

What Determines Capital Adequacy in the Banking System of Kingdom of Saudi Arabia? A Panel Data Analysis on Tadawul Banks

Ali Polat¹ and Hassan Al-khalaf²

Abstract

The aim of this paper is to present an empirical evidence to explain some bank internal factors that influence the capital adequacy ratio (CAR) of listed banks in the Kingdom of Saudi Arabia (KSA). We used the data covering from 2008 to 2012 for the Saudi Arabian Banks that are listed in Saudi Arabian Stock Market, Tadawul.

By using a panel data and modelling through fixed effect, robust estimation and generalized least square (GLS) and feasible GLS we found that except non-performing loans, other variables have significant effect on CAR. Depending on the model type the results vary.

Fixed effect, robust estimation and least squared dummy regression (LSDR) results shows that loans to assets ratio has negatively significant while leverage and the size of the banks have positively significant in determining CAR. In GLS estimation we found that in addition to earlier model results, loan to deposit ratio has negatively significant and the return on assets has positively significant on CAR. Our analysis also shows that there are significant bank specific effects in panel data structure while no time effect is found.

JEL classification numbers: G21, C33

Keywords: Banking, Capital Ratio, Capital Requirement, Panel Data

1 Introduction

The capital structure and the required level of capital are important topics for any corporation whether they are financial or non-financial. In addition to the importance of structure and the level of capital, the impact of regulations on such variables also cannot be

¹ Assistant Professor, King Saud University, College of Business Administration, Finance Department.

²Msf, Saudi Hollandi Bank, Manager.

ignored.[1] Banks, as financial service providers give a special importance on the level and structure of capital they have. Although there are market driven requirements for holding a certain level of capital, the impact of capital requirements regulations of banks are very important on capital held by banks. [2] In addition to that, the level and the structure of capital held by banks are also significant for macroeconomic indicators of the countries and for applications of monetary policies. Such importance has been discussed in the literature extensively. Blum and Hellwig [3], Concetta Chiuri, Ferri [4] and Borio and Zhu [5] are among these studies. Blum [6] indicated that capital adequacy requirements may increase riskiness of a bank. Therefore, from several perspectives capital level and its structure are important variables that should be analysed carefully.

The connection of bank capital and financial system increased the attention on the capital adequacy of banks to enhance the stability of the financial system. That is why the Basel accord, the rules on minimal risk-based capital required for banks, is introduced in 1988 by Bank for International Settlement (BIS). Such recommendation of BIS is intended to serve to protect depositors while promoting a stable and efficient financial system.

Basel capital requirement regulations evolved into a more complicated and detailed package of rules to serve the same aim, providing a ground for strong capital structure in order to minimize default risk of the banks. First Basel rule for capital was to keep 8% of risk-weighted assets as capital. Basel II published in 2004 proposed fundamental improvements in calculation of capital adequacy. Basel III, a more developed version of Basel II required an increase in risk-weighted capital (by also dividing it as Tier 1 and Tier 2 as it was in Basel II) and imposed a non-risk-weighted leverage ratio. The developments in Basel rules is discussed by Asarkaya and Özcan [7] in detail until the stage of Basel II. As the developments from Basel I to Basel III are not our main concern, we will focus more on the capital adequacy ratio (CAR) and its determinants. Considering regulatory levels are given, then what are the other determinants of capital ratio of bank which hold different levels of capital from each other?

In this study we will discuss the status of bank capital level and the internal determinants in the scope of above research question for KSA. In order to find internal determinants there are several ratios which can be obtained from the financials of the banks. Among these determinants are profitability, non-performing loans, loan to deposit ratio, leverage (equity to liability), bank size, dividend pay-out ratio and loans to asset ratio. The aim of this research is to supply an empirical evidence to understand some internal factors that influence the capital adequacy ratio in KSA banks by analysing annual data from 2008 to 2012.

Instead of drawing a final conclusion from the analysis we aim to understand the determinant factors of CAR specific to KSA for the specified time period. This study has six sections. The first section introduces the topic. Second section gives the relevant literature review. The third section includes data and methodology. Fourth section discusses model specifications and diagnosis while fifth section discusses models and findings. Sixth section concludes the findings.

2 Literature Review

There are theoretical and empirical researches on capital adequacy. Although the topic is more relevant particularly for last decades due to financial connections of the global banking activities, there are earlier studies made on the capital structure. For instance,

Modigliani and Miller [8] indicated that in a perfect financial market capital structure and therefore capital regulation is irrelevant. In an early study, Hahn [9] analysed determining factors of capital adequacy for the US covering period of 1953-1962.

Capital requirements may have an effect on bank behaviour to take more risk or not. Such issue is discussed by Rime [10] on Swiss Banks by employing a simultaneous equations model. Barrios and Blanco [11] analysed the effectiveness of bank capital adequacy regulation by evaluating a disequilibrium model for Spanish commercial banks data from 1985 to 1991. They compared two models where firms not affected by capital adequacy regulations and firms that are affected. They found that market pressure is the main determinant of banks capital rather than the regulatory constraint. Chen [12] in his evaluation of Chinese banks and capital adequacy concluded that in addition to government injection, profit surplus and other capital instruments there are long term tools required to boost capital to Chinese Banks.

Al-Sabbagh [13] studied Jordanian commercial banks for the determinants of the capital adequacy ratio and found that return on asset (ROA), loan to assets ratio (LAR), risky assets ratio (RAR) and dividends pay-out ratio positively affect the capital adequacy ratio (CAR) while deposits assets ratio (DAR), size of bank and loan provision ratio (LPR) negatively affect the capital adequacy ratio (CAR).

