A Study on the Capital Requirement to Asset Ratio (CRAR) Calculation of On Balance Sheet Items of Banks in India

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ABSTRACT

Banks deal in public money as they lend and invest funds they generate in the form of deposits. This exposes them to solvency risk. After the major banking crisis in U.S. which took place between 2007-2010, the banks of US and Europe led by the Bank for International Settlement (BIS), came up with a comprehensive set of norms for banks known as Basel Accord, which was assumed to address the solvency risk of banks across the globe. Basel norms are applicable in India with minor modifications made by the Reserve Bank of India. This paper throws light on the calculation of capital Requirement to Asset Ratio (CRAR) of on balance items of the banks under pillar I of the Basel Norms. Calculation of Capital Requirement to Assets Ratio calculation typically includes the calculation of risk weighted assets for credit risk, market risk and operational risk. In India, 9% of the total risk weighted assets should be in the form of capital to be maintained by the banks to avoid solvency risk.

Key Words: Capital Requirement to Assets Ratio (CRAR), Risk Weighted Assets (RWAs), Held till Maturity (HTM), Held for Trading (HFT), Available for Sale, (AFS), Trading book, Banking book, Credit Risk, Market Risk, General Market Risk, Specific Market Risk, Operational Risk

INTRODUCTION

The typical nature of banks is that they deal in public money. They advance funds to the customers and invest in equity, debt and derivative instruments..This makes the banks vulnerable if the investment goes bad and advances are not recovered on time. The former case exposes the banks to credit risk, whereas, the latter, exposes them to market risk. These risks, push the banks towards insolvency. Credit risk, featuring large mortgage market exposure, was the major reason of the closure of Lehman Brothers, an international investment bank.Basel norms for banks suggest to hold minimum capital of 9% by them in India of their respective total risk weighted assets to avoid solvency risk. As a risk management principle, provisions are made for average risk or mean risk, whereas, for standard deviation of risk, we are required to keep capital. In the same line, Basel norms suggest the banks to keep capital in the form of tier I, tier II and tier III capital. This additional capital requirements by the banks cost them in terms of finance cost. Credit risk is the risk of default made by the customers in their loans portfolio. This gives the major set back to the banks as it occupies a large proportion of the total assets of the banks. Total assets of a bank can be divided into funded (on balance sheet) items and non-funded (off balance sheet) items. Funded assets are those assets which involve bank's fund, whereas, Non -funded assets include items like letter of credit, bank guarantee, memorandum of understanding, etc. Non-funded assets also include derivatives.But, in this paper we are restricting ourselves to funded assets only.

Banks are exposed to market risk due to interest rate changes, foreign exchange rate changes, and inflation related matters like equity risk, commodity risk, etc. Market risk is comprised of three elements I.e interest rate risk, foreign exchange related risk (including gold), and equity risk. They form major part of the trading book of the bank. They contribute to total capital requirement for market risk in their respective proportions.

All those risks that cannot be put either in the category of credit risk or market risk, are put under the category of operational risk.Operational risk includes risks like personnel risk, system risk, IT failure risk, liquidity risk, money laundering risk, etc.

All the above mentioned risks force the banks towards insolvency. To avoid solvency risk, banks are suggested to maintain minimum capital, which is 8% of their risk weighted assets as per international standard but, in India, as per RBI's guidelines, it is 9%. Banks in India, are still following the standardized approach to measure capital for credit risk and market risk. Standardized approach to measure capital for credit risk is a static frame work and may lead to large capital requirement as almost 100% risk weight is suggested for all private sector exposures.

