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Article

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Dynamic modeling of idiosyncratic risk under economic sensitivity. A case of Pakistan

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Abstract: Financial institutions are an important source of providing impetus to investment by mobilizing savings and channelizing them to meet much needed capital requirements of other sectors. Similarly, the extant literature documents volatility of influential financial intuitions is not standalone but of contagious nature tending to spread through the financial system hence causes economic and financial shocks. This study brings new insights by investigating the dynamic aspect of idiosyncratic risk across different economic conditions in a developing economy like Pakistan. To analyze the impact of factors that influence idiosyncratic risk, one and two step system GMM is used. The findings of the study highlight that capital structure of the financial institutions needs proper monitoring of regulatory authorities as banks get a good amount of loans during good times but this can wreak havoc during the crisis as it happened in 2008–2009. In the like manner, the State Bank of Pakistan should also introduce higher liquidity requirements as results point out increased liquidity leads to lower level of idiosyncratic risk. In addition to that, Monetary policy and prudential regulation policy should also be aligned as contractionary monetary policy deters the munificence of the sector and leads to increase in external dynamism resulting in higher level of idiosyncratic volatility. The economic sensitivity analysis indicate that role of liquidity becomes more significant during crisis and postcrisis period. Finally, study also elucidates that sector level variables are also instrumental in modeling of idiosyncratic risk along with firm and country level variables.

Subjects: Economics; Finance; Industry & Industrial Studies

Keywords: Idiosyncratic risk; dynamic model; sector level variables; economic sensitivity

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PUBLIC INTEREST STATEMENT

The instability of banks is of concern for economic welfare as externalities caused by financial institutions can extend to real economy. As a result, the fall of financial institutions also brings general public in the equation as instability of banks directly or indirectly affects everybody in the economy. This study attempts to identify the factors that contribute to the instability of banks and recommends policy guidelines to ensure smooth functioning of the same. The findings of the study outline the key relationships that can be perused to lay down micro- and macroprudential regulations necessary for stability of financial system and economy as a whole.

1. Introduction

The global financial crisis unveiled that inadequate analysis of the risk can annihilate the financial system and repercussions can encompass the whole economy. The managers of the financial institutions were not able to measure and predict the risk exposure of the financial institutions and the cascade destroyed the whole system. After the global financial crisis, risk assessment in the financial sector has become a prominent topic in the banking literature. Consistent with these arguments, Avramidis and Pasiouras (2015) emphasize that in the aftermath of global financial crisis, there is a dire need of efficient measurement and prediction of risk.

The fragility of financial system can be avoided by adequately analyzing the risk exposure of the financial institutions. The instability of influential financial institution is not confined to that institution but is of contagious nature tending to spread through the financial system and causes severe negative macroeconomic shocks. The sub primes mortgage crises of 2008 elucidated that a shock originating from a single financial institution or country can rapidly extend to other institutions and markets, hence jeopardizing the whole financial system (Khiari & Nachnouchi, 2018).

The empirical research on credit booms and financial crises divulge positive impact of credit expansion on financial stress (Crowe et al., 2011; Dell'Ariccia et al., 2014). Consistent with above purview, the banking sector of Pakistan has shown compound annual growth of 14.7% over the last six years. Moreover, the banking sector of Pakistan is also an important source of financing for other sectors as stock and bond markets are comparatively less developed. Suffice to that, Anwar (2012) state that nonfinancial sectors of Pakistan are heavily dependent on bank financing. Dependence of other sectors on financial institutions makes them an important constituent in the network and collapse of financial sector can result in macroeconomic shocks. In the like manner, Demirguc-Kunt et al. (2009) state that collapse of banking sector can harm the whole economy. Hence, it is imperative to examine the idiosyncratic risk taking of financial institutions and the factors that build the idiosyncratic risk to avoid potential negative shocks to the whole economy in the times of distress.

As far as determinants of idiosyncratic risk are concerned, previous studies have mainly remained focused on firm and country level variables with little attention paid to sector level variables. Each sector has its own environment and extant literature outlines that sectoral environment influences the decision making of financial institutions (Mishra & Modi, 2013). Since, every sector is subject to different levels of competitive environment, risk and growth opportunities, the role of sector level variables munificence, dynamism, and concentration cannot be ignored in analyzing the risk taking behavior of the banks.