Ahmad, Ariff [14] did empirical study on the determinants of bank capital ratios in a developing economy. The unbalanced panel data set for eight years from 1995 to 2002 is used. They found the non-performing loans and risk index show a positive relation with the capital ratio. On the other hand the size is found to be negatively related to the capital ratios. And there is no strong relation between the earnings and the capital ratio.

Ho and Hsu [15] analysed the relation between leverage, performance and capital adequacy in Taiwan during 2001-2006. They find that the restrictions on CAR affect risky investment strategies and they also found that performance of firm is significantly and positively related to firm size, leverage and financial cost.

Gropp and Heider [16] used data of 16 different countries from US and 15 EU member countries covering the period from 1991 to 2004. Their evidence shows that bank capital deviations cannot be explained by excess capital of the regulatory minimum. They also did not find any significant effect of deposit insurance on capital structure.

Büyükkşalvarcı and Abdioğlu [17] analysed eight factors of capital adequacy of the Turkish banking sector by using panel data methodology for the period of 2006-2010. The results of their study indicate that loans (LOA), return on equity (ROE) and leverage (LEV) have a negative effect on CAR, while loan loss reserve (LLR) and return on assets (ROA) positively influence CAR. On the other hand, SIZE, deposits (DEP), liquidity (LIQ), and net interest margin (NIM) do not appear to have any significant effect on CAR.

Bokhari, Ali [18] analysed the determinants of CAR in Pakistan banking sector. In their empirical analyses on the panel data, weighted average least square statistical model is used on annual data for the period of 2005 to 2009. Deposits, GDP growth rate, portfolio risks and profitability used in the study as bank characteristics affecting capital ratio. They found return on equity has negative significant effect on CAR and deposits while portfolio risks and GDP have negative significant impact on CAR.

Romdhane [19] investigated developing countries in his empirical study for the determinants of banks' capital ratio. By using a sample of 18 banks' biannual data from 2002 to 2008 for Tunisia, the paper tried to answer if emerging and developed countries are affected by the same factors. He found that the interest margin and the risk positively affect the capital ratio. The equity cost and the deposits ratio both have negative impact. The main

determinants are the same for all the countries. In their explanation of the excess capital held by the Tunisian banks cannot be clarified only by regulatory pressures.

Jucá, de Sousa [20] analysed Brazilian and North American Banks for the main determinants of capital requirements for the period of 2004-2010 by using multiple linear cross section regression. They also connect their study to financial leverage of banks with commercial portfolio and found that many determinants of capital structure also contribute to the determination of the leverage level of banks.

Abusharba, Triyuwono [21] analysed Indonesian banking system for Islamic banks and the determinants of the capital adequacy ratio by multiple linear regression analysis and pair-wise correlation matrix for the years from 2009 to 2011. They concluded that profitability and liquidity are positively associated with the capital adequacy requirements. Meanwhile, nonperforming financing (NPF) is significant but negatively related to the capital adequacy ratio. Depositor's funds and operational efficiency have no significant effect on capital adequacy in the research.

Atici and Gursoy [22] determined that capital buffer and the cyclicity relation is available in Turkish banking system during 1988-2009 by applying two-step Generalized Method of Moments, using Arellano-Bond linear dynamic panel-data estimator.

Abdul Karim, Hassan [23] analysed Organization of Islamic Conference countries from 1999 to 2009 and also compared capital adequacy and lending and deposit behaviours of both conventional and Islamic banks. For both samples, it is found that capital requirements have a significant impact on deposit and lending behaviours of the banks. They also found a positive relationship between capital requirements and deposit and loan growth for both group of banks.

Almazari and Almumani [24] studied Saudi Arabia for the period 2007-2011 for determinants of capital adequacy of the listed banks. They found that capital adequacy and liquidity risk, interest risk and return on assets are positively correlated while credit risk, capital risk and return on equity and earning power are negatively correlated.

3 Data and Methodology

The purpose of this study is to investigate the determinants of banks capital adequacy ratio in KSA banking system. This study used secondary data collected from financial statements of the sample banks available in their annual reports.

Study covers five years from 2008 to 2012. Although total population of Saudi Arabian commercial banks is 23, there are 11 banks listed in the Saudi stock market. Among non-listed banks there are 12 foreign banks and one national bank. The study excluded foreign and not listed banks in Saudi stock market. In addition to that one bank from the 11 listed excluded because it is newly established and does not have complete data for the selected period. Therefore, the analysis relies on 10 banks.

We employed multivariate panel data structure to analyse relationships between bank specific variables which are available in Table 1. The total capital requirement requires a total risk-weighted capital adequacy ratio of 8 per cent is used as the proxy for bank capital adequacy ratio in this study.

Table 1: Variables, Formulas and Hypothesis

Variables	Formulas	Hypothesis
Capital Adequacy Ratio (CAR)	Shareholders' Equity/ (Amount Subject to Credit Risk + Amount Subject to Market Risk + Amount Subject to Operational Risk)	Dependent Variable
Profitability (ROA)	Return on Assets=Net Income /Average Total Assets	H1: Return on assets (ROA) has statistically significant effect on capital adequacy
Non-performing loan (NPL)	Non –performing loan/Gross loans	H2: Non-performing loan has statistically significant effect on capital adequacy
Loan to deposit (LTD)	(Loans / Customers deposits) X 100.	H3: Loan to deposit ratio LTD has a statistically significant effect on capital adequacy
Leverage (LEV)	(Shareholder's equity /Total Liabilities) X 100.	H4: Leverage has statistically significant impact on banks' capital adequacy ratio.
Bank size (SIZE)	Log of Bank Size	H5: Bank size has statistically significant impact on banks' capital adequacy ratio.
Dividends Payout Ratio (DPO)	(Dividend / Earning per share) X 100.	H6: dividends pay-out ratio has significant impact on banks' capital adequacy ratio.
Loans (LOA)	(Total Loan / Total Asset) X 100.	H7: Loan has statistically significant impact on banks' capital adequacy ratio.

