Managerial Finance

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Article information:
To cite this document:
Permanent link to this document:
http://dx.doi.org/10.1108/MF-05-2015-0145

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Relationship between Operational Risk Management, Size, and Ownership of Indian Banks

Abstract

• Purpose

This paper attempts to analyze the relationship between Operational Risk Management (ORM), Size, and ownership of Indian Banks. This is important in the context of financial crisis experienced by developed countries due to lax regulation.

• Design/methodology/approach

ORM practices of Indian banks are proxied by excess capital (over the required minimum capital for operational risk). Size of a bank is measured as deposits plus advances. Our sample includes 61 Indian banks during the period from 2010 to 2013. We empirically examine the impact of bank size on excess capital using panel data regression model.

• Findings

The results suggest that size of Indian banks is inversely related to excess capital held by them for managing operational risk. The inverse relationship implies that smaller banks hold higher excess capital over the required minimum as per Basel norms. There is no significant relationship between ownership (public, private, and foreign) and excess capital held by banks for managing operational risk.

• Practical implications

The study has implications for Indian banks given the high level of losses due to bad loans, and the implementation of Basel III norms by the central bank, i.e. Reserve Bank of India (RBI).

• Social implications

The study has implications for Indian financial system as a large percentage (about 33%) of household savings are deployed in deposits with commercial banks and other financial institutions. The bank failure(s) can have disastrous consequences for the Indian economy as the capacity of the Indian financial system to withstand such shocks is highly doubtful.

• Originality/value

There is very little evidence on operational risk management practices of Indian banks, and its relationship with size and ownership. The study assumes significance in the context of significant changes in the institutional and regulatory framework.
Keywords: Operational Risk, Excess Capital, Capital requirement, Risk Management, Indian Banks, Size, Ownership.

Classification: Research Paper
1. Introduction

Operational risk management (ORM) has been receiving attention by regulators and risk managers, trying to measure and mitigate its fatal effects on their organization during last two decades. Financial institutions began to identify operational risk from 1990’s (Janakiraman, 2008). After a series of high profile incidents and corporate failures such as Barings, Allied Irish, Daiwa and others (see Appendix); banks have been seeking a holistic framework for managing their operational risks. Finally, Basel Accord emerged as a universal remedy for operational risk management in banks (Chernobai et al., 2007).

The fraud and external events (such as natural disasters) leading to operational losses existed before, but the technological evolution has increased the potential of operational risk in recent times (Buchelt and Unteregger, 2004; Li, 2003). Dowd (2003) argued the following developments (see table 1) which have increased the likelihood of operational loss events.

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Insert Table 1 about here

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Banks, as leading financial intermediaries, face considerable credit, market and operational risks which can have significant effect on their earnings. The bank’s ability to survive under adverse economic conditions is relevant to the manner of its risk management practices, and methods of capital adequacy computation. Capital adequacy prevents individual bank bankruptcy and also creates a reliable banking system (Gardener and Ayling, 1984).

Basel Committee has developed minimum capital for managing operational risk in its second version accord (Basel Committee, 2004). Financial institutions across the world have been developing advanced operational risk management systems and are using rating companies to estimate operational risks to determine corporate financial ratings (see, for example, Moody’s investor’s service, 2003 and Fitch ratings, 2004).

These financial institutions such as banks play an important role in the economy. India as one of the world’s biggest economic player has huge volume of financial transaction domestically as well as internationally. Despite the vital role of banks in smoothing financial transactions, still majority of banks are utilizing manual techniques for managing their risk for dealing with future losses. These require an urgent realization by banks of their inherent weakness and adopt highly sophisticated advanced techniques for managing their operational risk. Although, Basel III capital regulations have been implemented in India from April 1, 2013 still many banks are not qualified to put it into action. Indian financial institutions need to adequately address operational risk similar to market and credit risk. Non-identification and mismanagement of operational risk might lead to failure of banks. Hence, this study assumes importance in the context of very limited evidence on operational risk management in financial institutions in emerging economies.
like India. This study contributes by analyzing the impact of size and ownership of Indian banks on the capital requirements for ORM practices.