LITERATURE REVIEW

Capital adequacy guarantees the stability of a bank (Leila Bateni, Hamidreza vakilifard, Farshid Asghari, 2014). Capital requirement regulations under Basel I, did not increase the capital ratio of banks in the developing countries. This implies that while deciding the regulations, factors like business, environment, legal and cultural factors must be considered (M Erchad Hussain, M Kabir Hassan). Standard determinants of capital structure do have power in explaining both book capital and market leverage (Monica Octavia, Rayan Brown, 2010). In response to international financial developments after the global financial tsunami in 2008, the Bank for International Settlements (BIS) proposed BASEL III in 2010, whereby banks have to increase their minimum capital adequacy ratios year by year with a goal of 10.5% in 2019 (Yang Li, Yi- Kai Chen, Feng Sheng Chien, Wen Chih Lee, Yi- Ching Hsu). The capital adequacy ratio determines the ratio of a bank's core capital to the assets and off balance sheet liabilities, weighted by the risk. It has been specified that the value of this coefficient cannot be lower than 8% (Malgorzata Bialas, Adrian Solek, 2010). The positive relationship between capital adequacy and bank's profitability suggest that banks with more equity capital are perceived to have more safety and such advantage can be translated into higher profitability (O Agbeja, Oj Adelakum, Fi Olufemi, 2015).Capital adequacy ratio is negatively correlated with proxy variables of lending (loans), asset quality and management efficiency. However, liquidity and sensitivity are positively correlated. Indian private sector banks have excessive funds to meet their obligation and have opportunity to give more advances to public by protecting owner's stake (PK Aspal, A Nazneen, 2014). Based on the sample of 24 banks listed on the Indonesia stock exchange, there is a negative and significant relationship with return on asset. Capital adequacy ratio mediates the effect of non - performing loans on return on assets (Ni Kadek Mareti Swandawi, Ni Ketut Purnawati, 2021) Capital adequacy ratio has a positive correlation with the financial stability of Vietnamese commercial banks during 2010-2020 (Minh Sang Nguyen, 2021).

Examining a sample of 560US bank holding companies for a period of 2003-2009, results reveal that the association between the core (Tier I) capital ratio and bank failure becomes significant only if the bank's holding company has a Tier I capital ratio of less than 6%. This is the level below which US bank regulators do not regard banks as being well capitalized (Heba Abou-El- Sood, 2016).

For the smooth flow of creditin an economy, it is essential that banks should be financially sound so as to meet the various requirements of other fields. Capital adequacy ratio (CAR) is one of the measures which ensures the financial soundness of bank in absorbing a reasonable amount of loss (Nikhat Fatima, 2014).

Perhaps the market for unsecured obligations of large banks can provide an "early warning" system to alert bank investors and regulators about the capital adequacy levels of these banks (Richard H Pettway, 1976).

It was assessed that the influence of binding capital requirements, finding that low regulatory capital buffers are associated with increased insolvency risk for banks holding greater quantities of non core Tier I and Tier II capital (Thomas Conlon, John Cotter, Philip Molyneux, 2020).

Banks encounter with the credit risk as a result of credit quality deterioration (Goyal, 2010). For the purpose of assigning risk weights, risks, are categorized as a. exposure to central and state government carrying 0% risk weight, b. public sector banks carrying risk weight ranging from 0-20%, and c. others carrying carrying 100% risk weight (Hull C. John, "Risk Management and Financial Institution", ISBN 81-317-482-9; First Impression, p184),

Basel I's achievement of uniform risk weight categories ironically emerged as one of the framework's greatest flaws. The categorical risk weights were not only crudely calibrated but they permitted and indeed encouraged

regulatory arbitrage. For example, OECD member countries such as Greece or Iceland received the same zero percent risk weighting for their debt as the United States and the United Kingdom. The same was true with respect to the uniform 100 percent risk weight.

Market risk is the second type of risk which the banks are exposed to. Market risk can be defined as the loss in value of assets held by the banks in the market due to movements and alteration in market prices (Goyal, 2010).

In the 2007-2008 financial crisis, operational risk factors played a significant role in fuelling its duration and severity (Erika De Jongh, Dawie De Jongh, Riaan De Jongh, Gary Van Vuuren, 2013).

Objectives:

Following are the objectives of this paper:

1. To understand the calculation process of capital requirement to assets ratio (CRAR) of banks in India.

2. To understand the different approaches applied in the calculation of credit risk, market risk, and operational risk under pillar I of Basel norms.

