A Formulaic Approach to the Basel II Accord’s First Pillar

Matthew Berger*

Introduction

a. Current Status

To estimate profitability on individual transactions, banks utilize risk based capital models. The first risk based capital model was developed in the 1980s by Bankers Trust and was subsequently modified by Bank of America. With slight variations, banks across the world adopted some variation of this model to assess whether to grant credit to debtors.

With banks focusing on risked based capital models to determine lending decisions, large multinational corporations have gained interest in utilizing the model as a tool to assess the return that banks are earning on borrowed capital. Theoretically, a higher return on risk adjusted capital reserves yields a more profitable bank relationship. Presumably, banks will be more likely to grant future credit to corporations that have a more profitable bank relationship. Therefore, risk based capital models are utilized by non-bank corporations to quantify the value of their bank relationships.

Although currently only 11% of corporations calculate the revenue to capital that banks earn on transactions and only 10% estimate the margin to capital that banks earn on transactions, the trend among corporations is to implement methods to evaluate bank relationships. This trend is an effort to ensure that future lending capital will be available from those banks when needed. In a market where the number of providers of capital is contracting, companys’ interest in bank relationship management and analysis will inevitably increase.

This risk based capital model utilized by banks and non-banking corporations is based on the Basel II Accord. With several modifications and advisory notes issued, the Basel II Accord’s numerous facets provide for a complex formula. Non-banking corporations experience difficulty in dissecting its many nuances. This difficulty in understanding the Basel II Accord is compounded by the lack of summarizing documentation on the subject. Accordingly, this article develops a formula that explains the first pillar of the Basel II Accord so that it may be used by multinational corporations in future bank relationship analyses.

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2 Id.
5 The percentage of total banking industry assets held by the top 10 banks increased to 54% in 2005 from 42% 18 months earlier. (See: Strategies for optimizing bank relationships; Treasury Leadership Roundtable, (2006): 5.)
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b. Overview

This analysis begins by explaining the historical development of the Basel Accord and its committee. It then explains the general capital adequacy formula. It proceeds to elaborate on the components of the numerator and denominator of the equation. Modifiers and adjustments of these components are discussed. Concluding remarks and an example of the formulas application are provided.

The Basel Accord and the Capital Ratio

a. The Basel Accord and its Committee

The Basel Committee on Banking Supervision is a committee established by the Bank of International Settlements consisting of representatives from national banking regulators. It is an international body that formulates policy on best practice in financial regulation.6

The Basel Committee implemented the “Basel Capital Accord” in 1988. Its purpose was to ensure that internationally active banks in the G-10 countries reserve the same amount of capital, relative to a particular segment of business, and to ensure regulators that particular standards were utilized when assessing a bank’s capital adequacy.7 The Accord was subsequently implemented in over 100 countries for both large and small financial institutions.8 Since 2000 the Basel Committee has consulted the industry for its revision to the Basel Accord. The resulting revision is known as the Basel II Accord.9

As an international standard, the Basel Accord is not directly enforceable by the Bank for International Settlements.10 However, after the Bank of Commerce and Credit International failure of 1991, the G-10 countries agreed to establish better bank regulatory standards.11 Accordingly, Title 12 of the United States Code (“U.S.C.”) and Title 12 of the Code of Federal Regulations (“C.F.R.”) were codified and closely mirror the Basel Accord.

Three pillars are included in the Basel II.12 These pillars are the minimum capital requirements, supervisory review process, and market discipline. The minimum capital requirements pillar defines a standard methodology for calculating the capital to assets ratio. The supervisory review process focuses on board oversight, sound capital assessment, comprehensive assessment of risks, monitoring and reporting, and internal control review. The market discipline process pillar governs disclosure requirements. The following sections focus on the first pillar, the minimum capital requirements.