Our study contributes to the risk management in the banks and especially in Indian banks by examining the relationship between the size of banks and the amount of capital which they keep aside as a buffer against their future operational losses. Our results suggest that size of banks is inversely related to excess capital signifying that Indian banks (especially small banks) should have in-depth assessment of their risk-weighted assets. This would help to identify and measure actual operational risk and classify assets into different risk categories to achieve better allocation of capital for managing operational risk. Hence, empirical results of this study could be valuable for bank regulators, risk managers and bank executives. The implications of this study apply directly to the banks which bear high level of losses due to operational failures and also high level of bad loans. It has also implication for implementation of Basel III norms by central bank of India (RBI).

The paper is organized as follows. Section 2 discusses the trajectory of Basel Accord and explains the minimum capital requirements for managing operational risk as per Basel rules and also argues its computing method in case of Indian banks. Section 3 reviews the relevant literature on operational risk management in financial institutions. Research methodology is outlined in section 4 which discusses the data, variables and the model. The subsequent section discusses the empirical results and their interpretations. The final section concludes by discussing the implications of the study.

2. Trajectory of Basel Accord: (Basel I, Basel II, Basel III)

The Basel Accord is related to a set of recommendations on banking regulations (which includes Basel I, Basel II, and Basel III), published by the Basel Committee on Banking Supervision (BCBS).

- Basel I is the first Accord published in 1988 and contain a set of minimum capital requirements for managing risks in banks. Predominantly, Basel I consists of two types of risk namely credit and market risk.

- Basel II is the second Accord published in 2004, which created an international standard for banking regulators. This accord introduced the concept of minimum capital requirement which banks should set aside for protection against various risks faced by the bank. In contrast to Basel I; Basel II consists of operational risk as well as credit and market risk.

- Basel III is the third Accord introduced in 2013 and has been scheduled for full implementation by 2018. Basel III is a regulatory standard on bank capital adequacy, stress
testing and market liquidity. It was created to strengthen banks capital requirements by increasing bank liquidity and decreasing bank leverage.

2.1 Operational Risk

According to the Basel committee framework (2004), operational risk is defined as “the risk of losses resulting from inadequate or failed internal processes, people and systems, or external events. This definition includes legal risk, but excludes strategic and reputational risk”. The committee found that operational losses are a significant source of bankruptcy in banks and it is necessary to hold minimum capital to protect against these losses.

Basel Committee (2002) regulations have identified seven different event types of operational loss. These losses are categorized on the basis of historical experience of various operational loss events and are stated below.

- Employment practices and the safety in the working place: Losses mostly result from the acts which are not in line with the standards in employment, health, safety laws or agreements, (e.g. payment of personal injury claims, diversity or discrimination activities).
- Internal fraud: Losses can be also found in the activities concerning intention to defraud, misappropriate property or circumvent the law or company policy which involves at least one internal party.
- External fraud: Losses resulting from intention to defraud, misappropriate property or circumvent the law by a third party.
- Clients, products, and business practices: Losses resulting from the neglected failures which are not aimed intentionally. The activity is done in order to meet a professional obligation of a specific client or to have some changes in the product design.
- Damage to physical assets: Losses which occur due to the damages of physical assets from natural disaster or other events such as the disasters which are manmade including fire, explosion, terrorism, etc.
- Business disruption and system failures: Losses resulting from disruption of business or system failures such as the failures in hardware and software, system development, and varied infrastructure issues.
- Execution, delivery and process management: Losses resulting from the failures in the transaction processing, process management or the relations with trade counterparties and vendors.
2.2 Minimum capital requirement

Basel Accord outlined three methods for computing minimum capital charge for operational risk in a sequence of growing sophistication and risk sensitivity. These are the Basic Indicator Approach (BIA), the Standardized Approach (TSA) and Advanced Measurement Approach (AMA). Typically, a bank is allowed to implement the BIA or TSA for some parts of its operations and AMA for others.

