Investigating the Impact of Bank Efficiency and Macroeconomic Variables on Risk Management of Banks

Mehdi Mehranfar
PhD Student of Economics, Institute for Management and Planning Studies (IMPS), Tehran, Iran
Email: mehdi_mehranfar@ut.ac.ir

Abstract

Banks play essential role within economy due to their depositing and lending operations. Having a role of an intermediary between borrowers and lenders, banks (especially commercial banks) can positively contribute to the health and stability of economy. Proper functioning of this system depends on the proper use of resources collected and this requires accurate assessment of hazards and risks, and recognition methods to deal with the risks that lie ahead. Due to this issue, this study focuses on factors affecting risk management efficiency in the Iranian banking industry. For empirical investigation, we employed Panel regression analysis taking a stratum of time series data and cross-sectional variants of macro and bank-specific factors for period covering 2001 to 2009. Result for panel regression indicates that risk management efficiency in Iranian banks is not just affected by bank-specific factors but also by macroeconomic variables. Empirical results show a positive relationship between the liquidity, profitability, operating efficiency and economic growth with capital adequacy ratio, while, the credit risk and inflation rates have the opposite effect.

Keywords: Risk management, Bank efficiency, capital adequacy, Basel, cyclicality.
JEL Classification: E32, G21, G32

1. Introduction

The banking sector is probably the most important financial intermediary in an economy because of the role it plays as a provider of liquidity in monitoring services and as producers of information (Diamond and Dybvig, 1983). In Iran, due to economic structure and reasons such as lack of development of the economy and capital markets and the banking conventional networks, the financing of the real sector of the economy, is the responsibility of the banking sector. Proper functioning of this system depends on the proper use of resources collected. In other words, banking system will be able to contribute to the economic development if the collected resources are used in an appropriate manner. This requires accurate assessment of hazards and risks, and recognition methods to deal with the risks that lie ahead. All banks and financial institutions must improve their understanding and practice of banking risk management to be able to successfully manage different product range. If the process of bank risk management and global management system is effective, then the bank will be successful. Banks can successfully manage the risks that banks recognize the strategic role of risk, if used paradigm for analysis and management to increase efficiency. So Identification and control of these risks for the banking and financial sector is very important.

To evaluate the performance of banks and credit institutions, some of financial indicators are used that capital adequacy ratio is very important among them. Adequate capitalization of the banking system is essential to maintain health. Each of the banks and credit institutions to ensure the stability and sustainability of their activities should establish the appropriate ratio between the capital and the risk of its assets. The main function of this ratio is supporting banks against all of financial and non-financial risks of banks, unexpected losses and so protecting depositors and creditors. So, accurate calculation of this ratio as a risk management efficiency indicator is very important.

Although capital generally accounts for a small percentage of the financial resources of banking institutions, it plays a crucial role in their long-term financing and solvency position and therefore in their public credibility. In the event of a crisis, the lower the leverage ratio is, the lower the probability that a bank will fail to pay back its debts. All these suggest the need for an analysis of how banks should set their capital to assets ratio.

A core objective of this study is to empirically investigate key determinants of bank risk management efficiency in Iran. For this purpose, a panel regression model is specified to show the relationship between risk management efficiency in banks and other determinants of bank performance such as bank specific indicators and macroeconomic variables. Macroeconomic components such as GDP growth rate and inflation are included in the model to reflect the cyclicality of bank operations to economic changes.

The structure of work is as follows: first section is the introductory part which aims at giving a background of the study, statement of problems, objectives and the significance of research. Section two reviews related literatures on risk management in banks. It provides a broad definition of the concept. The third section describes the methodology for analyzing this topic. Section four analyzes results and findings, and section five gives a summary of our findings, policy recommendation and concludes the study.
2. Literature Review

Banking activity is exposed to many types of risk, including such as credit, interest rate, foreign exchange, liquidity, derivatives, operational, compliance, strategic and reputation risk. Controlling the effect of those types of risk is one of the main objectives of the Bank’s and the Group’s management, and the risk level is an important factor of the planning process.

Risk management involves risk identification, risk measurement (and quantification), and mitigation. However, a point to note here is the perception of what constitutes risk to a firm may differ from institution to institution, time to time, and industry to industry. This section identifies the theoretical meaning of risk management as defined by different scholars.