Besides that, a number of studies have pointed out that the current years bank performance might be influenced by the past values (Naceur & Kandil, 2009; Naceur & Omran, 2011), therefore offering support for the use of dynamic model. According to Greene (2008), adding dynamics to a model creates a major change in the interpretation of the equation. Without the lagged dependent variable, the independent variables represent the full set of information that produce observed outcome. The incorporation of the lagged dependent variable allows the history of dependent variable to explain any variation in the current level and the impact of the independent variables represents the effect of new information. Likewise, the extant literature highlights the association between single factors and bank specific risk (Gregory & Hambusch, 2015), there is paucity of research that addresses how combination of several factors effect idiosyncratic volatility.

Literature highlights variations in the behavior of the financial institutions in changing economic conditions (Claessens et al., 2000). Consistent with this purview, Pakistan experienced robust growth of 5.0448 from 2000 to 2007 which declined drastically in 2008 to 1.701% and stayed below 3% till 2011. The GDP growth rate showed improvement since 2012. From 2012 to 2017 average GDP growth

rate averaged above 4.50%. Interestingly, apart from crisis and postcrisis analysis the sample of study comprises of two regimes consisting of dictatorial and democratic government. The findings of the study also highlight the role of changing economic conditions on idiosyncratic risk taking.

2. Literature review

This section sheds light on the firm, sector, and country level variables that influence idiosyncratic risk.

2.1. Determinants of idiosyncratic risk

2.1.1. Firm level determinants

Literature suggests that firm size is important determinant of idiosyncratic risk. For instance, Hughes and Mester (2013) postulate that large financial institutions can enjoy economies of scale and better diversification. Similarly, Strobl (2016) also report positive impact of size on idiosyncratic risk. In the same vein, large banks have greater capacity to absorb shocks that reduces idiosyncratic volatility (Fortin et al., 2010; Kumari et al., 2017; Wang, 2016).

In addition to size, literature emphasize that highly levered organizations are riskier, (Kumari et al., 2017; Mishra & Modi, 2013Wang, 2016). The reason for positive impact of leverage on idiosyncratic risk is that high level of debt in the capital structure increases the probability of default and there are more chances of highly levered firms crashing in the crisis. Another firm level variable, liquidity can help the financial institutions to reduce the risk of technical bankruptcy which eventually results in lower level of idiosyncratic risk. Literature suggests the firms with higher liquidity perform better in the time of crisis (Altanbus et al., 2017; Cohen et al., 2014; Kosmidou et al., 2017).

Non-interest income ratio explicates the intensity of revenue side diversification (Laeven & Levine, 2009). A parallel view also exists that emphasize that noninterest income highlights the nontraditional risky activities of the bank (Papanikolaou & Wolff, 2014). According to Bessler et al. (2015), up to a certain threshold of nontraditional activities the coefficient of noninterest income remains positive but once that threshold is crossed the coefficients becomes negative.

Another bank level variable, deposit ratio reduces the bank dependence on capital markets and institutional investors. By the same token Altunbas et al. (2017) divulge that increase in deposit ratio reduces systemic risk. On the other hand, Stiroh . 2006) report insignificant impact of deposit ratio on idiosyncratic risk. Literature presents evidence on the effect of market to book ratio on systemic risk. According to Kleinow et al. (2017), high expectations about the earnings of the organization increases the market to book ratio and to get high returns high risk is imperative. Similarly, Hasan and Habib (2017) espouse that higher market to book ratio is associated with increased level of idiosyncratic risk. On the other hand, Kosmidou et al. (2017) present the evidence in contrast with previous studies by reporting insignificant effect of market to book ratio on idiosyncratic risk.

Non-performing loans show the riskiness of operations. Increase in nonperforming loans jeopardizes the profitability and financial stability of the financial institutions (Stiorh, 2007; Bessler et al., 2015). Higher profitability enables the organizations to hoard more benefits and let them survive the shocks. Extant literature suggests higher profitability leads to lower idiosyncratic volatility, (Kumari et al., 2017; Mishra & Modi, 2013; Wang, 2016).

2.1.2. Sector level variables

Previous research also outlines the effect of competition on idiosyncratic risk. For instance, Balboa et al. (2015) report negative effect of high competition (low concentration) on idiosyncratic risk.

Besides that, Boyd and De Nicolo (2005) proclaim that higher competition might result in lower risk taking as high competitions results in lower interest rates which decreases the probability of default. Recently, Chen et al. (2017) report insignificant impact of HHI on idiosyncratic risk.

Beard and Dess (1984) define munificence as the capacity of an environment to maintain a persistent growth. According to Almazan and Molina (2005) high munificence leads to higher level of opportunities which can eventually augment the financial performance of the organization. The improved financial performance reduces the idiosyncratic volatility and imparts stability. For instance, Gruca and Rego (2005) report positive impact of growth on the cash flows of the firm. However, Mishra and Modi (2013) divulge insignificant impact of industry growth on idiosyncratic risk.