Operational risk measurement can be targeted as the top down or the bottom up approach depending on the method of computing the risk charge. In the top down approach, banks use financial data from financial statements (such as balance sheet and profit and loss statement) and utilize BIA and TSA approaches. Whereas the bottom up approach utilizes the estimates from internal operational risk assessments. Thus, bottom up approach corresponds with the Advanced Measurement Approach (AMA). We briefly discuss these three approaches in the following paragraphs.

(i) The Basic Indicator Approach (BIA)

The Basic Indicator Approach is the simplest approach for computing operational risk capital charges. In this approach banks use “gross income” as a single proxy for their overall operational risk exposure. According to this approach minimum capital requirement is a percentage (15%) of the average positive gross income (GI) of the preceding three years. Years with negative gross income are excluded.

\[ K(BIA) = \sum GI \times \alpha / n \]

Where

KBIA – minimum capital charge
GI – annual gross income in a given year
n – The number of previous three years in which gross income (GI) is positive

Gross income is calculated as the sum of net interest income and net non-interest income. It includes the gross figure of any provisions (e.g. unpaid interest) and excludes earnings from sale of securities in the banking book and also excludes unusual items such as income obtained from insurance.

The main advantage of BIA is its simplicity and ease of execution. It can be practiced universally and enables comparison across banks. Although it is suitable for small banks, internationally active banks rarely use it. These internationally active banks have considerable operational risk exposure and thus rely on highly sophisticated risk management and measurement approach.

(ii) The Standardized Approach (TSA)
The standardized approach is the advanced method of measurement of operational risk in comparison with basic indicator approach. Under this approach, bank’s activities are classified into different standardized business lines. Each business line has a broad financial indicator which acts as a proxy for the amount of operational risk for each of those business lines.

Operational risk capital charged for each business line is computed by multiplying its financial indicator by “beta” factor. Beta is a proxy for the relationship between operational loss experience and the financial indicator in a specific business line. Gross Income is a proxy for operational risk exposure in each business line. The eight business lines with their recognized beta values by risk managers are listed in table 2.

In this approach, total regulatory capital is calculated as three-year average of aggregate of the capital charge across each of the business lines in each year (Basel Committee, 2006).

(iii) Advanced Measurement Approach (AMA)
This approach is the most sophisticated approach in measuring operational risk. It focuses on the use of internal measurement process which leads to establishment of a trustworthy internal loss database in banks. According to AMA, the regulatory capital charge is calculated via risk measure provided by the bank’s internal operational risk measurement system. Experts try to identify the potential risk areas for each business line according to the historical loss data, size and the frequency of their occurrence. An AMA uses four types of data for computing capital requirements of operational risk in banks which are stated below:

- Internal loss data;
- External data;
- Scenario analysis and
- Business environment and internal control factors (BEICFs).

The Basel II forecasted that there is a need for different “combinations” of the data elements depending on the conduct of the loss generating procedure. There are multiple ways that banks can use four data elements. Supervisors should precisely assess data elements and combination options to ensure that the way of computing operational risk capital corresponds with the level of risk exposure. Transparency should be maintained in defining modeling options and assumptions. Also, decisions should be supported by adequate research and analysis (Basel Committee, 2011).
2.3 Minimum Capital Requirement in Indian Banks

The central bank of India - Reserve Bank of India (RBI, 2007) has communicated the guidelines for implementation of Basel II in Indian banks to maintain consistency with the global standards. RBI regulation has mandated every Indian bank to adopt the BIA for managing operational risk from March, 2007 (Janakiraman, 2008). Owing to the default position of BIA approach, no eligibility criteria is needed for implementing it.

Basel Committee has permitted each national supervisor to compute gross income in accordance with the existing accounting practices. Indian banks would require keeping aside 15% of average positive gross annual income over the past three years as minimum capital requirement for operational risk. RBI has permitted banks to switch over to more sophisticated approaches such as the TSA or AMA for calculating the capital requirements for operational risk since April, 2012. Thus, banks must demonstrate satisfactory risk management system as per RBI standards.