Seven bank specific variables that are hypothesized to influence CAR are examined. These bank specific variables are ROA, NPL, LTD, LEV, SIZE, DPO and LOA. Their selection criteria and a priori expectations of expected relationship with bank capital adequacy ratio are partially discussed in literature review part or below.

According to Basel committee the capital divided into two Tiers: core capital (paid-in capital, all kinds of reserves and retained earnings), and supplementary capital (undisclosed reserves, asset revaluation reserves, subordinated debt, loan-loss provisions). We applied the standard formula for the calculation of CAR.

One of the indicators of the profitability of the firm is the return on asset. It is an analytical measure of the effective use of assets. We expect in this study a positive relationship between ROA and capital adequacy ratio. The higher the profit means the more risk will be taking by the bank and this will lead to more of capital allocation for the risk. In the previous studies done by Büyüksalvarcı and Abdioğlu [17] they found ROA has a significant and positive effect on capital adequacy ratios in the Turkish banking sector and also Abusharba, Triyuwono [21] found profitability (ROA) has a positive and significant effect on capital adequacy.

The main role of the bank is to provide loan to the customers, and not all the customers will

be able to pay back the loan to the bank and those defaulted loans will be classified in the balance sheet of the bank as a non-performing loan (NPL). The NPL is also an indicator of the loan quality. Usually NPL is calculated as a percentage of the gross loan. The more NPL the bank has the more provisions they have to spare. Abusharba, Triyuwono [21] found the non-performing loan (NPL) has negative and significant influence on the capital adequacy ratio in the Indonesian banks.

The loan to deposit ratio (LTD) is one of the ratio regulated by the central bank. In KSA the maximum LTD is 85%. It is a measure of liquidity and indicates bank's ability to give additional loans. The higher the LTD the higher the risk taking by the bank and the higher risk weighted asset (RWA) will be. Such triggering of risk will lead to more capital required as compensation for the depositor. Abusharba, Triyuwono [21] found loan to deposit ratio (LTD) has positive and significant influence on CAR in the Indonesian banks.

The percentage of shareholders' equity to debts is the leverage (LEV). Higher ratio indicates lower indebtedness. The total equity to total liabilities ratio used as a factor impacting CAR by Büyüksalvarcı and Abdioğlu [17] found LEV have a negative effect on CAR.

Bank size means the total size of the balance sheet of the bank. Banks represent the total assets in the yearly and quarterly financial report. The bank size is important factor on the CAR because the larger the bank size the bigger the ability of the bank to diversify the investment leading to lower risk. Based on this we are expecting the bank size to have a negative impact on the CAR.

Gropp and Heider [16] found that asset-size of a banking organization is an important determinant of its capital ratio in an inverse direction, which means that larger banks have lower capital adequacy ratios. Büyüksalvarcı and Abdioğlu [17] found there is no significant relation between the bank size and CAR in the Turkish banks. Rime [10] found bank size has a negative and significant impact on capital in Switzerland banks. Al-Sabbagh [13] found the bank size in Jordan negatively impact the CAR. The natural logarithms of total assets are used as a proxy of banks' size.

The percentage of profits distributed by the company among shareholders, out of the net profits is the dividends pay-out ratio. The higher profitable the bank the more the returned earning will have. From the returned earning the banks usually distribute the dividends. And also the returned earning is one of the items in the core capital calculation. So the distribution of dividends will reduce the core capital leading to reduce the CAR. Al-Sabbagh [13] found the dividends positively affecting the CAR in Jordanian banks.

The important of the loans to total assets ratio to the CAR comes from the diversification concept. This means the higher the loan to asset ratio the higher the risk. Mpuga [25] found a positive significant relation between the loan to asset ratio and CAR for Uganda. Büyüksalvarcı and Abdioğlu [17] found a negative impact from loan ratio on the CAR.

4 Model Specifications and Diagnosis

4.1 Regression Diagnostics

We used a balanced panel data set as each company in the sample has 5 years of observation. In panel data analysis the estimation depends on the assumptions about the intercept, the slope coefficients and the error term unit. The assumptions are about whether they change across time and space or not. [26]

Although we use a balanced panel data we still need to verify that our data qualifies for the

assumptions of ordinary least square (OLS) regression. Therefore the regression diagnostics is a fundamental step in our analysis. We looked at the scatter plots of CAR against each of the dependent variables in order to have some ideas about possible problems. (Appendix 2) The graphs of CAR with dependent variables exhibit that in every plot, Bank10 is far away from the rest of the data points. In order to analyse outliers we also looked at the studentized residuals which are a type of standardized residual that can be used to identify outliers. Studentized residuals which exceed +2 or -2 are not desirable. [27] Looking at the studentized residual exceeds +2 -2 we identified 3 records which belong to year 2009 for Bank3 and Bank4 and belong to year 2008 for Bank10. Therefore these points are taken into consideration in our regression analysis.

We also looked at the plot that shows the leverage by the residual squared and search for jointly high observations on both of these measures. (Appendix 3). Another diagnostic tool is the added variable plot which is called as partial regression plot. This plot shows how the observation influences the coefficient. (Appendix4)

We perform the Shapiro-Wilk W test for normality. Null hypothesis is that the population is normally distributed while alternate hypothesis is that the population is not normally distributed.

Shapiro-Wilk W test for normality

Variable	Obs	W	V	z	Prob>z
r	50	0.98094	0.896	-0.233	0.59223

The test result shows that $p > 0,05$ and we reject alternate hypothesis and accept the null hypothesis which is our distribution is normal.