7 Id.
8 Id.
9 Id.
10 Id.
12 To obtain a complete copy of the Basel II Capital Accord, visit <http://www.bis.org/>.

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b. The Capital Adequacy Ratio

The Basel Accord, Title 12 U.S.C., and Title 12 C.F.R. define a bank’s capital adequacy ratio. This ratio consists of a numerator that represents the amount of capital in a financial institution and a denominator that represents a financial institution’s assets, classed by risk. In general, the ratio is computed by dividing total regulatory capital by the bank’s risk weighted assets. The result must equal or exceed eight percent.

Failure to maintain this minimum capital standard is a violation of the principles of safety and soundness and authorizes Federal Reserve regulators to take drastic corrective measures, such as temporary seizure of the company.

1. The Numerator

The total capital numerator is the sum of the banks tier one capital and tier two capital. Tier one capital consists of common shareholders equity, retained earnings, and non-cumulative preferred stock, but excludes goodwill. Tier two capital consists of undisclosed reserves, general loan loss reserves, hybrid debt equity capital instruments, and subordinated debt. Tier 2 capital is limited to 100% of tier 1 capital. Further, a maximum of 1.25% of risk weighted assets are permitted in general loan loss reserves.

2. The Denominator

Total adjusted risk weighted assets have three elements. These elements are market risk, operational risk, and credit risk. Total adjusted risk weighted assets are computed by multiplying the capital requirements for market and operational risk by 12.5 and adding the resulting figures to the sum of the adjusted risk weighted assets for credit risk.

i. Market Risk

Market risk is computed by adding the market risk equivalent assets to the adjusted risk weighted assets. Its purpose is to quantify the risk of market fluctuations in assets held by a bank.

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14 The following formula represents the general capital adequacy ratio: \( \frac{\text{Total Capital}}{\text{Risk Weighted Assets}} \geq 8\% \)
18 Basel Committee at 12.
19 The expanded numerator converts the equation to \( \frac{[\text{Tier 1 capital} + \text{Tier 2 Capital}] + \text{Risk Weighted Assets} \geq 8\%} {\text{Risk Weighted Assets}} \)
20 The capital adequacy equation is now modified to read \( \frac{[\text{Tier 1 capital} + \text{Tier 2 Capital}] + [12.5 \times (\text{Market Risk} + \text{Operational Risk}) + (\text{Credit Risk})]} {\text{Risk Weighted Assets}} \geq 8\% \)
risk is not applicable to banks whose trading activity is less than 10% of total assets or less than $1 billion dollars.21

A. Market Risk Equivalent Assets

Market risk equivalent assets are computed by adding a value at risk (“VAR”) variable to a specific risk add-on variable plus a de minimis variable.22

The VAR charge is the higher of the previous days VAR or the average daily VAR for preceding 60 days multiplied by three.23 Banks are instructed to develop and utilize internal models for establishing VAR. Similarly, de minimis exposure is computed according to internal methods that regulators have pre-approved.

The specific risk add-on element consists of three categories. These categories are government debt instruments, qualifying categories, and “other” categories. The government category includes bonds, treasury bills, and other short term debt instruments. The qualifying category includes debt instruments of US government sponsored agencies, general obligation debt instruments issued by states and debt instruments issued by US depository institutions.24 “Other” categories are debt instruments not included in the previous categories that regulators believe are appropriate. The “other” category includes items such as futures contracts. These contracts are to be multiplied by 8% to compute the appropriate risk add-on. If banks have an internal hedging mechanism to cover futures, then a 2% factor is used in lieu of the 8%.25

B. Adjusted Risk Weighted Assets

Adjusted risk weighted assets, in relation to the market risk formula26, are computed by subtracting from risk weighted assets27, the sum of all covered positions plus receivables from posting of cash collateral in securities transactions.28 Covered positions include fixed rate or floating rate instruments located in the trading accounts, instruments that react primarily to changes in the interest rates, options, and derivatives, which may be netted.29