Another sector level variable, dynamism measures the extent to which an environment is stable or unstable (Smith et al., 2014). By definition, more dynamic environments are less stable. Firms operating in a dynamic environment tend to deal with more uncertainty regarding growth (Boyd, 1995). According to Simerly and Li (2000) the rate and instability of changes in a firm's external environment is elucidated by the environmental dynamism. In dynamic environment cash flows of the organization are volatile leading to higher level of idiosyncratic risk. In addition to that Iyer and Harper (2017) propound that stocks with low cash flow volatility are categorized as safety stocks by the investors. Besides that, Mishra and Modi (2013) also divulge positive influence of industry volatility on idiosyncratic risk.

2.1.3. Country level variables

The importance of country level variables is highlighted by a large number of studies. For instance, monetary policy is considered to affect the idiosyncratic risk as Chen et al. (2017) examine the relationship between monetary policy and bank idiosyncratic risk and the results divulge decrease in the interest rates has significant positive impact on idiosyncratic risk. In addition to that, Altunbas et al. (2017) espouse that decrease in interest rates reduces the gross returns of banks resulting in demand of risky assets to improve the returns. The next country level variable, political instability hampers the smooth functioning of organizations which eventually results in increased level of idiosyncratic risk. Confirming that, Liu and Zhong (2017) divulge negative impact of political stability on idiosyncratic risk. In addition to that, a large number of studies have attributed the equity volatility to political uncertainty (Boutchkova et al., 2011; Pastor & Veronesi, 2012). Extant literature divulges that idiosyncratic risk can also be reduced by introducing stringent regulatory rules. For instance, Chen et al. (2017) divulge significant negative impact of regulatory rules on bank risk.

Literature also highlights the association between idiosyncratic risk and government debt ratio. Recently, Kinateder and Wagner (2017) incorporated change in government debt ratio as predictor of idiosyncratic volatility and divulge insignificant association. Another country level variable bank claims are considered a safe investment as the loan forwarded to the government is considered risk free. This implies negative impact of bank claims on idiosyncratic risk.

3. Data and methodology

3.1. Sources of data and sample population

There are 35 scheduled banks operating in Pakistan. All the listed banks with data availability are included in the sample. The reason behind selecting the listed banks is requirement of stock prices to compute measure of idiosyncratic risk. In the absence of stock price data residual volatility cannot be computed. The study extracts secondary data of the financial institutions listed at Pakistan Stock Exchange from 2000 to 2017. State Bank of Pakistan publishes the yearly balance sheet analysis of financial sector firms. Apart from that annual financial statements are also consulted to complete the data collection. The data on firm level variables is extracted from these publications. The data on country level variables is extracted from Publications of State

Bank of Pakistan, IMF, World Bank Governance and Development Indicators, Economic Surveys and Federal Bureau of Statistics. Weekly data on share prices of the banks listed at Pakistan Stock Exchange is retrieved from Brecorder.com.

3.2. Computation of dependent variable

3.2.1. Idiosyncratic risk (bank specific risk)

Literature highlights different measures of idiosyncratic risk. For instance, Esty (1997) apply standard deviation of daily returns. Later on, Salas and Saurina (2002) use ratio of nonperforming loans to total loans. Volatility of stock returns is used as measure of idiosyncratic risk by Saunders et al. (1990). In addition to that value at risk is applied by Marco et al. (2008), Andries and Mutu (2016), and Zedda and Cannas (2017). Moreover, Espinosa et al. (2013) use credit default swaps to account for idiosyncratic risk. In this study, a market-based measure is applied to calculate idiosyncratic risk.

3.3. Residual volatility of stock returns

Concomitantly, market model is also applied by Konishi and Yasuda (2004) and Gregory and Hambusch (2015). Market model segregates the total risk into systematic and nonsystematic variance. The observable factor refers to systematic whereas firm specific component is taken as idiosyncratic volatility. In order to compute idiosyncratic risk following market model is used,

$$R_{it} = \alpha_{it} + \beta R_{M,t} + \varepsilon_{it} \tag{3.1}$$

In Equation (3.1), R_{it} refers to the individual institution's return, $R_{M,t}$ denotes return of market. Standard deviation of ε_{it} explains the idiosyncratic volatility. Consistent with Strobl (2016), return of whole financial sector is also taken as proxy of market return to ensure robustness.

