinants of investment in government securities by banks in Uganda. *International Journal of Economics, Finance and Management Sciences*, 3(3), 294. <https://doi.org/10.11648/j.ijefm.20150303.26>
- El-Chaarani, H. (2017). The mutual impacts of corporate governance dimensions and legal protection systems on the performance of European banks: A post-crisis study. *European Research Studies Journal*, 20(2A), 538–567. <https://doi.org/10.35808/ersj/658>
- Felicio, J. A., Rodrigues, R., Grove, H., & Greiner, A. (2018). The influence of corporate governance on bank risk during a financial crisis. *Economic Research-Ekonomiska Istraživanja*, 31(1), 1078–1090. <https://doi.org/10.1080/1331677X.2018.1436457>
- Fu, X. M., Lin, Y. R., & Molyneux, P. (2014). Bank competition and financial stability in Asia Pacific. *Journal of Banking & Finance*, 38(1), 64–77. <https://doi.org/10.1016/j.jbankfin.2013.09.012>



- Geyfman, V., & Yeager, T. J. (2009). On the riskiness of universal banking: Evidence from banks in the investment banking business pre-and post-GLBA. *Journal of Money, Credit, and Banking*, 41(8), 1649–1669. <https://doi.org/10.1111/j.1538-4616.2009.00266.x>
- Ghosh, S. (2010). Credit growth, bank soundness and financial fragility: Evidence from Indian banking sector. *South Asia Economic Journal*, 11(1), 69–98. <https://doi.org/10.1177/139156141001100105>
- Ghufran, B., Awan, H. M., Khakwani, A. K., & Qureshi, M. A. (2016). What causes stock market volatility in Pakistan? Evidence from the field. *Economics Research International*, 26(2), 1–9. <https://doi.org/10.1155/2016/3698297>
- Gontarek, W. (2017). *Risk governance: Examining its impact upon bank performance and risk* [Doctoral dissertation]. Cranfield University.
- Gonzalez, F. (2005). Bank regulation and risk-taking incentives: An international comparison of bank risk. *Journal of Banking & Finance*, 29(5), 1153–1184. <https://doi.org/10.1016/j.jbankfin.2004.05.029>
- Gujarati, D. N. (2009). *Basic econometrics*. Tata McGraw-Hill Education.
- Hanif, H., Naveed, M., & Rehman, M. U. (2019). Dynamic modeling of systemic risk and firm value: A case of Pakistan. *Cogent Business & Management*, 6(1), 1651440. <https://doi.org/10.1080/23311975.2019.1651440>
- Haq, M., Faff, R., Seth, R., & Mohanty, S. (2014). Disciplinary tools and bank risk exposure. *Pacific-Basin Finance Journal*, 26(1), 37–64. <https://doi.org/10.1016/j.pacfin.2013.10.005>
- Haron, R. (2018). Firm level, ownership concentration and industry level determinants of capital structure in an emerging market: Indonesia evidence. *Asian Academy of Management Journal of Accounting & Finance*, 14(1), 127–151. <https://doi.org/10.21315/aamjaf2018.14.1.6>
- Heavey, C., Simsek, Z., Roche, F., & Kelly, A. (2009). Decision comprehensiveness and corporate entrepreneurship: The moderating role of managerial uncertainty preferences and environmental dynamism. *Journal of Management Studies*, 46(8), 1289–1314. <https://doi.org/10.1111/j.1467-6486.2009.00858.x>
- Honey, D., Tashfeen, R., Farid, S., & Sadiq, R. (2019). Credit risk management: Evidence of corporate governance in banks of Pakistan. *Journal of Finance and Accounting Research*, 1(1), 1–18. <https://doi.org/10.32350/JFAR.0101.01>
- Hox, J. J., Maas, C. J., & Brinkhuis, M. J. (2010). The effect of estimation method and sample size in multilevel structural equation modeling. *Statistica Neerlandica*, 64(2), 157–170. <https://doi.org/10.1111/j.1467-9574.2009.00445.x>
- Ibiam, O. A., & Chinedu, N. L. (2017). Effect of corporate governance on risk management of commercial banks in Nigeria. *International Journal of Finance and Accounting*, 6(5), 145–153. <http://article.sapub.org/10.5923.j.ijfa.20170605.03.html>