In order to look at if OLS assumption of homogeneity of variance of the residuals is met or not we run Breusch-Pagan test. The null hypothesis is that the variance of the residuals is homogenous. $p > 0,05$ and therefore we accept H_0 which means the variance is constant. Therefore our data is homoscedastic but not heteroscedastic. As a graphical detection, another common method used is to plot the residuals versus fitted (predicted) values. The graph in Appendix 5 also confirms that our data is homoscedastic.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity: Ho: Constant variance

Variables: fitted values of car

chi2(1) = 0.19

Prob > chi2 = 0.6597

Another problem that might be of interest is the multicollinearity. If two variables are near perfect linear combinations of one another this indicates multicollinearity. Variance inflation factors (VIF) used for detecting the multicollinearity. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation.[27]

Table 2: Variance Inflation Factors

Variable	VIF	1/VIF
ltd	4.51	0.221790
loa	4.32	0.231316
lnsize	2.88	0.346764
dpo	2.40	0.416704
roa	2.23	0.449235
npl	1.71	0.583490
lev	1.58	0.634468
Mean VIF	2.80	

Tolerance is defined as $1/\text{VIF}$. It is used to check on the degree of collinearity and a $1/\text{VIF}$ value lower than 0.1 is comparable to VIF of 10 in interpretation. Our VIF levels are good enough to continue our model.

Autocorrelation is tested by Wooldridge [28] test and found that there is auto correlation. Drukker [29] indicates serial correlation will create a bias to the standard errors of linear panel data models and cause the results to be inefficient. H_0 : no first-order autocorrelation $F(1, 9) = 9.467$ Prob > F = 0.0132

Cameron and Trivedi [30] suggests that one or more of the assumptions of homoscedasticity and non-correlation of regression errors fails, then generalized least-squares (GLS) estimators are appropriate.

4.2 Panel Data Diagnostics

In addition to regression diagnostics we need to decide which model to apply. Therefore, we run several tests as follow:

4.2.1 F Test to decide Pool or Fixed Effect

F-test for Fixed effect is calculated as $F(9, 33) = 8.94$ Prob > F = 0.0000. The null hypothesis here is that all dummy parameters except for the dropped one are all zero: $H_0: \mu_1 = \dots = \mu_{n-1} = 0$. If the null hypothesis is rejected that means there is a significant fixed effect and fixed effect model is better than the pooled OLS.

4.2.2 BP LM Test for Random Effect

Breusch and Pagan [31] Lagrangian multiplier (LM) test for random effects follows the chi-squared distribution and controls if individual specific variance components are $H_0: \sigma^2_1 = 0$. By using $\text{car}[id, t] = Xb + u[id] + e[id, t]$ formula the test result gives Chi-square of 3,35 with $p < 0,05$ value. Therefore, we reject the null hypothesis in favour of the random group effect model. Therefore our model has also random effects too.

4.2.3 Hausman Test for Fixed vs Random Effect

As we have both effects and to decide which effect is more relevant and significant we run the Hausman specification test. Hausman [32] null hypothesis is that individual effects are uncorrelated with any independent variables in the model.

As our test result shows below that null hypothesis is rejected and no correlations of individual effects are violated. Therefore, in that case LSDV will be consistent.

Table 3: Hausman Test

	Coefficients		(b-B) Difference	S.E
	(b) Random_Group	(B) Fixed_Group		
ltd	-0.1035627	0.0337877	-0.1373505	0.0287477
loa	0.0051092	-0.2079469	0.2130561	0.0327061
npl	0.0732138	-0.0744013	0.1476152	0.0925075
roa	0.8110348	-0.1545515	0.9655864	0.1424928
lev	0.5389413	0.7104854	-0.1715441	0.0340998
dpo	0.027775	0.0140387	0.0137362	0.0061859
lnsize	-1.144108	5.072435	-6.216543	.

Test: Ho: difference in coefficients not systematic
 $\chi^2(7) = (b-B)[(V_b - V_B)^{-1}](b-B) = 1523.15$
 Prob> $\chi^2 = 0.0000$

5 Models and Findings

Pooled OLS regression model assumes that all the banks are same without making any differentiation in the coefficients. Therefore, this approach does not distinguish between the various banks. That means by combining 10 banks and pooling them we deny the heterogeneity or individuality that may exist among ten banks. If we run OLS regression in a pooled way, we implicitly assume that the coefficients together with intercepts are the same for all the individuals. Therefore even if we find a significant p value, we cannot use pooled OLS regression result.

As Park [33] indicated employing all fixed and random effects in a panel data format is one of the common misunderstandings also. Unless there is a specific comparison purpose of models then only the best fit model should be reported. Therefore, depending on our diagnostics and post estimation tests, we will report the relevant analysis here only. Table 4 provides the mean, standard deviation, min and max of related variables.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
car (dep)	50	16.8326	2.609398	11.24	24.19
ltd	50	79.3996	7.77322	57.19	92.04
loa	50	59.5268	5.654075	42.82	66.9
npl	50	2.7454	1.780166	0.24	7.47
roa	50	1.7496	0.997677	-1.43	3.99
lev	50	16.193	3.278896	9.69	25.02
dpo	50	28.7248	24.19034	0	79.58
lnsize	50	18.3146	0.751589	16.59	19.4

A fixed effect model examines if intercepts vary across group or time period. A one-way model includes only one set of dummy variables. In our data, for instance adding dummies only for time or only for the banks mean one-way model.