3. Literature Review and Formulation of Hypotheses

The extant literature on operational risk management in India is limited. These studies have compared the ORM practices with either global or other developing nations to understand the impediments to adoption of better ORM practices.

Mehra (2013) compared Indian and global AMA-compliant banks in respect to their ORM practices. She observed that size of banks has affected the external loss data collection, deeper level of involvement of operational risk functionaries, and analysis. Further, ORM practices varied with ownership, age and size of banks. Small sized public banks and old private banks were observed to be lagging behind that of new private banks in their ORM practices. Finally her study concluded that there is a large gap in ORM practices among Indian banks and their global counterpart.

While Mehra’s study compared Indian with global AMA compliant banks; Janakiraman (2008) did a comparison of Indian banks with banks in Asia, Africa and Middle East countries. Her study highlighted that major impediments in implementing ORM in Indian banks are insufficient internal data, difficulties in collection of external loss data and complicated modeling.

Studies conducted globally also found size to be an important determinant of operational risk management. Fontnouvelle et al., (2006) demonstrate that operational losses are a significant source of risk for large banks, and the capital requirements for operational risk are higher than market risk. This finding is consistent with the amounts of capital that some large international banks allocate for operational risk. Later, Chernobai et al., (2011) validated that in US firms
most operational losses occur because of failure of internal control. Also, the firms suffering from these losses tend to be younger (small sized) and more complex with high credit risk. These studies indicate that size and ownership of Indian banks affects the capital requirement for managing ORM.

_Role of Economies of Scope and Economies of Scale_

There is evidence to suggest that economies of scale exist only for small and medium-sized banks while economies of scope exist for all banks regardless of their size (Benston et al., 1982; Berger et al., 1987; Hunter and Timme, 1989; Shaffer, 1991; Berger and Humphrey, 1991; Zardkoohi and Kolari, 1994; Wheelock and Wilson, 2001; Rime and Stiroh, 2003). Redundancy in internal firm structure plays a role as does the probability of failure for cells in a small bank. Small banks cannot invest in sophisticated internal control systems for they do not have the size to justify the same, and hence hold higher excess capital.

_Self-insurance Practices of Indian banks_

All Indian scheduled commercial banks are obliged to keep 4% of their net demand and time liabilities (NDTL) as liquid cash with the Reserve Bank of India (RBI), the country’s central bank. This is known as the cash reserve ratio (CRR), and can be used by banks as first line of defense in the event of a run on them.

They are also obliged to invest 21.5% of their NDTL in safe liquid securities such as bonds issued by government of India and provincial governments among other securities approved by the central bank. This is known as statutory liquidity ratio (SLR), and can be used by banks as second line of defense in the event of a run on them.

The deposits with Indian banks are also insured up to a maximum of Rs.100,000 with the Deposit Insurance and Credit Guarantee Corporation of India (DICGC), which is a wholly owned subsidiary of RBI. The depositors will receive a maximum of Rs.100,000 from DICGC in the event of a bank’s failure.

The RBI ensures that the banks’ loan and investment portfolios are well diversified by imposing appropriate restrictions on exposure to a single firm, group, industry, and a sector. The smaller banks carry higher risk and hence are expected to hold (relatively) higher excess capital while bigger banks carry lower risk and hence are expected to hold (relatively) lower excess capital (Gropp and Heider, 2010). Also, large banks hold well diversified portfolio of loans, investments and other assets. They also diversify into other financial services. Further, large banks are expected to hold relatively less excess capital as they have better and more sophisticated systems and skills to manage operational risk. Smaller banks cannot afford to invest in such sophisticated internal control mechanisms due to limited resources. Hence large banks are expected to hold relatively less excess capital. Therefore, we hypothesize that:
H₁: There is a negative relationship between size of Indian banks and the excess capital held by them for managing operational risk.