3. To understand the treatments of investments under banking book (HTM), and trading book (AFS and HFT) categories.

MATERIALS AND METHODS

*** Participating Variables:**

The capital requirement to Assets Ratio (CRAR) of any bank depended on capital requirements for credit risk market risk and operational risk. The capital requirements, in turn, depended on the risk weighted assets for these types of risk separately. Under standardized approach, risk weighted assets for credit risk depended on various risk weights assigned to various assets of the bank. The book value of an asset when multiplied by the assigned risk weight gave risk weighted value of the asset.To calculate risk weighted assets for market risk, the total capital charge for market risk (both specific risk and general market risk) was multiplied by 100/9, where, 9 was the required capital adequacy ratio (CRAR). Market risk was comprised of interest rate risk,foreign exchange risk including gold, and equity risk. Similarly, in case of operational risk, the total capital charge was again multiplied by 100/9 to obtain risk weighted assets for operational risk.Lastly, all the risk weighted assets were totaled to obtain total risk weighted assets of a bank. In India, 9% of this total risk weighted assets should be in the form of capital, which is known as capital requirement to assets ratio(CRAR) or capital adequacy ratio (CAR).

*** Materials:**

To explain the process of calculating capital adequacy ratio (pillar I of Basel II), example cited on RBI's web site had been taken, analyzed and explained. In the context of credit risk, standardized approach was considered, as the banks in India are still passing through a nascent stage of risk management. Under the approach, risk weights as provided by the RBI, were assigned to various on balance sheet items, which provided risk weighted assets for credit risk. To calculate the capital charge for market risk, standard duration approach was used which covered the general market risk. To calculate capital charge for specific risk, the capital charges prescribed by the RBI were followed. To calculate capital charge for operational risk, the basic indicator approach, as suggested by the RBI at introductory level had been considered.

Credit risk is the risk of default made by the customers on their loans. It is the largest type of a risk a bank generally is exposed to. Under standardized approach, risk weights are already provided by the RBI for different loan categories. 0% risk weight is assigned to loans extended to either central or state government, 0 - 20% in case of public sector banks, and 100% in case of 'others' category. This 100% risk weight for 'others' category acts as a flaw of the standardized approach , as a potential private sector customer can unnecessarily be assigned a risk weight of 100%. A bank's assets can be divided into 'fund based' and 'non- fund based' assets. The assets

which involve fund of the bank are funded assets and those which do not affect the fund of the bank are known as 'non - funded' assets.

Market risk comprised capital charge for interest rate related securities, equities and foreign exchange including gold open position. Interest rate related securities and equities qualified for both specific risk and general market risk, whereas, foreign exchange position including gold qualified only for general market risk capital charge.

Specific Market Risk is the issuer specific risk, in other words, it is the default risk attached with the issuer, which issues securities in which the banks invest. Specific risk capital charges have already been provided by the RBI, open position in gold and foreign exchange carry a capital charge of 9% each. It is noticeable that 9% capital charge always equals General market risk refers to adverse movements in prices of interest rate related securities due to change in interest rates. Under standardized duration approach, it is measured with the help of 'modified duration' approach, which measures changes in value of interest rate related securities due to one per cent change in yield. The model helps in calculating the capital charges for interest rate related securities.

Operational risk capital charge, based on the basic indicator approach, is calculated by multiplying the average gross annual income of the bank of previous three years, if positive, from 15%(α).

In the light of the above discussion, the process of calculating capital adequacy ratio of banks in India has been explained in details.

Due to the very nature of the banks, the risk management becomes all pervasive across sectors and, banks are no exception. Banks deal in public money which is accepted by them as deposits which are then lent to different entities and invested in various government and other securities. This makes a bank vulnerable in the sense that if the loans extended and investments made goes haywire, the entire bank lands into a financial crisis. This was the reason for the closure of Lehman Brothers, which was the biggest investment bank incorporated in the USA. In the light of this failure, Basel I was released in July, 1988 to provide a framework to address risk management from a bank's capital adequacy perspective.

In other words, according to the norms, banks were required to keep a capital of 8% of their credit risk weighted assets. Basel I dealt with credit risk only.