3.4. Data analysis techniques

The statistical analysis is started by examining the quality of data followed by Panel regression and finally postestimation analysis. According to Pikas et al. (2003) fixed effect and OLS regression results are vulnerable to upward and downward bias respectively. The application of GMM eliminates that problem and results in efficient estimates. Furthermore, the results of GMM are reliable even if some variables are omitted (Arellano & Bond, 1991). In addition to that, endogenity in the model can be avoided by taking the first difference of data and incorporating the lag of endogenous variables as instruments (Arellano & Bover, 1995; Gaud et al., 2005). This refers to applying Difference GMM. Later on Blundell and Bond (1998) state that *DGMM* introduces bias in small and large samples and recommend the use of System GMM that incorporates equations in level in addition to equations in difference and uses lagged differences and lagged levels as instruments. Consistent with these arguments, one step and two step System GMM are performed in the study to ensure robustness. All the levels of analysis are performed separately.

$$\begin{aligned}\Delta \boldsymbol{IdioRisk_t} &= \beta_0 + \beta_1 \Delta Idio_{t-1} + \beta_2 SIZE_{i,t} + \beta_3 Charter_{i,t} \\ &+ \beta_4 CreditQuaty_{i,t} + \beta_5 LEV_{i,t} + \beta_6 Profitability_{i,t} + \beta_7 LIQUIDITY_{i,t} \\ &+ \beta_8 IncomeDiver_{i,t} + +\beta_9 DEPOSIT_{i,t} + \varepsilon_{it}\end{aligned} \tag{3.2}$$

$$\Delta \boldsymbol{IdioRisk_t} = \beta_0 + \beta_1 IDIORisk_{i,t-1} + \beta_2 Mun_t + \beta_3 Dyna_t + \beta_4 Conc_t + \varepsilon_{it} \tag{3.3}$$

$$\Delta \boldsymbol{IdioRisk_t} = \beta_0 + \beta_1 IdiosynRisk_{i,t-1} + \beta_2 Political_t + \beta_3 Claims_t + \beta_4 Monetary_t + \beta_5 GovDebt_t + \beta_6 Regulations_t + \varepsilon_{it} \quad (3.4)$$

The dependent variable is idiosyncratic risk. Equation (3.2) shows estimation of idiosyncratic risk based on firm level variables. The independent variables are size, charter value, credit quality (nonperforming loans), leverage, profitability, liquidity, income diversification (noninterest income) and deposit ratio. Equation (3.3) shows estimation of idiosyncratic risk based on sector level variables. The independent variables are munificence, dynamism, and concentration. Equation (3.4) shows estimation of idiosyncratic risk based on country level variables. The independent variables are political stability, bank claims, monetary, government debt, and regulations. The formulation of independent variables and empirical evidence is provided in Appendix A.

3.4.1. Postestimation

According to Roodman (2009), results of small samples are vulnerable to bias due to large number of instruments in System GMM. This study ensures to keep the number of instruments below the number of groups to ensure too many instruments don't over fit the sample. Moreover, if autocorrelation of order 1 is rejected and cannot reject no autocorrelation of order 2 there is evidence that the Arellano–Bond model assumptions are satisfied. Furthermore, Sargan and Hansen test are performed to assess the reliability of instruments. Sargan test explicates the relevance of the instruments used. The null hypothesis states that instruments are exogenous. If null is rejected, then instruments are not exogenous and the estimates are incorrect. The instruments have to be changed to extract correct results.

4. Results and interpretation

This section provides the results of the analysis to address the objectives of the study.

4.1. Descriptive statistics of dependent and independent variables

Table 1 shows descriptive statistics of dependent and independent variables incorporated in the study. The data set consists of 20 banks ranging across 18 years. Mean value of idiosyncratic risk is 2.1710. Leverage is high with mean value of 0.894 and high mean of deposit ratio confirms that a large chunk of the bank finances comes from private creditors. Munificence of the banking sector is high at 10.11%. Dynamism is also high with mean value of 2.96% due to the crisis that hit the banking stocks and overall market during 2008–2009. The environmental dynamism was at its peak during that time period. Country level variable political stability refers to the situation in which a government can be thrown out using unconstitutional and violent means. As Pakistan went through ups and downs with 8 years of the sample period in dictatorial regime and remaining 10 years in democratic regime. Another country level bank claims are reasonably high as mean value approaches to 21.61%. Moreover, government debt to GDP is also very high with mean value of 67.06%. Monetary policy interest rate is used as measure of monetary policy and mean value of 9.25%. Regulatory quality elucidates introduction and implementation of sound business policies and score is also negative for Pakistan as it is for political stability.