Ozturk (2007) defines risk management as the process by which managers satisfy their risk taking needs by identifying key risks, obtaining consistent, understandable, operational risk measures, choosing which risks to reduce and which to increase and by what means, and establishing procedures to monitor the resulting risk position. In other words, risk management is the process of assessing operational dangers of a particular position, measuring its magnitude, and mitigating such exposures in order not to deter the institutional goals of the banking firm.

The banking risk management process in the Group includes the following activities:

- Risk identification which consists in defining both current and potential risk sources, which result from the Bank’s current and planned activity,
- Risk measurement,
- Risk management which consists in taking decisions as to the acceptable risk level, planning of activities, issuing recommendations and guidance, and developing the procedures and ancillary tools,
- Monitoring which consists in the ongoing monitoring of the risk level based on the adopted risk measurement methods,
- Reporting within which the management are informed on a cyclical basis on the scale of risk exposure and activities undertaken.

Ahmad et al. (2009) used an unbalanced panel data to evaluate the core determinants of bank capital. They applied capital adequacy ratio as a dependent variable, on other indicators such as proxy on ratio of non-performing loan to gross loan, market risk index, net interest margin, ratio of total liquid asset to total deposit, and size of the bank which was taken as natural log of total assets.

Altonbas et al. (2000) and Fadzlan and Habibullah (2010), have employed panel data statistics to check the impact of bank-specific variables on capital adequacy in banks. Fadzlan and Habibullah included GDP growth and inflation into their model to reflect sensitivity of bank performance to macroeconomic conditions. Flamini et al. (2009) applied growth in bank capital as a dependent variable, proxy on liquidity ratio, earning to capital ratio, deposit growth rate, interest sensitivity ratio, among others.

Reviewing these studies, we observe that in most of them, the role of macroeconomic factors in risk management of banks is ignored, while some of the existing literature emphasizes on the necessity of assessing the role of these variables. Hence in the present study, we examined the role of macroeconomic variables and bank-specific factors on capital adequacy ratio of banks.

3. Methodology and Variable Description

A core objective of this study as earlier stated is to check the efficiency of banks risk management usually determined by bank-specific factors indicated by profitability and other performance indices. Progressively, Panel analysis will be used to check the impact of macroeconomic indicators such as GDP growth and inflation rate, in addition to bank-specific factors on bank capital adequacy in Iran.

3.1. Dependent Variable

Bank capital has always been a central and vexing issue in the context of financial health and safety of a bank. It can in fact be said that the ultimate strength of a bank lies in its capital fund given its significance as a tool for meeting liabilities in a financial crisis and as a cushion for insulating a bank from the vagaries of the market adversity. Increase in capital ceteris paribus is expected to enhance earnings by reducing the expected cost of financial distress including bankruptcy: Oluyemi (1996), Nanon (1999) and Mathura (2009).

Ebhodaghe (1991) defines capital adequacy as a situation where the adjusted capital is sufficient to absorb all losses and cover fixed assets of the bank leaving a comfortable surplus for the current operation and future expansion. Functionally, adequate capital is regarded as the amount of capital that can effectively discharge the primary function of preventing bank failures by absorbing losses. On the other hand measurement of capital for adequacy purposes is determined by several factors (both internal and external) influencing the level of risk occasioned by operation. Furthermore the level of capital perceived to be adequate at one time may need to be adjusted over time as the risk characteristics the competitive environment, markets and economic conditions in which the bank operates change.

Capital adequacy management is designed to provide cushion for absorbing operational losses; afford some measures of shareholders confidence and reveals the bank’s ability to finance its capital project as well as ensure some level of protection for depositors’ funds; Greuning and Bratanovic (2003).
Capital adequacy is a term used to describe the adequacy of a bank’s aggregate capital in relation to the risks which arise from its asset portfolio, off-balance sheet transactions, its common operations and all other risks associated with its business (Hitchins et al., 2001). Following Kwan and Eisenbeis (1997), Berger and Young (1997), Hitchins et al. (2001), Ojo (2008), and Ahmad et al. (2009) among others, this study sets capital adequacy as a dependent variable as indicator of risk management efficiency. In line with the Basel framework for risk management, capital adequacy stands as a prudential requirement for risk operations of a financial institution. In other words, the efficiency of the internal based risk models is based on capital sufficiency of the system. The minimum risk-based standard for capital adequacy was set by Basel Accord, i.e. 8% of risk-weighted assets of which the core capital element should be at least 4%. Oftentimes a bank statutory capital is considered as adequate if it is enough to cover the bank’s operational expenses, satisfy customers’ withdrawal needs and protect depositors against total or partial loss of deposits in the event of liquidation or losses sustained by the bank; Onuh (2002) Crosse and Hansel (1980).