- Ijtsma, P., Spierdijk, L., & Shaffer, S. (2017). The concentration–stability controversy in banking: New evidence from the EU-25. *Journal of Financial Stability*, 33(6), 273–284. <https://doi.org/10.1016/j.jfs.2017.06.003>
- International Monetary Fund. (2019). *Global financial stability report: Vulnerabilities in a maturing credit cycle*. International Monetary Fund. <https://www.imf.org/en/Publications/GFSR/Issues/2019/03/27/Global-Financial-Stability-Report-April-2019>
- Jabra, W. B., Mighri, Z., & Mansouri, F. (2017). Determinants of European bank risk during financial crisis. *Cogent Economics & Finance*, 5(1), 1298420. <https://doi.org/10.1080/23322039.2017.1298420>
- Jiménez, G., & Saurina, J. (2002). Loan characteristics and credit risk. *Bank of Spain*, 1–34. <https://www.bis.org/bcbs/events/wkshop0303/p03jimesaur.pdf>
- Jumono, S., A., & Mala, C. M. (2017). Market Concentration Index and Performance: Evidence from Indonesian Banking Industry. *International Journal of Economics and Financial Issues*, 7(2), 249–258. <https://www.econjournals.com/index.php/ijefi/article/view/4030>
- Karkowska, R., & Pawłowska, M. (2017). *The concentration and bank stability in Central and Eastern European countries*. Narodowy Bank Polski, Education & Publishing Department.
- Kayo, E. K., & Kimura, H. (2011). Hierarchical determinants of capital structure. *Journal of Banking & Finance*, 35(2), 358–371. <https://doi.org/10.1016/j.jbankfin.2010.08.015>
- Keramati, A., Azadeh, M. A., Mehran-Gohar, M., & Afshari-Mofrad, M. (2012). Investigating the effects of information technology investment on bank performance: Considering the role of environmental dynamism and strategy. *International Journal of Applied Decision Sciences*, 5(1), 32–46. <https://doi.org/10.1504/IJADS.2012.044945>
- Kharabsheh, B. (2019). Determinants of bank credit risk: Empirical evidence from Jordanian commercial banks. *Academy of Accounting and Financial Studies Journal*, 23(3), 1–12. <https://www.abacademies.org/articles/determinants-of-bank-credit-risk-empirical-evidence-from-jordanian-commercial-banks-8197.html>
- Kirkpatrick, G. (2009). The corporate governance lessons from the financial crisis. *OECD Journal: Financial Market Trends*, 2009(1), 61–87. <https://www.oecd.org/finance/financial-markets/42229620.pdf>
- Konishi, M., & Yasuda, Y. (2004). Factors affecting bank risk taking: Evidence from Japan. *Journal of Banking & Finance*, 28(1), 215–232. [https://doi.org/10.1016/S0378-4266\(02\)00405-3](https://doi.org/10.1016/S0378-4266(02)00405-3)
- Kuviková, G. (2015). Does loan maturity matter in risk-based pricing. *CERGE-EI Working Paper Series*. p. 538.
- Lepetit, L., & Strobel, F. (2013). Bank insolvency risk and time-varying Z-score measures. *Journal of International Financial Markets, Institutions and Money*, 25(7), 73–87. <https://doi.org/10.1016/j.intfin.2013.01.004>
- Levine, (2005). *Finance and growth: Theory and evidence*, *Handbook of economic growth* (1 ed., Vol. 1, pp. 865–934). Ch 12. Elsevier.
- Luu, H. N. (2015). Corporate governance, regulation and bank risk-taking behavior in developing Asian countries. *Journal of Governance and Regulation*, 4(1–2), 201–223. [https://doi.org/10.22495/jgr\\_v4\\_i1\\_c2\\_p4](https://doi.org/10.22495/jgr_v4_i1_c2_p4)
- Martinez-Miera, D., & Repullo, R. (2010). Does Competition Reduce the Risk of Bank Failure? Review of Financial Studies, 23(10), 3638–3664. <https://doi.org/10.1093/rfs/hhq057>
- Mathew, S., Ibrahim, S., & Archbold, S. (2016). Boards attributes that increase firm risk—evidence from the UK. *Corporate Governance*, 16(2), 233–258. <https://doi.org/10.1108/CG-09-2015-0122>
- Mirzaei, M., Ramakrishnan, S., & Bekri, M. (2016). Corporate default prediction with industry effects: Evidence from emerging markets. *International Journal of Economics and Financial Issues*, 6(3S),