A revised capital framework was introduced in June, 2004 known as Basel II. this revised framework comprised three Pillars.

- Pillar I was related to the calculation of capital adequacy ratio.
- Pillar II was related to supervisory review, which provide freedom to banks to migrate to higher level of risk management models to assess their respective risks.
- Pillar III was related with disclosure requirements by the banks which called for disclosing all the relevant facts related to the risk exposures to the general public through their financial statements and reports.

Basel II is considered to be the skeleton of the Basel norms in terms of structure. The Norms are modifiers and restructured keeping Basel II as base.

Basel II extended itself to the calculation of capital adequacy for market risk and operational risk also.

Basel III Augmenting and superseding parts of the Basel II standards, it was developed in response to the deficiencies in financial regulation revealed by the financial crisis of 2007-08. Banks were required to strengthen their capital requirement by increasing minimum capital reserve, holding of high quality liquid assets to address liquidity risk and decreasing bank leverage. By decreasing bank leverage it was sought by the authorities to lessen the dependency of banks on debt capital.

Here we will focus on pillar I, as to how to calculate capital adequacy ratio for the banks.

[Data sourced from https://rbidocs.rbi.org.in/rdocs/content/pdfs/86BS010715F_A10.pdf]

Case I: where the trading book does not contain equities and interest rate related derivative instruments.

A bank may have the following position:

Sl.No.	**Details**	**4700**
1	Cash & Balances with RBI	**4700**
2	Bank balances	**4700**
3	Investments	**4700**
	3.1 Held for Trading (Market Value) 3.2 Available for Sale (Market Value) 3.3 Held to Maturity	**4700**
4	Advances (net)	**4700**
5	Other Assets	**4700**
6	**Total Assets**	**4700**

Source:
https://iibf.org.in/documents/MasterCirculars/RiskManagement/1.%20Prudential%20Norms%20on%20Capital%20Adequacy%20-%20Basel%20I%20Framework.pdf

In terms of counter party, the investments are assumed to be as under:

Government - Rs.1000 crore

Banks - Rs.500 crore

Others - Rs.500 crore

For simplicity sake the details of investments are assumed to be as under:

Government Securities

Date of Issue	**Date of reporting**	**Maturity Date**	**Amount in crore**	**Coupon (%)**	**Type**
01/03/1992	31/03/2003	01/03/2004	100	12.5	AFS
01/05/1993	31/03/2003	01/05/2003	100	12	AFS
01/03/1994	31/03/2003	31/05/2003	100	12	AFS
01/03/1995	31/03/2003	01/03/2015	100	12	AFS

01/03/1998	31/03/2003	01/03/2010	100	11.5	AFS
01/03/1 999	31/03/2003	01/03/2009	100	11	AFS
01/03/2000	31/03/2003	01/03/2005	100	10.5	HFT
01/03/2001	31/03/2003	01/03/2006	100	10	HTM
01/03/2002	31/03/2003	01/03/2012	100	8	HTM
01/03/2003	31/03/2003	01/03/2023	100	6.5	HTM
Total			**1000**		

Bank Bonds

Date of Issue	Date of reporting	Maturity Date	Amount in crore	Coupon (%)	Type
01/03/1992	31/03/2003	01/03/2004	100	12.5	AFS
01/05/1993	31/03/2003	01/05/2003	100	12	AFS
01/03/1994	31/03/2003	31/05/2003	100	12	AFS
01/03/1995	31/03/2003	01/03/2006	100	12.5	AFS
01/03/1998	31/03/2003	01/03/2007	100	11.5	HFT
Total			**500**		

Other Securities

Date of Issue	Date of reporting	Maturity Date	Amount in crore	Coupon (%)	Type
01/03/1992	31/03/2003	01/03/2004	100	12.5	HFT
01/05/1993	31/03/2003	01/05/2003	100	12	HFT
01/03/1994	31/03/2003	31/05/2003	100	12	HFT
01/03/1995	31/03/2003	01/03/2006	100	12.5	HTM
01/03/1998	31/03/2003	01/03/2017	100	11.5	HTM
Total			**500**		

Overall Position

	Break-up of total investments (` in crore)			
	Government Securities	**Bank bonds**	**Other securities**	**Total**
HFT	100	100	300	**500**
AFS	600	400	0	**1000**
Trading Book	**700**	**500**	**300**	**1500**
HTM	300	0	200	**500**
Total	**1000**	**500**	**500**	**2000**

It is further assumed that the average of positive gross annual income of last three years is Rs. 50,00,000.