21 The market risk formula is stated in the following manner: Market Risk = Market Risk Equivalent Assets + Adjusted Risk Weighted Assets
22 A legal term meaning of little importance.
23 12 CFR 225, Appendix E, Section 3 (a)(1)(B)(2)(ii)(2)
24 12 CFR 225, Appendix E, Section 5 (c).
25 The market risk equivalent assets portion of the market risk formula is stated in the following manner: Market Risk Equivalent Assets = VAR Charge + Specific Risk Add-on + De Minimis Exposure
26 It is important to note that adjusted risk weighted assets, which are referred to in this section, relate to the market risk component of the capital adequacy ratio. This distinction is important because adjustments will be made to the risk weighted assets contained in the credit risk portion of the denominator subsequently in this explanation.
27 Risk Weighted Asset computation is described infra.
28 The adjusted risk weighted asset formula, in relation to the market risk component, can be stated in the following manner: Adjusted Risk Weighted Assets = Risk Weighted Assets – Covered Positions – Receivables from posting of cash collateral in securities transactions
29 See 12 CFR 225, Appendix E, Section 5 (c) (1) for a complete list of covered position variables.
ii. Operational Risk

Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events. This includes legal risk but excludes strategic and reputational risk. Three methods exist to compute operational risk. These methods are the advanced measurement approach, the standard approach, and the basic indicator approach.

The advanced measurement approach uses a bank developed regulator approved measurement system. Accordingly, this method is unique to each bank.

The standard approach allows for the division of each bank into eight business segments. A risk beta between 12% and 18% is assigned to each of the eight segments. The risk beta figure is assigned by the regulators. Each beta is multiplied by the gross income of the appropriate segment. The sum of the eight risk adjusted gross income figures is computed to result in the total operational risk per the standard approach.

The basic indicator approach is the simplest method and can be used by any bank. However, its intended use is as an entry level method that is sufficient until a bank has the means to utilize one of the above listed approaches. The basic indicator approach multiplies the three year average gross income of the bank by 15%.

iii. Credit Risk

Credit Risk classifies assets based on the risk of the underlying credit exposure. The new Basel II Accord provides three approaches. The first approach, the internal ratings based ("IRB") Foundation approach, allows for banks internal assessments of key risk drivers to serve as primary inputs to the capital calculation. It relies on four quantitative inputs. These inputs are the probability of default, the exposure at default, the loss given a default, and maturity. Loss given default measures the proportion of the exposure that will be lost if a default occurs, and exposure at default measures the amount of a loan facility that is likely to be drawn if a default occurs plus any current amount outstanding. Maturity measures the remaining economic maturity.

30 Basel Committee at 140.
31 The standard approach formula for operational risk is mathematically stated in the following manner:
\[ K = \sum GI \times \beta \]
Where: GI = average gross income
\[ \beta = \text{is assigned by the regulatory committee to be between 12}\% \text{ and } 18\% . \]
32 Basel Committee
33 The basic indicator approach formula for operational risk is mathematically stated in the following manner: \[ K = GI \times 15\% \]
Where:
\[ GI = \text{average gross income} \]
of the exposure. The IRB Foundation approach provides for a bank to utilize internal models to assess the probability of default, while the remaining categories are determined by the supervisory committee.

The second approach, the IRB Advanced approach, operates identical to IRB Foundation approach with one modification. The loss given default, exposure at default, and maturity categories are determined by internal bank systems, rather than by a supervisory committee.

The third approach, the Standard approach, is the traditional method utilized. It classifies assets into categories based on the underlying credit risk and assigns a pre-determined percent.

Banks must determine if a modifier need be applied to the assets prior to their allocation into the appropriate risk categories.

The following section address the Standardized approach, as it is the method typically utilized by non-bank corporations wishing to use the capital adequacy ratio to quantify the value of bank relationships.

A. Risk Weighted Assets

Total risk weighted assets are composed of on-balance sheet risk weighted assets and off-balance sheet risk weighted assets. The sum of these two categories results in the risk weighted assets as used in the denominator of the capital ratio formula.