- 161–169. <https://www.econjournals.com/index.php/ijefi/article/view/2625/pdf>
- Moussa, F. B. (2019). The influence of internal corporate governance on bank credit risk: An empirical analysis for Tunisia. *Global Business Review*, 20(3), 640–667. <https://doi.org/10.1177/0972150919837078>
- Nisar, S., Peng, K., Wang, S., & Ashraf, B. N. (2018). The impact of revenue diversification on bank profitability and stability: Empirical evidence from south Asian countries. *International Journal of Financial Studies*, 6(2), 1–25. <https://doi.org/10.3390/ijfs6020040>
- Okeyo, W. O. (2014). The influence of business environmental dynamism, complexity and munificence on performance of small and medium enterprises in Kenya. *International Journal of Business and Social Research*, 4(8), 59–73. <https://thejournalofbusiness.org/index.php/site/article/view/587/457>
- Otero, L., Alaraj, R., & Lado-Sestayo, R. (2019). How corporate governance and ownership affect banks' risk-taking in the MENA countries? *European Journal of Management and Business Economics*, 29(2) 2444–8494. DOI:10.1108/EJMBE-01-2019-0010
- Ozsoz, E., Rengifo, E. W., & Akinkunmi, M. A. (2014). What determines return risks for bank equities in Turkey? *Borsa Istanbul Review*, 14(1), 23–31. <https://doi.org/10.1016/j.bir.2013.12.002>
- Park, S. (2000). Effects of the affiliation of banking and commerce on the firm's investment and the bank's risk. *Journal of Banking & Finance*, 24(10), 1629–1650. [https://doi.org/10.1016/S0378-4266\(99\)00099-0](https://doi.org/10.1016/S0378-4266(99)00099-0)
- Pathan, S. (2009). Strong boards, CEO power and bank risk-taking. *Journal of Banking & Finance*, 33(7), 1340–1350. <https://doi.org/10.1016/j.jbankfin.2009.02.001>
- Pawlowska, M. (2016). Does the size and market structure of the banking sector have an effect on the financial stability of the European Union? *The Journal of Economic Asymmetries*, 14(2), 112–127. <https://doi.org/10.1016/j.jeca.2016.07.009>
- Rahman, S., Rashid, A., & Ilyas, M. (2018). Returns volatility in stock market and performance of banks: Evidence from Pakistan. *Pakistan Journal of Applied Economics: Special Issue*, 389–410. <http://www.aerc.edu.pk/wp-content/uploads/2019/04/20-Paper-700-SAIF-UL-REHMAN-XX-RETURNS-VOLATILITY-IN-STOCK-MARKET-AND-PERFORMANCE-OF-BANKS-Evidence-from-Pakistan-1.pdf>
- Rajan, R., & Dhal, S. C. (2003). Non-performing loans and terms of credit of public sector banks in India: An empirical assessment. *Reserve Bank of India Occasional Papers*, 24(3), 81–121. <https://rbidocs.rbi.org.in/rdocs/publications/pdfs/60613.pdf>
- Rose, C. (2016). The relationship between corporate governance characteristics and credit risk exposure in banks: Implications for financial regulation. *European Journal of Law and Economics*, 43(1), 167–194. <https://doi.org/10.1007/s10657-016-9535-2>
- Shijaku, G., & Ismajli, H. (2017). Does concentration matter for bank stability? Evidence from the Albanian banking sector. *Journal of Central Banking Theory and Practice*, 12(4), 90–97. <https://doi.org/10.1515/jcbtp-2017-0021>
- Shungu, P., Ngirande, H., & Ndlovu, G. (2014). Impact of corporate governance on the performance of commercial banks in Zimbabwe. *Mediterranean Journal of Social Sciences*, 5(15), 93. <https://www.mcser.org/journal/index.php/mjss/article/view/3211>
- Simerly, R. L., & Li, M. (2000). Environmental dynamism, capital structure and performance: A theoretical integration and an empirical test. *Strategic Management Journal*, 21(1), 31–49. [https://doi.org/10.1002/\(SICI\)1097-0266\(200001\)21:1<31::AID-SMJ76>3.0.CO;2-T](https://doi.org/10.1002/(SICI)1097-0266(200001)21:1<31::AID-SMJ76>3.0.CO;2-T)
- State Bank of Pakistan. (2010). *Risk management guidelines for commercial banks and DFIs*. State Bank of Pakistan. <http://www.sbp.org.pk/riskmgm.pdf>
- Strobl, S. (2016). Stand-alone vs systemic risk-taking of financial institutions. *The Journal of Risk Finance*, 17(4), 374–389. <https://doi.org/10.1108/JRF-05-2016-0064>
- Sun, W., & Cui, K. (2015). Service quality, cash flow volatility, and moderating environmental factors. *Marketing Intelligence & Planning*, 33(1), 20–38. <https://doi.org/10.1108/MIP-07-2013-0123>
- Tan, Y., & Floros, C. (2014). Risk, profitability, and competition: Evidence from the Chinese banking industry. *The Journal of Developing Areas*, 48(3), 303–319. <https://doi.org/10.1353/jda.2014.0054>
- Trenca, I., Petria, N., & Corovei, E. A. (2015). Impact of macroeconomic variables upon the banking system liquidity. *Procedia Economics and Finance*, 32(2015), 1170–1177. [https://doi.org/10.1016/S2212-5671\(15\)01583-X](https://doi.org/10.1016/S2212-5671(15)01583-X)
- Uhde, A., & Heimeshoff, U. (2009). Consolidation in banking and financial stability in Europe: Empirical evidence. *Journal of Banking & Finance*, 33(7), 1299–1311. <https://doi.org/10.1016/j.jbankfin.2009.01.006>
- Van Uden, A., Knoben, J., & Vermeulen, P. A. M. (2015). Making sense of industry characteristics as drivers of dynamic capabilities. *DFID Working Paper*. Tilburg University.
- Vardar, G. (2015). Bank competition, concentration and risk-taking in the Turkish banking industry. *Journal of Business Economics and Finance*, 4(3), 536–567. <https://dergipark.org.tr/tr/download/article-file/374517>
- Yuanita, N. (2019). Competition and bank profitability. *Journal of Economic Structures*, 8(1), 31. <https://doi.org/10.1186/s40008-019-0164-0>