The fixed effect models we used have 0.84 R² values with high F-test values with a higher fit of robust estimation. Rho value in fixed model, the fraction of variance means that 96 percent of the variance is due to differences across panels. All the models, t values and

significances are given at the Appendix part. We employed mainly two regression models which are as follow:

$$CAR = \beta_0 + \beta_1 ltd + \beta_2 loa + \beta_3 npl + \beta_4 roa + \beta_5 lev + \beta_6 dpo + \beta_7 lnsize \quad (1)$$

$$CAR = \beta_0 + \beta_1 ltd + \beta_2 loa + \beta_3 npl + \beta_4 roa + \beta_5 lev + \beta_6 dpo + \beta_7 lnsize + d_1 b_1 + d_2 b_1 + d_3 b_1 + d_4 b_1 + d_5 b_5 + d_6 b_6 + d_7 b_7 + d_8 b_8 + d_9 b_9 + d_{10} b_{10} + \varepsilon \quad (2)$$

In addition to above models we also employed fixed effect one way regressions for time for controlling to see if there is any significant time effect. There was no significant effect for the years but for banks which is reported in Appendix 1.

As our data has autocorrelation problem, we wanted to ease the assumptions of OLS as indicated by Cameron and Trivedi [30] and applied GLS estimation to our data. The total result of all regression tests are provided in Table 1. The table indicates the relation between capital adequacy ratio and other independent variables. Depending on the models we applied, the results are differentiated.

The first model in Table 5 is the standard fixed effect within regression. The second model is robust estimation to check for the outliers mentioned in the earlier sections. The third model is used by adding bank dummies to control for bank changes. Investigating time-invariant causes of the dependent variables cannot be investigated by fixed-effects models as time-invariant characteristics of the individuals are perfectly collinear with the bank dummies. [34] Fixed-effects models are originated to study the causes of changes within a person [or entity]. However, our data has time and bank characteristics which are time variant. That is why we can look at the changes coming with the year and bank. The last model is applied due to the problems of autocorrelation in our data set.

Table 5: Variables, Formulas and Hypothesis

Variables	Hypothesis	RESULTS			
		Fixed Effect	Robust Fixed Effect	Random Effect GLS	Feasible GLS
Capital Adequacy Ratio (CAR)	Dependent Variable				
Loan to deposit (LTD)	H3: Loan to deposit ratio LTD has a statistically significant effect on capital adequacy				Sig -
Loans (LOA)	H7: Loan has statistically significant impact on banks' capital adequacy ratio.	Sig -	Sig -	Sig -	
Non-performing loan (NPL)	H2: Non-performing loan has statistically significant effect on capital adequacy				
Profitability (ROA)	H1: Return on assets (ROA) has statistically significant effect on capital adequacy				Sig +
Leverage (LEV)	H4: Leverage has statistically significant impact on banks' capital adequacy ratio.	Sig +	Sig +	Sig +	Sig +
Dividends Pay-out Ratio	H6: dividends pay-out ratio has significant impact on banks'				Sig +

(DPO)	capital adequacy ratio.				
Bank size (SIZE)	H5: Bank size has statistically significant impact on banks' capital adequacy ratio.	Sig +	Sig +	Sig +	Sig -

Sig means significant, +/- shows the direction of the significance. Empty cells mean non significance.

6 Conclusion

Capital requirement level of banks is a fundamental issue not only in Saudi Arabia but also in all countries. Credit crunch and European debt crisis which still continue made the banks vulnerable in their total operations. Such a high risk environment requires a good level of capital. Banks usually hold more capital than the required level of capital proposed by regulation to operate in a prudential manner against probable shocks.[7]. Although Basel and country specific arrangements in parallel to Basel provide a good regulative ground, the determinants of such effects are very important in decision making.

In this research we empirically investigated some internal factors and their relation with capital adequacy ratio of the listed banks in KSA. We used the data covering 2008 to 2012 for the Saudi Arabian Banks that are listed in Saudi Arabian Stock Market, Tadawul.

By adopting some panel data techniques we found the important internal ratios that affect the CAR, Capital Adequacy Ratio. As we employed several models, the results vary depending on the model we applied. Fixed effect, robust estimation and least squared dummy regression (LSDR) results shows that loans to assets ratio has negative significant effect on capital requirement ratio while leverage and the size of the banks have positive significant effect in determining that ratio. In generalized linear regression (GLS) estimation we found that in addition to earlier results we found loan to deposit ratio has negative significance and the return on assets has positive significance on capital ratio. Our analysis also shows that there are significant bank specific effects in panel data structure while no time effect is found. That means that the bank level individual differences are available while time level differences are not.

ACKNOWLEDGEMENTS: The Researchers would like to thank the Deanship of Scientific Research at King Saud University, represented by the research center at CBA, for supporting this research financially.

References

- [1] Osterberg, W.P. and J.B. Thomson, *Optimal financial structure and bank capital requirements: an empirical investigation*, 1990.
- [2] Berger, A.N., R.J. Herring, and G.P. Szegö, *The role of capital in financial institutions*. Journal of Banking & Finance, 1995. **19**(3): p. 393-430.
- [3] Blum, J. and M. Hellwig, *The macroeconomic implications of capital adequacy requirements for banks*. European Economic Review, 1995. **39**(3): p. 739-749.