Ownership and Excess Capital

We expect government (public sector) banks to hold higher excess capital for operational risk compared to private and foreign banks as they enjoy relatively less operational freedom due to the government ownership and the resultant interference from politicians and bureaucrats. The loan officers and bank managers in government banks are less likely to take the initiative and be more conservative in loan decisions as their decisions are likely to be questioned any time in future, and due to the prospect of facing investigation by government agencies in the case of bad loans. These government banks receive capital from the budget of government of India, and they are not expected to earn a reasonable return unlike the private and foreign banks where the providers of capital expect higher returns on the capital lent. However, we can also argue that government banks may have some resources, networks, and clout with the regulators and hence they may not be obliged to adhere to strict regulations. Therefore, we hypothesize that:

H₂: There is a significant relationship between ownership of Indian banks and the excess capital held by them for managing operational risk.

Research Gap (s)

There is enough evidence on operational risk in banks and financial institutions in the US and Europe. The evidence on operational risk in Indian banks and capital requirements as per Basel norms in particular, is inadequate. The relationship between size and ownership, and operational risk management in Indian Banks has also not been examined extensively.

The Indian financial system didn't suffer due to the global financial crisis initiated by sub-prime crisis in the U.S. due to its inherent strengths and superior regulatory infrastructure. However, the Indian banks and financial institutions are also vulnerable like their counterparts in the US and Europe in the absence of better risk management practices and prescriptions.

This study is an attempt to contribute to the evidence on operational risk management in Indian Banks and its relationship with size and ownership.

4. Research Design

4.1 Data
The data includes annual observations for 61 Indian banks with fiscal years ending in March 2010 to 2013, and obtained from Prowess database compiled by the Centre for Monitoring Indian Economy (CMIE). Indeed, there were 205 Indian banks available in database but we excluded those banks which had not disclosed complete information related to operational risk during the above mentioned years.

4.2 Variables

- **Size of bank as independent variable**
  
  In literature, log (assets) or log (sales) is used as a proxy for size of the firm. Thus, we are using log of business (deposits and advances) as a proxy for size of bank. Size is an independent variable in this study.

- **Excess Capital as a percentage of gross income as dependent variable**

  Excess capital is defined as the difference between actual capital held by banks to manage operational risk and the minimum capital (for operational risk) required as per Basel II.

  The Basel II norms prescribe the minimum capital, which is estimated using the basic indicator approach as a percentage (α equal to 15%) of the average of positive gross income during the preceding three years. Here, gross income is defined as the sum of net interest income and net non-interest income. The excess capital is the difference between required minimum capital (for operational risk) as per Basel II Pillar 3 norms as prescribed by the Reserve Bank of India (RBI) and the actual capital held (for operational risk) as sourced from the banks’ balance sheets. The dependent variable is excess capital as a percentage of gross income (EKGI) and is defined as:

  \[
  EKGI = \% \left( \frac{\text{Excess Capital}}{\text{Gross Income}} \right)
  \]

  where

  \[
  \begin{align*}
  \text{Excess Capital (EK)} & = \text{Actual Capital (for ORM)} - \text{Minimum Capital (for ORM)} \\
  \text{Minimum Capital} & = 15\% \times (\text{Average positive gross income of preceding 3 years})
  \end{align*}
  \]

- **Ownership as Dummy Variable**

  Dummy variable classified our data on Indian banks into three different ownership groups such as government (public), private, and foreign banks. Our sample includes 21 government, 14 private, and 26 foreign banks in India during the period from 2010 to 2013.