## Appendices

### Appendix A

**Table A1. Fisher stationarity test**

Variable	STA	PSI	GSI	ATN	COM	FRQ	CON	MUN	DYN
Inverse chi-squared P	76.242 (0.000)	109.521 (0.000)	104.044 (0.000)	160.924 (0.000)	84.199 (0.000)	178.947 (0.000)	77.074 (0.000)	81.937 (0.000)	200.318 (0.000)
Inverse normal Z	-2.612 (0.004)	-1.874 (0.030)	-6.220 (0.000)	-8.538 (0.000)	-4.134 (0.000)	-8.729 (0.000)	-3.105 (0.001)	-4.818 (0.000)	-6.8576 (0.000)
Inverse logit L	-3.081 (0.001)	-4.552 (0.000)	-6.152 (0.000)	9.714 (0.000)	-4.255 (0.000)	-10.508 (0.000)	-3.153 (0.001)	-4.596 (0.000)	-11.337 (0.000)
Modified inv. chi-squared Pm	4.052 (0.000)	7.772 (0.000)	7.1604 (0.000)	13.519 (0.000)	5.299 (0.000)	15.534 (0.000)	4.145 (0.000)	4.688 (0.000)	17.924 (0.000)

Describes stationarity results, where coefficients depict the statistics and probability is enclosed in parenthesis. All four statistics recommended by Choi (2001) for Fisher's test are presented.