1. On-Balance Sheet Risk Weighted Assets

On-balance sheet risk weighted assets are computed by separating assets listed on the balance sheet into four categories. The four categories are a zero percent category, 20% category, 50% category, and 100% category. These categories are based on the relative liquidity and risk that is inherent in the underlying asset. Therefore, the less risky and more liquid assets are placed in a lower risk weighted category. Accordingly, the zero percent category consists of cash and cash equivalents, cash collateralized claims, and direct claims guaranteed by U.S. government agencies or central banks of the OECD. The 20% category consist of cash items in the process of collection, standby letters of credit, general obligations guaranteed by the state, and other similar items. The 50% category consists of one to four family residential property mortgages, non-general obligations guaranteed by states or municipalities, and other similar items. The 100% category consists of private sector loans, property plant and equipment, and other types of illiquid high risk assets.

The assets in each category are multiplied by the percent of the category. A sum of these figures is the on-balance sheet risk weighted assets.

36 See 12 C.F.R. 225 Appendix A Part III C for a complete list of assets listed in each risk weighted category.

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2. Off-Balance Sheet Risk Weighted Assets

Off-balance sheet risk weighted assets are treated in a similar manner as the on-balance sheet risk weighted assets. However, a two step approach is utilized. First, the face amount of the asset is multiplied by a credit conversion factor. Secondly, if relevant, the result of step 1 is applied to the appropriate risk category of the obligor, guarantor, or external credit rating. Recourse Obligations and Direct credit substitutes are exempt from this two step process.

The five credit conversion categories are zero percent, 10%, 20%, 50% and 100%. The zero percent category consists of unused portions of commitments that have a maturity of one year or less and are cancelable at any time. The 10% category consists of unused portions of asset backed commercial paper liquidity facilities while the 20% category consists of documentary letters of credit. The 50% category consists of transaction related contingencies, unused portions of commitments with maturity exceeding one year, and revolving underwriting facilities. The 100% category consists of forward contracts and assets supported by direct credit substitutes. Further, securities lent by a bank may be included in this category depending upon the structure of the transaction and who bears the risk of loss. Other types of assets with similar liquidity and risk requirements may be placed into each of the above categories.37

Typically, the second step is not applied as the assets are adjusted by modifiers based on the same specifications prior to their placement in the conversion factor category. Accordingly, the assets in each category are multiplied by the percent of the category. A sum of these figures is the off-balance sheet risk weighted assets.

Accordingly, the capital adequacy formula can be stated as:

\[
\frac{\text{Tier 1 Capital + Tier 2 Capital}}{12.5 \times (\text{Market Risk + Operational Risk}) + (\text{On-balance sheet RWA + Off-balance sheet RWA})} \geq 8\%
\]

3. Adjustments

Prior to the separation of assets into their respective categories, an adjustment may need to be applied to the asset. The two relevant types of adjustments are modifiers based on credit ratings and credit conversion factors applied to derivative contract transactions.

i. Modifying and Mitigating Factors

37 See 12 C.F.R. 225 Appendix A Part III D for a complete list of assets listed in each risk weighted category.
Modifiers consist of claims on sovereigns, claims on corporates, and claims on banks. These categories have a percentage that is applied to each asset. The percentage is a sliding scale based on the credit rating of the debtor organization. For example, claims on corporations with a credit assessment between AAA and A- have a 20% modifier whereas a corporation with a credit rating of BB- or below have a 150% modifier. A 50% modifier is applied to firms with an A+ to an A- credit rating and 100% is applied to a BBB+ to BB- firm. Unrated firms have a 100% modifier.

Supervisory authorities may permit banks to risk weight all corporate claims at 100% without regard to external ratings. However, regulators must utilize a consistent approach for all banks and always use ratings when available, or not at all.