4.3 Methodology

The following model is specified to estimate the relationship between operational risk management (ORM), size, and ownership of Indian Banks:
\[ EKGI_{i,t} = \alpha + \beta_1 S_{i,t} + \beta_2 OS_{i,t} + \epsilon_{i,t} \]

Where

- \( EKGI_{i,t} \) = \% (Excess Capital/Gross Income) for bank ‘i’ in period ‘t’
- \( S_{i,t} \) = Size for bank ‘i’ in period ‘t’
- \( OS_{i,t} \) = Ownership Dummy for bank ‘i’ in period ‘t’
- \( \epsilon_{i,t} \) = Random error term

We first estimated Equation (1) by pooling the data for all banks (pooled OLS) (column 1, Table 4). Due to omitted variables, the OLS results may be biased, and hence panel data techniques may help. Subsequently, we estimated both – fixed effect (FE) and random effect (RE) models. The presence of individual FE is tested with an F-test. Since estimated F value (4.87) is greater than tabulated value, we reject the null hypothesis (i.e., model is pooled OLS) and we need to do FE and RE. Columns 2 and 3 of Table 4 give FE and RE estimates. Whether these omitted variables (bank-specific differences) are fixed or random are tested using Hausman (1978) Test as given in the last row of Table 4. Since the test statistic (0.17) is less than the critical value of a Chi-squared (1df, 5%) (3.84), we accept the null hypothesis of RE being more efficient. We carried out additional tests i.e., Breusch–Pagan (1979) Lagrange-Multiplier test to check for RE. As LM (Lagrange-Multiplier) value (211.03) is greater than the critical value, we reject the null hypothesis, thus indicating the presence of individual random effect. The presence of autocorrelation cannot be ruled out as we used panel data. We employed Feasible Generalized Least Squares (FGLS) method to estimate the parameters (Column 4 of Table 4) due to the problems of heteroskedasticity and autocorrelation. Subsequently, we interpreted only FGLS model (i.e., Column 4) as it is a cross-sectional time-series regression. The assumption here is that each group/panel will have errors which follow the same AR (1) process; that is, the autocorrelation parameter is the same for all groups.

5. Empirical Results

As can be seen from row 1, table 4, size of bank is negatively related to excess capital (EK). This negative relation is in conformity with the findings of Mehra (2013) that smaller banks lag in their ORM practices and hence hold larger amount of excess capital. There is no significant relationship between ownership of banks and excess capital held by them.

The presence (or absence) of autocorrelation in panel data is tested using the Wooldridge (2002) test for autocorrelation (where null is no first order correlation). The estimated value is 8.31 with a level of significance of 1% confirms the presence of autocorrelation.

The presence of group-wise heteroskedasticity is tested with modified Wald test. The chi-square value of 344 confirms the presence of heteroskedasticity. The generalized least square
model is used to overcome the problems of heteroskedasticity and autocorrelation. The results are given in column 4 of Table 4. The coefficient of size retains the same sign and becomes more significant after the correction.

The summary statistics during the sample period are presented in Table 3. Log excess capital has a mean of 1.7 and a standard deviation of 1.45 whereas log size has a mean of 12.51 with a standard variation of 2.35. The variance inflation factors affirm the absence of multi-collinearity among the variables since the values are well within the acceptable limits.

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Table 4 includes the results of the regression of excess capital on size and ownership of banks. Bank size is significant with a negative coefficient ($\beta = -0.18$, z-stat = -4.61, p = 0.01). This confirms the expected negative relationship between size of Indian banks and the capital held by them for managing operational risk. The results indicate that one per cent decrease in business (deposits plus advances) will lead to 0.18\% increase in excess capital. This confirms the *a priori* expectation that smaller banks maintain larger amount of excess capital as a buffer against operational losses.

Further, the results suggest that there is no significant relationship between excess capital for operational risk held by banks and their ownership (government, private, and foreign).

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5. Conclusions and Implications

Our results suggest that size of Indian banks is inversely related to excess capital held by them for managing operational risk. This excess capital is held as buffer to manage their operational loss events. The inverse relationship implies that smaller banks hold higher excess capital over the required minimum as per Basel norms. The smaller banks are at a significantly higher risk of facing a run on and hence are expected to set aside more capital. In contrast, larger banks are less likely to face such situations, and hence keep less capital to take care of such exigencies. So, smaller banks are advised to maintain excess capital beyond the minimum stipulated by Basel norms. The smaller banks are more sensitive to risks and hence are advised to maintain higher excess capital (as a percentage of gross income).