4.2. Estimation of idiosyncratic risk across different economic conditions

This section provides insights into the estimations of systemic and idiosyncratic risk by separately analyzing the firm, sector and country level variables.

4.2.1. Estimation of idiosyncratic risk based of firm level variables

The postestimation results of *SGMM* show that the null hypothesis of both Sargan tests and Hansen J-stat cannot be rejected implying the validity of instruments. Secondly, AR (2) test results also confirm the absence of second-order autocorrelation. The ratio of instruments to number of cross sections confirms that model is not overfitted by instruments. Moving to the results, lag of

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Firm				
Residual volatility	2.1710	1.0446	1.0791	6.0126
Size	8.1349	5.4611	6.5417	9.4082
Profitability	0.0243	0.0669	−0.0773	0.2836
Noninterest	0.1981	0.1025	0.0074	0.3762
Liquidity	0.0671	0.0906	−0.3158	0.2722
Leverage	0.7952	0.9546	0.6339	0.8698
Credit Quality	0.0394	0.0371	0.0024	0.2735
Deposit Ratio	0.7539	0.8612	0.4411	0.8954
Charter Value	1.552	1.066	−0.735	8.268
Sector				
Munificence	0.1014	0.0911	−0.0131	0.2267
Concentration	971.3164	103.1475	852.5903	1525.91
Dynamism	0.0296	0.0133	0.0008	0.0614
Country				
Political	−2.3914	0.3491	−2.8100	−1.5831
Claims	0.2161	0.7008	0.1141	0.3166
Gov Debt	0.6706	0.0906	0.5670	0.8791
Regulatory Quality	−0.654	0.099	−0.901	−0.483
Monetary Interest	0.0925	0.0263	0.0575	0.1447

Note: The table presents descriptive statistics for bank, sector and country specific financial data used in the panel regressions. Bank-specific data are taken from the databases of State Bank of Pakistan. Sector level variables are computed by authors. Political stability and Bank claims is provided by World Wide Governance and development indicators.

idiosyncratic risk is significant is significant in both one step and two step system GMM. This implies the dynamic nature of idiosyncratic risk and findings are in line with Chen et al. (2017).

Moving to the results, Table 2 shows size is significant in reducing idiosyncratic risk during crisis and postcrisis period. The impact of size on idiosyncratic risk is negative just like it was during precrisis period. Interestingly the level of significance has dropped during crisis and postcrisis analysis. The results of the study imply that larger banks are less volatile during good times but the deterring impact on idiosyncratic risk reduces in crisis and postcrisis period. In the like manner, Gregory and Hambusch (2015) also report negative impact of size ion idiosyncratic risk.

Another bank level variable leverage exacerbates idiosyncratic volatility during crisis. Contrary to that, leverage is insignificant during precrisis. Financial institutions willingly increase their leverage during normal times that creates adverse effects during crisis. The findings of the study validate the varying effect of leverage on idiosyncratic risk across different economic conditions. In the same vein Wang (2016) also report significant positive impact of leverage on idiosyncratic risk. Moreover, deposit ratio has significant influence in reducing the idiosyncratic risk. The impact of deposit ratio on idiosyncratic risk is insignificant during precrisis period. During normal times, financial institutions experience low volatility and it does not matter as if these financial institutions are financed by private creditors or institutional investors. Conversely, private depositors and creditors react slowly to the crisis and do not impose restrictions on financial institutions that eases the operating environment. Furthermore, liquidity has negative impact on idiosyncratic risk. The impact of liquidity on