1. Computation of risk weighted assets for credit risk:

Trading book of banks comprises investments under Held for Trading (HFT) and Available for Sale (AFS) Categories. Trading books are excluded while calculating risk weighted assets of credit risk. Hence the risk weighted assets for credit risk would be as under.

Amount in Rupees [Crore]

Sl No.	Details of assets	market value	Risk weight in %	Risk weighted assets
1	Cash and balances with RBI	200	0	0
2	Bank balances	200	20	40
3	Investments[HTM category]: Government Banks Others	300 0 200	0 0 100	0 0 200
4	Advances[Net]	2000	100	2000
5	Other assets	300	100	300
	Total	**3200**		**2540**

2. Calculation of Risk Weighted Assets for Market Risk

Trading book investments qualify for risk weighted assets for market risk. In other words held for the trading [HFT] category and available for sale[AFS] category qualify for market risk and not credit risk. Market risk comprises both specific risk and general market risk.

For specific market risk, capital charges have already been suggested by the RBI.

Whereas, for calculating risk weighted assets for general market risk, 'duration model' has been suggested by the rbi to the banks.

A. Specific Risk:

1. Govt sec Rs. 700 crore- Nil;
2. Bank Bonds:

Amount in Rupees [Crore]

Details	Capital charge in %	Amount	Capital charge in Rs
For residual term to final maturity. 6 months or less	0.30	200	0.60
For residual term to final maturity between 6-24 months	1.125	100	1.125
For residual term to final maturity EXCEEDING 24 Months	1.80	200	3.60
otal		500	5.325

3. Other securities: Rs 300 crore @9% = RS 27 Crore[9% capital charge always = 100 % risk weight].

Total of specific market risk is 1+2+3=0+5.325+27 = 32.325 crore

B. **General Market Risk**

Modified duration is used to arrive at the price sensitivity of the interest rate related instruments listed below, where, the date of reporting is taken as 31.03.2003.

Amount in Rupees [Crore]

Counterparty	Maturity date	Amount [market value]	Coupon %	Cap charge for general market risk
Government	1/3/2004	100	12.50	0.84
Government	1/5/2003	100	12	0.08

Government	31/5/2003	100	12	0.16
Government	1/3/2015	100	12.50	3.63
Government	1/3/2010	100	11.50	2.79
Government	1/3/2009	100	11	2.75
Government	1/3/2005	100	10.5	1.35
Banks	1/3/2004	100	12.50	0.84
Banks	1/5/2003	100	12	0.08
Banks	31/5/2003	100	12	0.16
Banks	1/3/2006	100	12.5	1.77
Banks	1/3/2007	100	11.5	2.29
Others	1/3/2004	100	12.5	0.84
Others	1/5/2003	100	12	0.08
Others	31/5/2003	100	12	0.16
Total		**1500**		**17.82**

Source:
https://iibf.org.in/documents/MasterCirculars/RiskManagement/1.%20Prudential%20Norms%20on%20Capital%20Adequacy%20-%20Basel%20I%20Framework.pdf

The above capital charges for general market risk have been calculated based on the modified duration concept. The formula for calculating modified duration:

Modified Duration= Duration/1+Yield

For example, if we assume that the yield is 10% in the market and duration which will always be in the terms of years is 4 years then the modified duration will be

4/1.1= 3.63%.

This means that if there is a 1% increase in the general market rate of interest [yield], then the bond's price will fall by 3.63% and vice versa.