- [4] Concetta Chiuri, M., G. Ferri, and G. Majnoni, *The macroeconomic impact of bank capital requirements in emerging economies: Past evidence to assess the future*. Journal of Banking & Finance, 2002. **26**(5): p. 881-904.
- [5] Borio, C. and H. Zhu, *Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?* Journal of Financial Stability, 2012. **8**(4): p. 236-251.
- [6] Blum, J., *Do capital adequacy requirements reduce risks in banking?* Journal of Banking & Finance, 1999. **23**(5): p. 755-771.
- [7] Asarkaya, Y. and S. Özcan, *Determinants of Capital Structure in Financial Institutions: The Case of Turkey*. Journal of BRSA Banking and Financial Markets, 2007. **1**(1): p. 91-109.
- [8] Modigliani, F. and M.H. Miller, *The cost of capital, corporation finance and the theory of investment*. The American economic review, 1958: p. 261-297.
- [9] Hahn, P.J., *Factors Determining Adequacy of Capital in Commercial Banks*. The Journal of Finance, 1966. **21**(1): p. 135-136.
- [10] Rime, B., *Capital requirements and bank behaviour: Empirical evidence for Switzerland*. Journal of Banking & Finance, 2001. **25**(4): p. 789-805.
- [11] Barrios, V.c.E. and J.M. Blanco, *The effectiveness of bank capital adequacy regulation: A theoretical and empirical approach*. Journal of Banking & Finance, 2003. **27**(10): p. 1935-1958.
- [12] Chen, J., *Capital adequacy of Chinese banks: evaluation and enhancement*. Journal of Banking Regulation, 2003. **4**(4): p. 320-327.
- [13] Al-Sabbagh, N.M., *Determinants of capital adequacy ratio in Jordanian banks*, 2004, Yarmouk University.
- [14] Ahmad, R., M. Ariff, and M.J. Skully, *The determinants of bank capital ratios in a developing economy*. Asia-Pacific financial markets, 2008. **15**(3-4): p. 255-272.
- [15] Ho, S.J. and S.-C. Hsu, *Leverage, performance and capital adequacy ratio in Taiwan's banking industry*. Japan and the World Economy, 2010. **22**(4): p. 264-272.
- [16] Gropp, R. and F. Heider, *The Determinants of Bank Capital Structure*. Review of Finance, 2010. **14**(4): p. 587-622.
- [17] Büyüksalvarcı, A. and H. Abdioğlu, *Determinants of capital adequacy ratio in Turkish Banks: A panel data analysis*. African Journal of Business Management, 2011. **5**(27): p. 11199-11209.
- [18] Bokhari, I.H., M. Ali, and K. Sultan, *Determinants of Capital Adequacy Ratio in Banking Sector: An Empirical Analysis from Pakistan*. Academy of Contemporary Research Journal, 2012.
- [19] Romdhane, M., *The Determinants of Banks' Capital Ratio in Developing Countries: Empirical Evidence from Tunisia*. Research Journal of Finance and Accounting, 2012. **3**(1): p. 35-46.
- [20] Jucá, M.N., A.F. de Sousa, and A. Fishlow, *Capital Structure Determinant's of North American Banks and the Compensation Executive Program-An Empiric Study on the Actual Systemic Crisis*. International Journal of Business & Management, 2012. **7**(17).
- [21] Abusharba, M.T., et al., *Determinants of Capital Adequacy Ratio (CAR) in Indonesian Islamic Commercial Banks*. Global Review of Accounting and Finance, 2013. **4**(1).
- [22] Atici, G. and G. Gursoy, *The Determinants of Capital Buffer in the Turkish Banking System*. International Business Research, 2013. **6**(1).
- [23] Abdul Karim, M., et al., *Capital adequacy and lending and deposit behaviors of conventional and Islamic banks*. Pacific-Basin Finance Journal, 2013.

- [24] Almazari, A.A. and M.A. Almumani, *Determinants of Capital Adequacy in the Listed Saudi Banks in Stock Market*. Asian Journal of Research in Banking and Finance, 2014. **4**(1): p. 55-64.
- [25] Mpuga, P., *The 1998-99 banking crisis in Uganda: What was the role of the new capital requirements?* Journal of Financial Regulation and Compliance, 2002. **10**(3): p. 224-242.
- [26] Gujarati, D.N., *Sangeetha.(2007). Basic Econometrics*. Tata McGraw Hill Publishing Company Limited, New Delhi, 2007. **110**(008): p. 451-452.
- [27] Idre. *Regression Diagnostics*. 2014 [cited 2014 21 March 2014]; Available from: <http://www.ats.ucla.edu/stat/stata/webbooks/reg/chapter2/statareg2.htm>.
- [28] Wooldridge, J.M., *Econometric analysis of cross section and panel data*2002: MIT press.
- [29] Drukker, D.M., *Testing for serial correlation in linear panel-data models*. Stata Journal, 2003. **3**(2): p. 168-177.
- [30] Cameron, A.C. and P.K. Trivedi, *Microeconometrics using stata*. Vol. 5. 2009: Stata Press College Station, TX.
- [31] Breusch, T.S. and A.R. Pagan, *The Lagrange multiplier test and its applications to model specification in econometrics*. The Review of Economic Studies, 1980: p. 239-253.
- [32] Hausman, J.A., *Specification tests in econometrics*. Econometrica: Journal of the Econometric Society, 1978: p. 1251-1271.
- [33] Park, H.M., *Practical Guides To Panel Data Modeling: A Step-by-step Analysis Using Stata*, 2011, Tutorial Working Paper. Graduate School of International Relations, International University of Japan.
- [34] Torres-Reyna, O., *Panel Data Analysis Fixed & Random Effects (using Stata 10. x)*. Retrieved from <http://www.princeton.edu/~otorres/panel101.pdf>, 2011.