Table 2. Estimation of Idiosyncratic Risk

	(2000–2007)		(20,082,017)	
$IDIO_t$	***SGMM1***	***SGMM 2***	***SGMM1***	***SGMM 2***
$IDIO_{t-1}$	0.266 (0.188)	0.289* (0.161)	0.195* (0.116)	0.254* (0.130)
Size	−0.672** (0.327)	−0.781* (0.407)	−1.367* (0.701)	−2.287* (1.250)
Leverage	1.0730 (5.912)	1.182 (5.467)	0.314 (0.257)	0.584** (0.265)
Deposit	−0.573 (0.755)	−0.448 (0.416)	−0.702 (0.389)	− 0.653** (0.257)
Liquidity	−0.096 (0.201)	−0.201* (0.115)	−0.137* (0.072)	−0.470** (0.226)
Non-Interest	0.192 (0.613)	0.416 (0.655)	0.114 (0.910)	0.090 (0.093)
Non-Performing	0.157 (0.106)	0.298 (0.197)	0.384* (0.199)	0.476* (0.242)
Charter Value	0.205 (0.183)	0.050 (0.167)	−0.155 (0.122)	−0.116 (0.086)
Profitability	−0.044 (0.174)	−0.031 (0.021)	−0.039 (0.031)	−0.020 (0.024)
Num of obs	89	89	180	180
F-stat(P-value)	4.88(0.000)	78.14(0.00)	13.19(0.000)	159.47(0.00)
N.Ins/N.Groups	(0.95)	(0.75)	(0.90)	(0.90)
J-stat(p-value)	_____	9.65 (0.787)	_____	10.21 (0.422)
Sargan(p-value)	15.26 (0.292)	15.94 (0.720)	7.43 (0.763)	8.07 (0.622)
AR(1)p-value	1.53 (0.127)	−1.46 (0.143)	−2.01 (0.044)	−1.69 (0.091)
AR(2)p-value	−1.11 (0.2	−0.79 (0.432)	−1.50 (0.135	−1.49 (0.136)

Note: Table reports the results of one step and two step system GMM. (*), (**), and (***) shows significance at 1%, 5%, and 10% respectively. Standard errors are shown in parenthesis. AR (1) and AR (2) present results of first- and second-order correlation in first differenced results. Sargan and J-stat show if instruments are exogenous. J-stat is reported by stata in one-step, resultantly only Sargan stat is reported.

idiosyncratic is negative even during precrisis period but significance level is lower. Higher liquidity can help the financial institutions to reduce the risk of technical bankruptcy which eventually results in lower level of idiosyncratic risk. Likewise, Altanbus et al. (2017) also report negative influence of liquidity on idiosyncratic risk. Another determinant of idiosyncratic risk, noninterest income is insignificant in explaining idiosyncratic risk negative influence of liquidity on idiosyncratic risk. Another determinant of idiosyncratic risk, noninterest income is insignificant in explaining idiosyncratic risk. Interestingly, there is no effect of change in economic periods on the relationship between non-interest income and idiosyncratic risk. The findings of the study are in line with Chen et al. (2017).

Non-performing loans highlight the quality of loans and are significant in explaining the increase in idiosyncratic risk during crisis and recovery period. Increase in nonperforming loans jeopardizes the profitability and financial stability of the financial institutions (Altunbus et al., 2017). The growth in revenues of banks during good times dilutes the impact of nonperforming loans but the same nonperforming loans make the banks vulnerable to collapse during crisis. Besides that, Bessler et al. (2015) posit that higher nonperforming loans send negative signals to the investors. In addition to that, charter value has no effect on idiosyncratic risk and the same is observed during precrisis time period. Similar findings are reported by Kosmidou et al. (2017). Moreover, profitability is also insignificant in explaining any variation in idiosyncratic risk and results are same across different time periods. The findings of the study are consistent with Kosmidou et al. (2017).

4.2.2. Sector level determinants analysis of idiosyncratic risk

The results in Table 3 show that munificence is highly significant in reducing idiosyncratic risk. The effect of munificence is also negative during precrisis period but significance is lower. The results suggest that steps taken to improve the growth of the sector during crisis can significantly lower the

Table 3. Estimation of Idiosyncratic Risk

	2000–2007		2008–2017	
$IDI0_t$	***SGMM1***	***SGMM 2***	***SGMM1***	***SGMM 2***
$IDIO_{t-1}$	0.392* (0.215)	0.414* (0.228)	0.193*** (0.075)	0.270*** (0.013)
Munificence	−0.376** (0.144)	−0.851* (0.430)	−1.184*** (0.422)	−1.076*** (0.320)
Concentration	−0.002 (0.004)	−0.001* (0.0007)	−0.003 (0.011)	−0.006* (0.002)
Dynamism	0.874* (0.511)	0.705 (0.605)	0.892** (0.366)	0.586* (0.306)
Num of obs	89	89	89	89
F-stat(P-value)	9.28	23.06	172.78(0.000)	73.34(0.00)
N.Ins/N.Groups	0.80	(0.80)	(0.50)	(0.50)
J-stat(p-value)	_____	14.57 (0.203)	_____	18.19 (0.110)
Sargan(p-value)	12.96 (0.296)	12.96 (0.296)	17.26(0.137)	15.51(0.145)
AR(1)p-value	−3.82 (0.000)	−1.74 (0.082)	−3.82 (0.000)	15.71(0.108)
AR(2)p-value	0.26 (0.796)	0.50 (0.621)	0.73 (0.462)	2.48 (0.290)

Note: Table reports the results one step and two step system GMM. (*), (**), and (***) shows significance at 1%, 5%, and 10% respectively. Standard errors are shown in parenthesis. AR (1) and AR (2) present results of first and second order correlation in first differenced results. Sargan and J-stat show if instruments are exogenous. J-stat is reported by stata in one-step, resultantly only Sargan stat is reported.

idiosyncratic volatility of firms and that can also lead to lower systemic risk. In the like manner, Almazan and Molina (2005) posit that high munificence leads to higherlevel of opportunities which can eventually augment the financial performance of the organization.