The procedure for the calculation of different interest rate related instruments[bonds] has been discussed below:

Years	Cash inflow	Present value factor @10%	Present value factor multiplied by cash inflow	Proportionate cash flow received	Year multiplied by proportionate cash inflow
0.92	10.5	0.90	9.45	1.00	0.92
					D=0.92 years

Modified duration = D/1+Yield. D is 0.92 year and yield is assumed to be 10 percent hence modified duration will be 0.92/1.1= 0.84. The same process will be applied for all interest rate related securities [Bonds] for the calculation of modified duration.

This can be referred to in the table above.

3. Capital Charge for Operational Risk:

Capital charge under basic indicator approach = $[\Sigma GI_{1—3} /3 \times \alpha]$

Where,

GI = Gross Annual Income; and

α = 15% [As per Industry wide experience].

Calculation of risk weighted assets for operational risk:

$[\Sigma GI_{1—3} /3 \times \alpha]$

50,00,000 × 15% = Rs. 7,50,000

This capital charge of Rs. 7,50,000 is required to be converted into risk weighted assets as follows:

7,50,000 × 100/9 = Rs. 83,33,333.

Calculation of total risk weighted assets:

1. Risk weighted assets for credit risk =2540 crore
2. Total cap charge for market risk [specific risk + general market risk]= 50.145 crore.

   This is required to be converted into risk weighted assets for market risk. Therefore, following formula will be used:

   50.145 x 100/9

   Risk weighted assets for market risk will be Rs. 557.17 crore.
3. The capital charge for operational risk = Rs. 7,50,000. This is again required to be converted into risk weighted assets for operational risk by using the following formula:

   7,50,000 × 100/9 = Rs. 83,33,333. Therefore, the risk weighted assets for operational risk is Rs. 83,33,333.

The total risk weighted assets will be the sum of 2540 crore + 557.17 crore + 0.8333333 crore = 3,098 crore.

Calculation of Capital Requirement to Asset Ratio [CRAR]:

9% × 3098 crore = 279 crore.

Rs. 279 crore is the capital adequacy, which the bank is required to maintain with itself in the form of capital.

*** Procedure:**

In the illustration above, the on balance sheet items of a bank were allotted risk weights to calculate the risk weighted assets of the bank. 9% of the risk weighted assets for credit risk is required to be held in the capital form, which is known as capital adequacy ratio for credit risk. Investments under banking book (HTM) and trading book (HFT and AFS) have been projected in details. Investments under banking book qualifies for calculating risk weighted assets for credit risk, whereas, investments under trading book qualifies for the market risk. Market risk capital charge is further divided into specific market risk and general market risk. Specific market risk capital charge depends on he capital charge percentages decided by the RBI, whereas, a duration model has been used to calculate capital charge for general market risk. The capital charge thus obtained is further multiplied by a factor of 100/9 obtain risk weighted assets for market risk. In the same way the capital charge for operational risk is calculated by applying the formula mentioned above, which is further multiplied by a factor of 100/9 to get risk weighted assets for operational risk. At the end, the total risk weighted assets is calculated by adding the risk weighted assets for credit risk, market risk, and operational risk. 9% of this total risk weighted assets is kept as a capital adequacy ratio by a bank.To calculate capital charges for credit risk and operational risk, the standardized approach has been considered for each of the risk types separately.

FINDINGS

The standardized approach is still being used by the banks in India to calculate the risk weighted assets for credit risk. As a thumb rule, a 100% risk weight is assignable to all private sector exposures. This puts a bank in a situation where all private sector exposures, irrespective of their credit standing, are to be assigned 100% risk weight individually. This requires higher capital requirement on the part of the bank.

All trading book exposures qualify for market risk, whereas, banking book exposures qualify for credit risk. Specific risk indicates issuer specific risk, whereas, general market risk depends on factors like movements in interest rate, foreign exchange rates including gold open positions, etc.

All those risks which cannot either be put under the category of credit risk or market risk, are treated as operational risk.

9% of the total risk weighted assets for credit risk, market risk, and operational risk is required to be kept as capital by the banks, which is known as capital requirement to assets ratio (CRAR) or simply the capital adequacy ratio (CAR).

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