The 1988 Basel Accord on the international harmonization of regulatory bank capital requirements has been criticized for quite a while as being too crude and out of line with the evolving standards for managing and assessing bank performance. A central focus of the Basel guide has been on capital adequacy as a cushioning mechanism for risk exposure of bank assets. In other words, a higher exposure of a financial institution to credit and operation risk will require an augmentation of its capital to safeguard future operation in case of losses from such risk. The shortcomings of the Basel I led to a re-structuring of its tenets and a subsequent re-birth of the Basel II Accord. The recent world financial downturn also exposes the inadequacies of the Basel II which focus on capital adequacy. A new framework tagged Basel III has been proposed and the new banking guide has been scheduled to be implemented in the G20 economies starting from 31st of December 2011. A major concern of the Basel framework is its inability to explain systemic risk which could come as a result of economic changes. Its applicability to developing countries such as in the case of Iran has also raised more questions.

Under the 1988 Basel Accord, bank capital is grouped under tier 1 and tier 2 capital. In our regression equation, the total risk-weighted capital adequacy ratio (CAR) acts as the dependent variable (Jacques & Nigro 1997; Ediz et al. 1998; De Bondt & Prast 2000; Rime 2001). CAR is defined according to the 1988 Basel Accord and is calculated as:

\[
\text{CAR} = \frac{\text{Tier 1 capital + Tier 2 capital}}{\text{Total risk weighted assets}} \times 100
\]

For banks, tier 1 capital consists primarily of shareholders’ equity and other reserves, whereas tier 2 includes general loan loss provisions and subordinated debt. The denominator for the risk-weighted capital ratio is total risk-weighted assets. Total risk-weighted assets are the sum of the products of the book value of each asset and their corresponding risk weights. A risk weight is assigned according to the credit risk of the asset following the standard Basel 1 weightings of 0, 10, 20, 50 and 100%.

3.2. Descriptive Variables

Six explanatory variables from the literature are chosen as the determinants of risk management efficiency in the Iranian banks. Four bank-specific factors applied in our model, which are mainly influenced by the banking firm’s policy, such as risk asset portfolio, liquidity ratio, management quality and profitability. Two macroeconomic determinants also incorporated that includes economic growth and inflation rate. Liquidity as a bank-specific factor is included to show responsiveness of a bank to its short term obligation. It measures the ability of a bank to generate cash or turn quickly receivable assets into cash. An increase in bank liquidity (high LQR), has a positive impact on the capital ratio through its effect on the changes in required rate of return on bank shares. As the proportion of funds invested in cash and cash equivalents increases, bank liquidity risk must decline. This lowers the liquidity premium on the required rate of return on bank shares (Angbazo, 1997). This rate in turn may encourage banks to raise equity. On the other hand, this is also positively related to bank leverage given that the risk to equity holders increases with leverage. As this risk rises, so will the cost of equity capital. The bank-specific determinants used in the modeling include credit to total asset ratio which is a measure for counterparty exposures of banks. Credit risk is understood as the risk of incurring losses as a result of counterparty default in the settlement of liabilities towards the bank or the risk of decrease in the economic value of the bank’s receivables as a result of deterioration of the counterparty’s ability to service its liabilities. Other determinants include profitability, measured by Rivard and Thomas (1997) as return on asset (ROA); The ROA is used to incorporate bank profitability as a bank-specific determinant of risk management efficiency. Saunders and Wilson (2001) proved that a better performing bank with good returns on asset and consistent management policies can be well capitalized for future operations. It is expected that a positive relation exist between capital position and profitability of a bank as indicated in our study as ROA. Operation efficiency is also considered as a bank-specific determinant of risk management efficiency. OPR has been computed as net operating income divided by operating expenses. The operating efficiency is also a good measure of
management quality. The impact of operating efficiency ratio on capital is expected to be positive, because an increase in this ratio, means the management is better positioned for profit.