Appendix

Table A1: Regression Results

	Fixed Effect	Robust Fixed Effect	LSDV Individual Effects	GLS Estimation
ltd	0.0338 [0.83]	0.0338 [0.75]	0.0338 [0.83]	-0.115* [-2.45]
loa	-0.208** [-3.48]	-0.208* [-3.07]	-0.208*** [-3.48]	0.0227 [0.36]
npl	-0.0744 [-0.78]	-0.0744 [-0.91]	-0.0744 [-0.78]	0.101 [0.80]
roa	-0.155 [-0.62]	-0.155 [-1.08]	-0.155 [-0.62]	0.961*** [3.72]
lev	0.710*** [11.14]	0.710*** [10.56]	0.710*** [11.14]	0.519*** [7.86]
dpo	0.014 [1.33]	0.014 [1.60]	0.014 [1.33]	0.0314** [2.84]
lnsize	5.072*** [4.20]	5.072** [4.70]	5.072*** [4.20]	-1.359*** [-3.49]
bank1			-13.05*** [-5.01]	
bank2			-2.623*** [-3.37]	
bank3			-6.894*** [-5.85]	
bank4			-3.419** [-2.88]	
bank5			-10.90*** [-5.27]	
bank6			-10.22*** [-4.97]	
bank7			-9.072*** [-4.69]	
bank8			-11.85*** [-4.80]	
bank9			-9.408*** [-3.73]	
_cons	-77.80** [-3.44]	-77.80** [-3.69]	-70.06*** [-3.32]	38.26*** [4.91]
N	50	50	50	50

t statistics are in bracket, * p<0.05, ** p<0.01, *** p<0.001

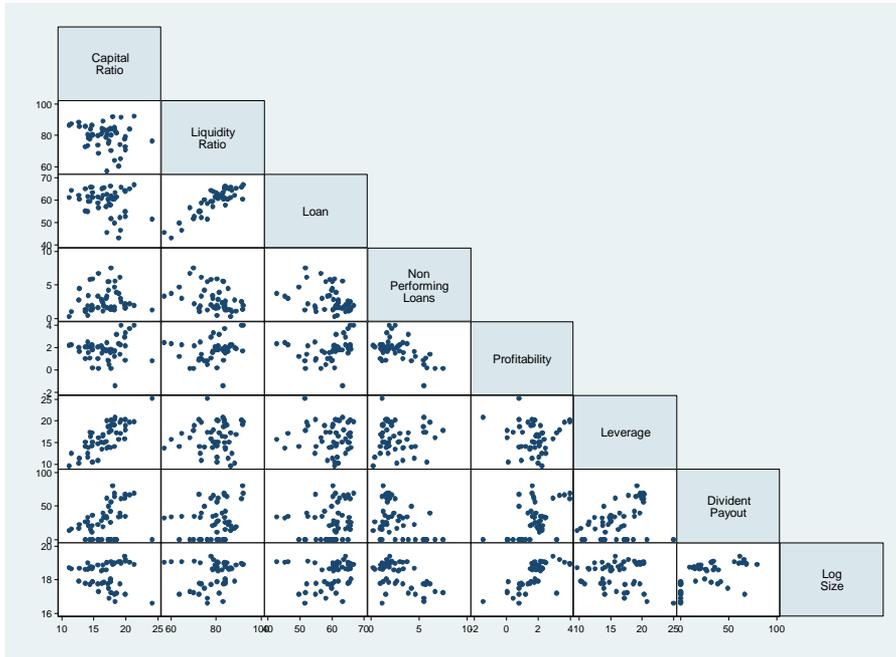


Figure A1: Scatter Plots of CAR against Each of the Predictor Variables

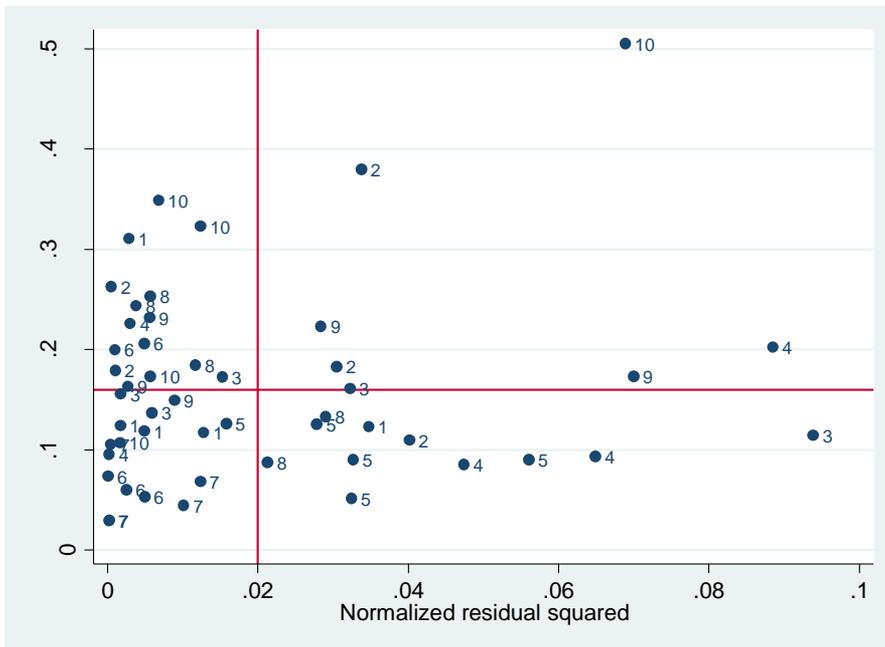


Figure A2: Plot of the Leverage by the Residual Squared (a)