### Appendix B

**Table A2. Model selection for bank risk measures**

Set of variables	F Test	Bruesh & Pagan LM Test	Hausman Test	Econometric Model
Standalone Risk(SAR) Models				
INTEGRATED	5.400 (0.000)	60.800 (0.000)	13.452 (0.143)	Random Effect
M1: BLF+BLG	5.700 (0.000)	69.610 (0.000)	2.310 (0.889)	Random Effect
M2: BLF+ IND	5.720 (0.000)	73.500 (0.000)	13.615 (0.034)	Fixed Effect
M3:BLG + IND	4.820 (0.000)	53.970 (0.000)	11.915 (0.063)	Random Effect
Total Risk (TR) Models				
INTEGRATED	4.303 (0.000)	37.089 (0.000)	15.432 (0.079)	Random Effect
M1: BLF+BLG	4.667 (0.000)	46.653 (0.000)	4.563 (0.600)	Random Effect
M2: BLF+ IND	4.628 (0.000)	45.813 (0.000)	14.828 (0.021)	Fixed Effect
M3: BLG + IND	3.541 (0.000)	26.580 (0.000)	12.713 (0.047)	Fixed Effect
Asset Return Risk (ARR) Models				
INTEGRATED	7.019 (0.000)	127.059 (0.000)	16.344 (0.060)	Feasible Generalized Least Squares
M1: BLF+BLG	5.523 (0.000)	86.124 (0.000)	18.938 (0.004)	Autoregressive Model

(Continued)

Set of variables	F Test	Bruesh & Pagan LM Test	Hausman Test	Econometric Model
M2: BLF+ IND	6.701 (0.000)	130.294 (0.000)	10.518 (0.104)	Feasible Generalized Least Squares
M3: BLG + IND	5.367 (0.000)	78.170 (0.000)	11.119 (0.084)	Autoregressive Model

Presents the econometric model selection mechanism for model equations 1, 2, 3 and 4 to estimate standalone, total and asset return risk. INTEGRATED refers to a model which combines all explanatory variables. Nested Tested Modeling comprises of three models, where M1: BLF+BLG includes a combination of bank-level financial and governance variables, M2: BLF+ IND combines bank-level financial and industry-level variables and M3: BLG+IND pools bank-level governance and industry level variables. For all models, F test and B&P LM test advise either random or fixed-effect model and then Hausman decides, however, to address heteroscedasticity and autocorrelation issues, FGLS & AR(1) models are advised for asset return risk estimation.

## Appendix C

**Table A3. White's Heteroscedasticity test**

Models	Standalone Risk		Total Risk		Asset Return Risk	
	Chi-square	P value	Chi-square	P value	Chi-square	P value
Integrated Model	44.971	0.804	49.219	0.658	98.503	0.000
Bank level financial + Governance	24.026	0.628	19.754	0.840	39.763	0.053
Bank level financial + Industry level	27.880	0.417	31.787	0.240	51.605	0.002
Governance + Industry level	23.281	0.669	31.196	0.263	39.763	0.053

Shows results of post estimation White's Heteroscedasticity test

## Appendix D

**Table A4. Durbin Watson Autocorrelation Test**

Models	DW Statistic SAR	DW Statistic TR	DW Statistic ARR
Integrated model	2.070	2.124	1.443
Bank level financial + Governance	2.072	2.054	1.166
Bank level financial + Industry level	2.015	2.059	1.435
Bank level governance + Industry level	1.932	1.915	1.301