In the present study, we explore the relationship between bank risk management and the business cycle. There are several reasons why bank risk management efficiency may be pro-cyclical. During economic boom, banks augment capital base through plowback profits and increased participation in the capital market; while in periods of contraction, slowing down business transactions in the money sector, makes the social cost of funding bank assets high. Moreover, loan defaults are more common in times of economic recession. Rapidity of loan defaults which negatively affects banks’ profitability and capital position is a common feature of cyclicity of the banking sector (Sathye et al., 2003). Saunders and Wilson (2001) established a positive relationship between capital adequacy and economic cycles. (see further examples in, Borio et al., 2001; Nier and Zucchino, 2005; and Wu and Bowe, 2010). However, Berger et al. (2004) argue that banks may be faced with increasing demand for loans during economic expansion, but restrain supply during recession to avoid possible losses caused by economic downturn.

Demirguc-Kunt and Huizinga (1998) and Bikker and Hu (2002) have studied the impact of economic conditions on bank efficiency. Their findings suggest that such correlation exists, although the variables used were not direct measures of the business cycle. Demirgüç-Kunt and Huizinga (1998) signified a positive linear relationship between bank suitability and the business cycle. They used the annual growth rate of GDP and GNP per capita to identify such a relationship, while Bikker and Hu (2002) used a number of macroeconomic variables (such as GDP, unemployment rate and interest rate differential). Athanasoglou et al. (2005) identified a positive relationship between bank profitability and business cycles in Greek banking industry. Neely and Wheelock (1997) measured cyclicity of bank performance with GDP per capita. Crosse and Hamsel (1980) stated that the adequacy of capital is a dynamic concept and it is influenced by the prevailing and expected economic conditions of the entire economy. However, these studies have indicated the effect of business-cycles on capital adequacy. Due to this, economic growth rate in our study is considered as a proxy for cyclicity.

In addition to the growth rate, inflation rate is included as a macroeconomic determinant. Demirguc-Kunt and Huizinga (1999); and Sufian and Habibullah (2010) identified a linkage between inflation and bank activities. Alexandre and Fabiano (2004) also emphasized on the importance of inflation in the analysis of profitability and capital adequacy.

### Table 1: Summary of Variables, description and measurement

<table>
<thead>
<tr>
<th>Variable</th>
<th>Explanation</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regressand:</strong></td>
<td>CAR</td>
<td>Capital adequacy as a measure of solvency level forced by Capital depletion</td>
</tr>
<tr>
<td><strong>Regressors:</strong></td>
<td>CRisk</td>
<td>Credit risk measures banks’ exposure to counterparty risk</td>
</tr>
<tr>
<td></td>
<td>LQR</td>
<td>short term obligations cannot be met and the bank is forced to liquidate part of its fixed assets below their market worth</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
<td>Return on Bank’s total assets</td>
</tr>
<tr>
<td></td>
<td>OPR</td>
<td>Operating efficiency as a measure of management quality</td>
</tr>
<tr>
<td></td>
<td>GRT</td>
<td>Economic growth rate is proxy for cyclicity</td>
</tr>
<tr>
<td></td>
<td>INF</td>
<td>Domestic rate of inflation</td>
</tr>
</tbody>
</table>

#### 3.3. Econometric Specification

As earlier stated, the aim of this paper is to check the efficiency of bank risk management determined by both bank-specific and macroeconomic factors. We estimate the following regression model using panel data techniques:

\[
CAR_{it} = \alpha + \beta_1 CRisk_{it} + \beta_2 LQR_{it} + \beta_3 ROA_{it} + \beta_4 OPR_{it} + \theta_1 GRT_{t} + \theta_2 INF_{t} + v_{it} + u_i
\]

\( (\pi_{it} = v_{it} + u_i) \)

‘i’ is a notation for individual banking firm, ‘t’ stands for time period, and \( \pi_{it} \) is the disturbance term. Decomposition of \( \pi_{it} \) is to capture error from unobserved bank specific variables \( (v_{it}) \), while \( u_i \) is the robust standard error (RSE); \( \alpha \) is the intercept, \( \beta \) and \( \theta \) are parameters for estimating bank-specific and macroeconomic variables respectively.
4. Major Findings and Discussion

For estimation of model at first we identified suitable estimation method. First, the F-test led to the validation of significant cross section effects. So the heterogeneity across banks is confirmed. Test for Fix and Random effect methods with Hausman test conducted, the Random effect method was confirmed. F-test and Hausman test results are presented in Table 2.