The evidence confirms the *a priori* expectation of bigger banks holding relatively less excess capital as they have better and more sophisticated systems and skills to manage
operational risk. The smaller banks cannot afford to invest in sophisticated internal control systems due to limited resources and hence hold higher excess capital.

Therefore, regulators and risk managers have to consider this while estimating the capital requirements. They should carry out an in-depth analysis to identify potential risks, and allocate the required capital.

The results suggest that there is no significant relationship between excess capital for operational risk held by banks and their ownership (government, private, and foreign). So, government banks don’t seem to benefit from their resources, network, and clout (if any) with regulators (due to government ownership) by holding relatively lower excess capital for operational risk (as expected).

The study has implications for Indian financial system as a large percentage (about 33%) of household savings are deployed in deposits with commercial banks and other financial institutions. The bank deposits accounted for 57.3% of total financial assets held by households in 2013-14. The bank failure(s) can have disastrous consequences for the Indian economy as the capacity of the Indian financial system to withstand such shocks is highly doubtful.

Further, the study has implications for Indian banks given the high level of losses due to bad loans, and the implementation of Basel III norms by the central bank, i.e. Reserve Bank of India (RBI). The study also assumes significance in the context of huge losses due to operational risk incurred by banks abroad such as Barings Bank in UK, Daiwa Bank in Japan, and Allied Irish Bank in Ireland.

References


Table 1 Developments increasing likelihood of operational loss events

- Highly automated technology
  - This might be a potential source of greater system failure risks as there is higher reliance on highly mechanized technology

- E-Commerce
  - Appearance of e-commerce has formed potential risks such as internal and external fraud and system securities issues.

- Outsourcing
  - Emergence of outsourcing measures and its contribution in clearing and settlement systems can decrease some risks, but it might also exhibit serious risks to banks.

- Mergers and Acquisitions
  - Large-scale mergers, demergers, and consolidations

- Large Volume Service Providers
  - The rising trend of banks playing the role of large-volume service providers in sourcing back and middle office functions.

Table 2 Beta values of business lines

<table>
<thead>
<tr>
<th>Business Lines</th>
<th>Beta values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Banking Corporate Finance</td>
<td>18%</td>
</tr>
<tr>
<td>Trading &amp; Sales</td>
<td>18%</td>
</tr>
<tr>
<td>Banking Commercial Banking</td>
<td>15%</td>
</tr>
<tr>
<td>Retail Banking</td>
<td>12%</td>
</tr>
<tr>
<td>Payment and Settlement</td>
<td>18%</td>
</tr>
<tr>
<td>Others Retail Brokerage</td>
<td>12%</td>
</tr>
<tr>
<td>Asset Management</td>
<td>12%</td>
</tr>
<tr>
<td>Agency Services</td>
<td>15%</td>
</tr>
</tbody>
</table>

Table 3 Descriptive statistics (Observation: 244)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess Capital</td>
<td>1.70</td>
<td>1.45</td>
<td>-2.14</td>
<td>6.10</td>
</tr>
<tr>
<td>Size</td>
<td>12.51</td>
<td>2.35</td>
<td>6.92</td>
<td>16.08</td>
</tr>
<tr>
<td>Public sector bank</td>
<td>0.23</td>
<td>0.42</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Private sector bank</td>
<td>0.33</td>
<td>0.47</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

a Natural logarithm
Table 4 Does size and ownership of banks impact percentage of excess capital to gross income? (Dependent variable = EKGI\textsuperscript{a})