Moreover, concentration has negative impact on idiosyncratic risk during crisis and recovery period. In the absence of concentration, the banks have to compete for available resources that further aggravates the crisis. Similar findings are also reported by Tuli and Bharadwaj (2009), who also outline the negative effect of industry concentration on idiosyncratic risk. Lastly, environmental dynamism has significant positive influence on idiosyncratic risk. According to Krasnikov et al. (2009), the volatility of industry is an integral constituent of the environment and affects the holdings of shareholders. Besides that, Mishra and Modi (2013) also divulge negative influence of industry volatility on idiosyncratic risk. The crisis of market and dynamism of sector aggravate the idiosyncratic volatility as significance level of dynamism is very low during precrisis period.

4.2.3. Estimation of idiosyncratic risk based of country level variables

The results in Table 4 show that lag of idiosyncratic risk is highly significant in explaining current level of idiosyncratic risk. In addition to that, contractionary monetary policy is also significant in increasing idiosyncratic risk during crisis and recovery period. Findings of the study are in line with Ramos-Tallada (2015). Contrary to that, monetary policy is insignificant in influencing idiosyncratic risk during precrisis period. The results imply that economic conditions play an important role in determining the role of monetary policy in explaining idiosyncratic risk. By the same token, political stability is also significant in reducing idiosyncratic risk. Similar findings are reported by Liu and Zhong (2017). The significance level is considerably higher during crisis and postcrisis period as compared to precrisis period. The results imply that political stability becomes more important during the times of market stress.

Another macroeconomic variable bank claim has significant negative impact on idiosyncratic volatility during crisis and postcrisis period. Bank claim is also significant during precrisis period but level of significance is lower as compared to crisis and recovery period. Higher claims of bank on government reduces the volatility of cash flows that eventually lowers the idiosyncratic volatility.

Table 4. Estimation of Idiosyncratic Risk

	2000–2007		2008–2017	
$IDIO_t$	***SGMM1***	***SGMM 2***	***SGMM1***	***SGMM 2***
$IDIO_{t-1}$	0.289 (0.174)	0.271***(0.0474)	1.119** (0.446)	1.358***(0.426)
Monetary Pol	0.023* (0.013)	0.019** (0.007)	0.030* (0.016)	0.034** (0.016)
Political Stb	−0.999* (0.542)	−0.473 (0.463)	−1.657** (0.741)	−1.367** (0.554)
Bank Claims	−0.232* (0.131)	−0.110 (0.102)	−0.046* (0.025)	−0.048** (0.021)
Regulations	−0.690 (1.077)	−0.494 (0.352)	−0.042 (0.264)	0.083 (0.187)
Government Debt	−0.103 (0.094)	−0.114 (0.091)	0.051 (0.038)	0.057 (0.039)
Num of obs	89	89	180	180
F-stat(P-value)	5.88 (0.000)	33.81 (0.00)	9.46 (0.000)	16.43 (0.00)
N.Ins/N.Groups	0.90	0.90	0.80	0.80
J-stat(p-value)		10.72 (0.708)		4.71 (0.354)
Sargan(p-value)	10.96(0.628)	10.46(0.722)	3.57 (0.468)	3.57 (0.468)
AR(1)p-value	0.47 (0.641)	−0.16 (0.873)	−2.42 (0.015)	−2.15 (0.031)
AR(2)p-value	−0.08 (0.938)	0.29 (0.775)	−0.71 (0.477)	−1.21 (0.228)

Note: Table reports the results of one step and two step system GMM. (*), (**), and (***) shows significance at 1%, 5%, and 10% respectively. Standard errors are shown in parenthesis. AR (1) and AR (2) present results of first- and second-order correlation in first differenced results. Sargan and J-stat show if instruments are exogenous. J-stat is not reported by stata in one-step, resultantly only Sargan stat is reported.