Table 2- Estimates of Parameters for Panel Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRisk</td>
<td>-2.27**</td>
<td>-2.58</td>
<td>0.011</td>
</tr>
<tr>
<td>LQR</td>
<td>247.71</td>
<td>14.89</td>
<td>0.000</td>
</tr>
<tr>
<td>ROA</td>
<td>5.91**</td>
<td>2.91</td>
<td>0.004</td>
</tr>
<tr>
<td>OPR</td>
<td>1.35**</td>
<td>2.47</td>
<td>0.014</td>
</tr>
<tr>
<td>GRT</td>
<td>0.16**</td>
<td>2.47</td>
<td>0.014</td>
</tr>
<tr>
<td>INF</td>
<td>-0.07**</td>
<td>-2.30</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Fixed Effects Test

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>d.f.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-section F</td>
<td>4.10</td>
<td>(14,110)</td>
</tr>
<tr>
<td>Hausman’s Test</td>
<td>Chi-Sq. Statistic</td>
<td>Chi-Sq. d.f.</td>
</tr>
<tr>
<td>Cross-section random</td>
<td>0.00</td>
<td>6</td>
</tr>
</tbody>
</table>

F-statistic=46.35
R-Square=0.69
D.W=1.41

* and ** shows 1% and 5% level of significance, respectively.

As expected, credit risk is negatively and significantly related to bank risk management efficiency. This shows that in the Iranian banking system, managers attempting to maximize profits, have followed a risk-averse strategy, mainly through policies that improve screening and monitoring credit risk.

From our empirical results, LQR parameter is statistically significant and positive at 1 percent. This shows that bank risk management efficiency in Iran, are positively correlated with their liquidity position. It is important for a bank to ensure that its current assets are well matched with current liabilities. In other words, a bank with low liquidity is prone to having untimed operational misadventure whereby it cannot fulfill its short term obligations to customers. In this situation, a bank may have to liquidate part of its asset or take from its capital to service such obligations. This means low liquidity will affect capital ratio negatively and so, has positive movement with capital adequacy ratio.

In the case of ROA, our empirical results show a positive result for impact of ROA on CAR, compatible with theoretical expectation and findings from Cebenoyan et al. (1999), and Saunders and Wilson (2001). Management quality, which has been measured as operating efficiency of the banks, indicates a positive impact on risk management efficiency. If operating efficiency ratio increase, it means the management is better positioned for profit and the impact of this on capital is expected to be positive. Model estimator for this parameter is estimated at 1.35, indicating a unit increase in management efficiency index will result in 1.35 increases in capital adequacy ratio and risk management efficiency of the bank.

Regarding macro-determinants, we find that economic growth which is a proxy for business cyclicalty has positive impact on capital adequacy of Iranian banks. In other words, Iranian banking industry is pro-cyclical to economic cycles. In times of economic boom, more capital can be easily sourced from the financial market to buffer for possible shocks from risk-taking operations of the bank, but on the other hand, during recession period, cost of capital is high and default rate on loans are high as well.

In the case of inflation, the random effect estimate shows a negative coefficient. When the inflation rate is high, equity holders usually demand for higher returns, and this makes cost of funds high. In this case, capital augmentation is an expensive process due to increasing inflation.

Durbin Watson result for autocorrelation shows there is no first order autocorrelation in the models. For our model, R^2 is 0.69 under the random effect model. This means that about 69 percent variation in capital ratio is explained by changes in selected bank-specific and macroeconomic variants.

5. Summary and Conclusion

A core objective of this study is to empirically investigate the key determinants of bank risk management efficiency in Iran. We examine long run equilibrium among financial ratios with bank-specific variables, macroeconomic factors, and capital ratio as indicator for risk management efficiency. Panel regression methodology was employed to envelope both bank-specific and macro-determinants. Our empirical results show that bank capital adequacy is positively associated with liquidity, operating efficiency and profitability, while credit risk ratio has opposite effect on it. Considering our findings from the panel regression analysis, it has been established that macro-determinant-economic growth, has positive impact on risk management efficiency among Iranian banks; and inflation is negatively related to bank’s capital.
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adequacy, in accordance to prior theoretical expectation. In other words, our results indicate that risk management efficiency in Iranian banks is not just affected by bank-specific factors but also by macroeconomic variables.

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