Additional mitigating factors can be applied to secured collateralized lending transactions. Banks can utilize 2 approaches. Under the simple approach, the risk weight of the collateral is substituted for the risk weight of the borrower. This method is subject to a 20% floor. Under the comprehensive approach, a bank can reduce the exposure amount by the value ascribed to the collateral.

Both methods require a proper security filing. The committee issued an advisory note stating a security types permissible for this reduction.

Additionally, guarantors can reduce the risk weight. However, bank regulators prefer to see a guarantor in a 20% risk weight category.

ii. Derivative Contracts

Derivative contracts require adjustments prior to their placement in the proper asset class. Derivative contracts are interest rate, equity, commodity and exchange rate linked contracts. The C.F.R. defines interest rate contracts as single currency interest rate swaps, basis swaps, forward rate agreements, interest rate options, and any other instrument linked to interest rates that give a similar credit risk. Equity derivative contracts are equity linked swaps, equity linked options, forwards, and any other instrument linked to equities that gives rise to similar credit risk. Exchange rate contracts are defined as cross-currency interest rate swaps, forward foreign exchange, currency options, and any other instrument linked to exchange rates that give rise to similar credit risk. Therefore, foreign exchange swaps and forwards require an adjustment.

A three step adjustment process is implemented to obtain the proper foreign exchange amount to allocate to the proper asset class. The first step is to calculate the credit equivalent amounts of derivative contracts. This is computed by adding the current exposure to the potential future

39 Id. at 19.
40 Id. at 28.
41 Id. at Annex 11 P. 269.
42 Id. at 270.
43 12 C.F.R. 225 Appendix A Part III E.
credit exposure of the contract. Current exposure is the marked-to-market value of the contract. If the marked-to-market value is zero or negative, a zero is used as the value. Potential future credit exposure is computed by multiplying the principal amount of the contract by a credit conversion factor. The credit conversion factors for derivative contracts are summarized in the following table.

<table>
<thead>
<tr>
<th>Remaining Maturities:</th>
<th>Interest Rate</th>
<th>Exchange Rate</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year or less</td>
<td>0.0%</td>
<td>1.0%</td>
<td>6.0%</td>
</tr>
<tr>
<td>One to five years</td>
<td>0.5%</td>
<td>5.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Over five years</td>
<td>1.5%</td>
<td>7.5%</td>
<td>10.0%</td>
</tr>
</tbody>
</table>

The second step requires a determination of whether an exception applies. The first exception places a maximum of 50% risk weight to the credit equivalent amount of such contract. The second exception provides for the exclusion of derivative contracts traded in exchanges which require daily receipt and payment of cash variation margin from the risk-based ratio calculation. Accordingly, foreign exchange spot transactions are excluded from the risk-based ratio calculation.

The final step is to compute the adjustments and assign the adjusted asset to the proper risk category. The sum of the above is the risk weighted assets.

Accordingly, the capital adequacy formula is modified further.

\[
\text{Tier 1 Capital} + \text{Tier 2 Capital} \geq 8%
\]

\[
[12.5 \times (\text{Market Risk} + \text{Operational Risk}) + (\text{Adjusted On-balance sheet RWA} + \text{Adjusted Off-balance sheet RWA})]
\]

Conclusion

In sum, the Basel II Accord defines a bank’s minimum ratio of capital to assets. This ratio must equal or exceed 8%. Since its inception, bank holding companies have utilized this ratio to ensure that it is considered well capitalized and in compliance with the principals of safety and soundness. Operationally, banks have utilized the ratio to determine lending decisions. Recently, however, through the implementation of return on risk adjusted capital models, non-bank corporations have utilized the ratio as a means to assess bank relationships. With the voluminous amount of complex codified rules and advisory notes, many corporations do not

44 Id.
45 Id.
46 Id.
possess the knowledge and understanding of the Basel II Accord to devise a return on risk adjusted capital model. This summary provides an explanation of the necessary elements for a corporation unfamiliar with the Basel II Accord to begin developing a risk adjusted capital model to analyze the value of its bank relationships.