Displays results of post estimation Durbin Watson (DW) test

## Appendix E

**Table A5. Preferred model selection**

Model	AIC	HQ
Standalone Risk		
INTEGRATED	-1380.905	-1366.455
M1: BLF + BLG	-1374.937	-1364.822
M2: BLF + IND	-1426.718	-1389.149
M3: BLG + IND	-1384.179	-1374.065
Total Risk		
INTEGRATED	-1360.371	-1345.922
M1: BLF + BLG	-1341.363	-1331.248
M2: BLF + IND	-1394.690	-1357.121
M3: BLG + IND	-1380.906	-1343.337
Asset Return Risk		
INTEGRATED	1197.600	1212.049
M1: BLF + BLG	1184.478	1194.593
M2: BLF + IND	1194.505	1204.620
M3: BLG + IND	1125.242	1135.357

Presents results of Akaike Information Criterion (AIC) and Hannan–Quinn Information Criterion (HQ) to select the preferred bank risk model. INTEGRATED refers to a model which combines all explanatory variables. Nested Tested Modeling comprises of three models, where M1: BLF+BLG includes a combination of bank-level financial and governance variables, M2: BLF+ IND combines bank-level financial and industry level variables and M3: BLG+IND combines bank-level governance and industry level variables. In case of positive values the highest one and for negative lowest figures of AIC and HQ recommend a preferred model.

## Appendix F

**Table A6. Variance inflation factor**

Variable	VIF	1/VIF
Short Term Advances (STA)	<b>1.170</b>	<b>0.856</b>
Govt. Securities Investment (GSI)	<b>1.550</b>	<b>0.646</b>
Private Securities Investment (PSI)	<b>1.370</b>	<b>0.728</b>
Board Attendance (ATN)	<b>1.160</b>	<b>0.856</b>
Board Committees (COM)	<b>1.130</b>	<b>0.886</b>
Meeting Frequency (FRQ)	<b>1.120</b>	<b>0.896</b>
Concentration (CON)	<b>3.360</b>	<b>0.297</b>
Munificence (MUN)	<b>3.530</b>	<b>0.283</b>
Dynamism (DYN)	<b>1.27</b>	<b>0.789</b>

## Appendix G

**Table A7. Bank risk estimation using System Generalized Method of Moments**

Variable	Standalone Risk	Total Risk	Asset Return Risk
Standalone Risk $t-1$	0.005 (0.208)	-	-
Total Risk $t-1$	-	0.138 (0.204)	-
Asset Return Risk $t-1$	-	-	-0.004 (0.236)
Short Term Advances	0.022 (0.057)	0.028 (0.041)	0.133 (0.790)
Private Securities Investment	0.031 (0.240)	-0.005 (0.153)	0.458 (0.515)
Govt. Securities Investment	-0.035 (0.026)	-0.032 (0.032)	-0.155*** (0.044)
Board Attendance	-0.065 (.049)	-0.053 (0.083)	-0.010 (0.162)
Monitoring Committees	-0.002 (0.001)	-0.001 (0.002)	-0.005 (0.003)
Meeting Frequency	0.001 (0.003)	0.001 (0.002)	0.001 (0.004)
Level of Concentration	0.374 (0.402)	0.577 (0.421)	-1.050 (1.510)
Munificence	0.047 (0.084)	0.116* (0.066)	-0.392 (0.265)
Dynamism	-0.421 (0.264)	-0.079 (0.409)	1.605** (0.682)
F-stat (P Value)	23.800 (0.000)	6.940 (0.000)	540.690 (0.000)
Sargan (P Value)	218.770 (0.107)	235.070 (0.133)	170.080 (0.527)
Hansen (P Value)	15.1000 (1.000)	18.050 (1.000)	13.590 (1.000)
AR(2) P Value	0.610 (0.539)	0.330 (0.742)	-0.270 (0.785)

Note: (\*), (\*\*) and (\*\*\*) represent significance at 1, 5, and 10%, respectively. Standard errors are shown in brackets. Heteroskedasticity robust Huber-White standard errors are used. AR (2) present results of second order correlation in first differenced results. Sargan and J-stat represent if instruments are exogenous



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