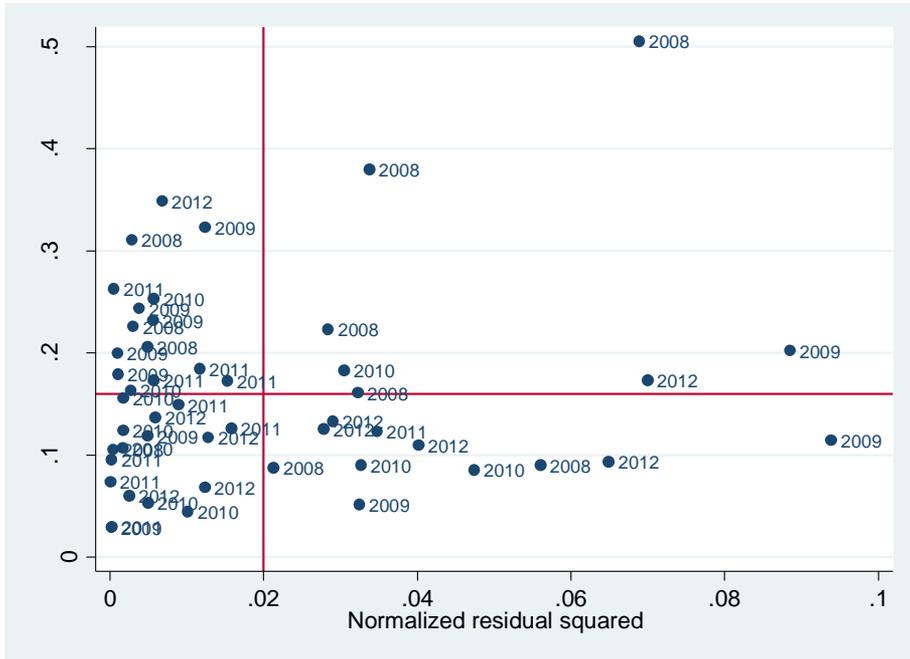


Figure A3: Plot of the Leverage by the Residual Squared (b)

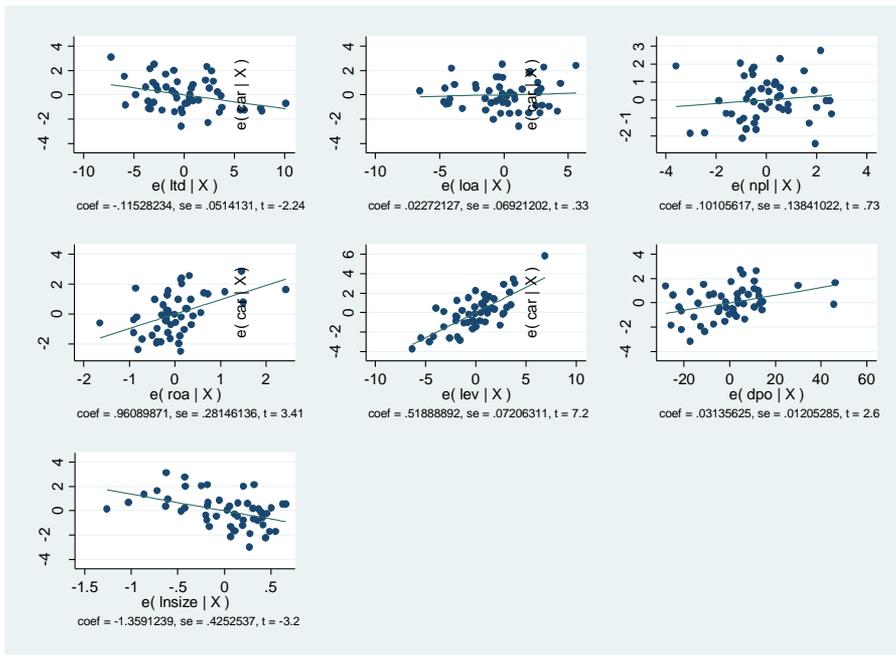


Figure A4: Added Variable Plot

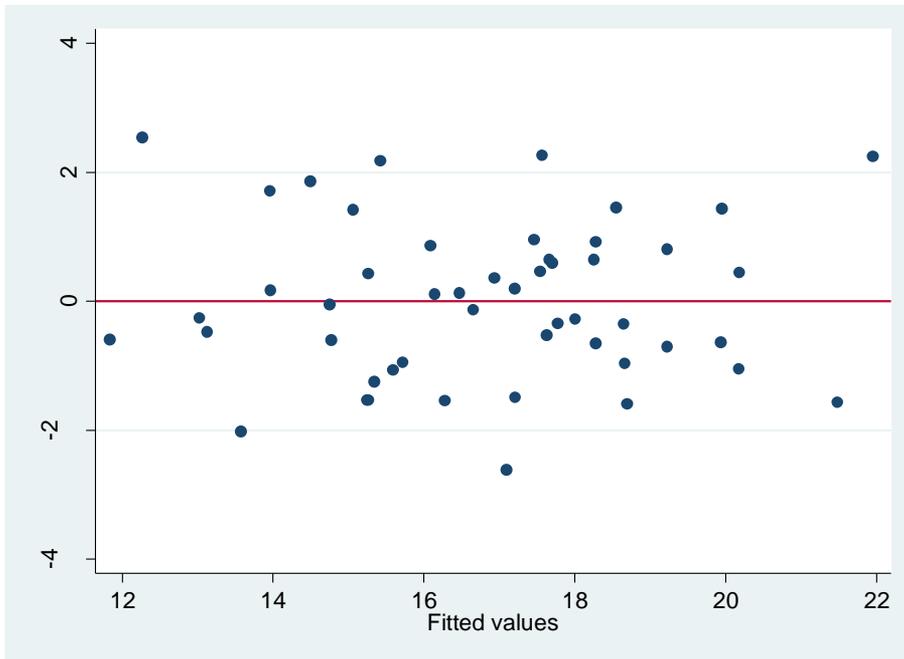


Figure A5: Plot of the Residuals Versus Fitted(Predicted) Values