Moreover, government debt is insignificant in explaining idiosyncratic volatility in precrisis, crisis, and postcrisis period implying the relationship between government debt and idiosyncratic risk is not sensitive to economic conditions. The results are consistent with the findings of Kinateder and Wagner (2017). In the like manner, regulatory quality is also insignificant in explaining idiosyncratic volatility.

5. Conclusion

This study examines idiosyncratic risk across different economic conditions for the economy of Pakistan and also highlights similarities and difference in idiosyncratic risk-taking during precrisis, crisis, and postcrisis period. In brief, the stability of financial system is very important and failure of financial institutions can generate negative macroeconomic shocks that can jeopardize the functioning of whole system. The stability of financial system can be ensured by examining risk exposure of financial institutions and introducing timely micro- and macro-prudential policies that are aligned to the stability of the system.

The study identifies important relationships across different economic conditions that can be used by regulatory authorities to ensure stability of financial system. Most importantly, capital structure of the financial institutions needs proper monitoring of regulatory authorities as banks get a good amount of loans during good times but this can wreak havoc during the crisis as it happened in 2008–2009. In the like manner, the State Bank of Pakistan should also introduce higher liquidity requirements as results point out increased liquidity leads to lower level of idiosyncratic risk. The economic sensitivity analysis indicate that role of liquidity becomes more significant during crisis and postcrisis period. In addition to that, Monetary policy and prudential regulation policy should also be aligned as contractionary monetary policy deters the munificence of the sector and leads to increase in external dynamism resulting in higher level of idiosyncratic volatility. The negative effect of munificence of sector on idiosyncratic risk gives clear message to regulators that steps should be taken to improve the environment of banking sector to ameliorate

the effect of crisis. The study also highlights the volatile nature of concentration across different economic conditions that needs to be perused by regulatory authorities.

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Appendix A.

Variable	Measurements	Empirical Evidence	Expected Influence Idiosyncratic Risk
Bank-Level Determinants			
Size	*Logarithm of Total Assets*	Kleinow and Nell (2015)	Negative
Leverage	$1-\frac{Equity}{Total\ Assets}$	Niţoi et al. (2019),	Positive
Charter Value	$\frac{Market\ Capitalization}{Book\ value\ of\ common\ equiy}$	Kleinow et al. (2017)	Positive/Negative
Profitability	Return on Assets (ROA)	Andries and Mutu (2016).	Positive/Negative
Liquidity	Financial power measured as $\frac{cash\ flow\ of\ operating}{total\ liabilities}$	Kleinow et al. (2017).	Negative
Income Diversification (NoniInterest Income)	$\frac{Non-Interest\ income}{Total\ interst\ Income}$	Kleinow and Nell (2015)	Positive/Negative
Credit Quality (Nonperforming Loans)	$\frac{Loan\ Loss\ Provision}{Total\ Assets}$	Kleinow and Nell (2015)	Positive
Deposit Ratio	$\frac{Deposit}{Total\ Liabilities}$	Kleinow et al. (2017)	Negative
Sector Level Determinants			
Munificence	**1**. Regressing time against the Revenues of banking sector over the period of study, and **2**.Taking the ratio of the regression slope coefficient to the mean value of revenues over the same period.	Boyd (1995), Kayo and Kimura (2011), Mishra and Modi (2013),	Positive
Dynamism	Standard error of munificent slope coefficient divided by the mean value of revenues over the same period.	Boyd (1995), Kayo and Kimura (2011), Krasnikov et al. (2009),	Positive/ Negative

(*Continued*)

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Appendix A. (*Continued*)

Variable	Measurements	Empirical Evidence	Expected Influence Idiosyncratic Risk
Concentration	The sum of assets of the three largest national commercial banks. HHI is the sum of the squares of the market shares (assets) of each bank in the financial system	Chen et al. (2017), Mishra and Modi (2013)	Negative
Country level Determinants			
Contractionary/Expansionary Monetary Policy	Monetary policy Interest Rate	De Mendonça and da Silva (2018)	Positive/Negative
Political Stability	Index of instability of Democracy.	Kleinow and Nell (2015), Kleinow et al. (2017)	Negative
Government Debt Ratio	$\frac{Government\ Debt}{GDP}$	Kleinow and Nell (2015), Kleinow et al. (2017)	Positive/Negative
Bank Claim	$\frac{Bank\ claims\ on\ Govt}{GDP}$	Kleinow and Nell (2015), Kleinow et al. (2017)	Positive
Regulatory Quality	Ability of government to develop and implement sound policies.	Kleinow and Nell (2015)	Negative

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