Appendix
The following balance sheet is present for Bank A.

The market risk component will not apply because the trading thresholds are not satisfied.

Assume that the company has an average gross income of $12 and the Basic Indicator approach is utilized.

Assume that all of Bank A's corporate loans are to companies with a B debt rating.

### Capital Adequacy Formula

\[
\text{Tier 1 Capital} + \text{Tier 2 Capital} \geq 8\%
\]

### [12.5 \times (\text{Operational Risk} + \text{Market Risk})] + [\text{On Balance Sheet Risk Weighted Assets} + \text{Off Balance Sheet Risk Weighted Assets}]

#### Balance Sheet

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Adjustments</th>
<th>Asset Value</th>
<th>Risk Weighted Asset Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>0</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>US Treasury Bond</td>
<td>0</td>
<td>51</td>
<td>0%</td>
</tr>
<tr>
<td>NY State Bonds</td>
<td>0</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>Loans Secured by 1st Mortgage on Family home</td>
<td>0</td>
<td>18</td>
<td>50%</td>
</tr>
<tr>
<td>Other loans</td>
<td>0</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Building and Equip</td>
<td>0</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td>Total Liabilities + Shareholder Equity</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Risk Weighted Assets: 28**

#### Off-Balance Sheet Items

<table>
<thead>
<tr>
<th>Off-Balance Sheet Items</th>
<th>Adjustments</th>
<th>Asset Value</th>
<th>Risk Weighted Asset Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Letters of Credit</td>
<td>0</td>
<td>5</td>
<td>20%</td>
</tr>
<tr>
<td>Corporate Loan - Revolver committed but not drawn upon</td>
<td>150%</td>
<td>15</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Adjusted RWA</strong>: 36.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### On-Balance Sheet Risk Weighted Assets

<table>
<thead>
<tr>
<th>Asset Category</th>
<th>Adjustments</th>
<th>Asset Value</th>
<th>Risk Weighted Asset Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>0</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>US Treasury Bond</td>
<td>0</td>
<td>51</td>
<td>0%</td>
</tr>
<tr>
<td>NY State Bonds</td>
<td>0</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>Loans Secured by 1st Mortgage on Family home</td>
<td>0</td>
<td>18</td>
<td>50%</td>
</tr>
<tr>
<td>Other loans</td>
<td>0</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Building and Equip</td>
<td>0</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total Risk Weighted Assets</strong>: 28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Operational Risk

| Average Gross Income of previous three years | 12 | 15% | 12.5 | 22.5 |
| **Total Adjusted RWA**: 59 |

#### Total Capital

| Tier 1 | 5 |
| Tier 2 | 0 |
| **Total**: 5 |

### Capital Adequacy Ratio

\[
\frac{\text{Tier 1} + \text{Tier 2}}{\text{Total Adjusted Risk weighted Assets}} = 8.47\%
\]

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The preceding example demonstrates a computation of Bank A’s capital adequacy. First, the credit portion of the denominator is computed utilizing the standard approach. The appropriate adjustments are made to each asset class. In the instant case, the only required adjustment is a 150% modifier for claims on corporates with a B rating. After the adjustment is computed, the assets are placed into the appropriate risk weight category. These on-balance sheet and off-balance sheet items are multiplied by the risk weight percent, and the sum is computed resulting in the adjusted risk weighted assets. The operational risk component of the denominator is computed using the basic indicator approach. The three year average gross income is multiplied by 15%. The market risk component is not computed as the threshold requirements for its use are not present. The denominator is computed by multiplying 12.5 by the operational risk and adding it to the sum of on-balance sheet and off-balance sheet adjusted risk weighted assets. The numerator is computed by summing tier one and tier two capital. In the instant case, the only relevant category is the tier one common shareholder equity. The numerator is divided by the denominator resulting in a number greater than 8%. Accordingly, Bank A is adequately capitalized.