<table>
<thead>
<tr>
<th></th>
<th>Pooled OLS (1)</th>
<th>FE (2)</th>
<th>RE (3)</th>
<th>Feasible generalized least squares (4)</th>
<th>Feasible generalized least squares (5)</th>
<th>Feasible generalized least squares (6)</th>
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<tbody>
<tr>
<td>Size\textsuperscript{a}</td>
<td>-0.187***</td>
<td>-0.263</td>
<td>-0.196**</td>
<td>-0.187***</td>
<td>-0.1872***</td>
<td>-0.1872***</td>
</tr>
<tr>
<td></td>
<td>(0.0499)</td>
<td>(0.294)</td>
<td>(0.0831)</td>
<td>(0.0407)</td>
<td>(0.0407)</td>
<td>(0.0407)</td>
</tr>
<tr>
<td>Public Sector</td>
<td>0.0542</td>
<td>0.0400</td>
<td>0.0396</td>
<td>0.0542</td>
<td>0.0698</td>
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<tr>
<td></td>
<td>(0.235)</td>
<td>(0.122)</td>
<td>(0.121)</td>
<td>(0.235)</td>
<td>(0.2485)</td>
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<td>-0.0121</td>
<td>-0.0143</td>
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<td>(0.113)</td>
<td>(0.114)</td>
<td>(0.216)</td>
<td>(0.2485)</td>
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<tr>
<td>Foreign Sector</td>
<td></td>
<td></td>
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<td>- 0.0542</td>
<td>0.0155</td>
<td>(0.2157)</td>
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<td></td>
<td></td>
<td>(0.2348)</td>
<td></td>
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</tr>
<tr>
<td>Constant</td>
<td>4.058***</td>
<td>5.010</td>
<td>4.159***</td>
<td>4.058***</td>
<td>4.1125***</td>
<td>4.04***</td>
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<tr>
<td></td>
<td>(0.661)</td>
<td>(3.707)</td>
<td>(1.084)</td>
<td>(0.520)</td>
<td>(0.5523)</td>
<td>(0.546)</td>
</tr>
<tr>
<td>R-square</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
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<td></td>
</tr>
<tr>
<td>F-test/Wald \chi^2</td>
<td>4.87</td>
<td>0.60</td>
<td>9.98</td>
<td>21.47</td>
<td>21.47</td>
<td>21.47</td>
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<tr>
<td></td>
<td>(0.00)</td>
<td>(0.61)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
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<tr>
<td>Hausman Test</td>
<td>0.17</td>
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<td></td>
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<tr>
<td></td>
<td>(0.98)</td>
<td></td>
<td></td>
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\textsuperscript{a} Natural logarithm
Robust standard errors in parentheses
*** p<0.01, ** p<0.05
## Appendix: Operational Loss Events

<table>
<thead>
<tr>
<th>Events</th>
<th>Year</th>
<th>Country</th>
<th>Loss Amount (billion)</th>
<th>Risk Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Société Générale Bank</td>
<td>2008</td>
<td>France</td>
<td>4.9 Euro</td>
<td>Fraud</td>
<td>Fraudulent transactions by Jérôme Kerviel</td>
</tr>
<tr>
<td>Barings Bank</td>
<td>1995</td>
<td>England</td>
<td>1.4 Dollar</td>
<td>Fraud</td>
<td>Nick Leeson, the trader in Singapore branch made bad bets on Japanese markets</td>
</tr>
<tr>
<td>Confederation Life Insurance Company</td>
<td>1996</td>
<td>Canada</td>
<td>1.3 Dollar</td>
<td>Human error and ignorance, greed</td>
<td>Officers with limited knowledge and expertise</td>
</tr>
<tr>
<td>Curragh Resources’ Westray Mine</td>
<td>1992</td>
<td>Canada</td>
<td></td>
<td>Inadequate safety system</td>
<td>26 miners were killed in an explosion</td>
</tr>
<tr>
<td>September 11</td>
<td>2001</td>
<td>United States</td>
<td></td>
<td>External event</td>
<td>Terrorist attacks</td>
</tr>
<tr>
<td>The NASA Space Shuttle Disasters</td>
<td>1986 &amp; 2003</td>
<td>United States</td>
<td></td>
<td>Human factor/ internal events</td>
<td>Challenger, and Columbia</td>
</tr>
</tbody>
</table>