Assessment of Business Risk Economic Capital for South African banks: A response to Pillar 2 of Basel II

Submitted to:

Wits Business School

University of the Witwatersrand

Johannesburg, South Africa

Submitted by:

Student Name: Kaylene Alie

Student Number: 1278358

Supervisor: Professor Kalu Ojah

MMFI Research Project

5 August 2016

Contents

List of Figures

List of Tables

ACKNOWLEDGMENTS

I would like to express my gratitude to manager, Dr. Jonathan Turney, for providing me with his support and assistance throughout the process of researching and writing this project.

In addition, I must thank my family for their unfailing and continuous encouragement throughout my years of study.

ABSTRACT

The study is an assessment of the current treatment of business risk, as a significant risk type for financial institutions. It includes an industry analysis of the five major banks in South Africa, as well as international banks, and how these banks currently manage business risk in the Pillar 2 supervisory process. It assesses economic capital frameworks and the importance of business risk in the risk assessment and measurement process in the global and local industry.

Various methodologies have been researched to assess which statistical methods are best suited in the measurement of this risk type as well as the quantification of the capital levels required. This study has compared the available statistical methodologies currently used in the industry and concludes which is best given the issues pertaining to the modelling of business risk quantification.

A statistical model has been developed to quantify business risk for a specific bank using bank specific data, using a methodology which is relatively generic and could be applied widely across all financial institutions. The model serves to illustrate the principles surrounding the quantification of business risk economic capital.

1. Introduction

1.1. Background

In 2006, the Basel Committee on Banking Supervision (BCBS) released the revised capital accord, commonly referred to as Basel II, which was called "International Convergence of Capital Measurement and Capital Standards: A Revised Framework". The objective of the revision of the capital accord was to increase the stability of the international banking system and introduce more risk sensitive measures to calculate capital requirements (BCBS, 2006).

Basel II is based on three pillars:

- Pillar 1: Minimum Capital Requirements
- Pillar 2: Supervisory Review Process
- Pillar 3: Market Discipline

The first pillar, Minimum Capital Requirements, details how banks need to calculate their minimum required capital (regulatory capital demand) for the three major risk types which are credit, market and operational risk. It also specifies the type of capital instruments the bank should hold as a buffer against these risks (regulatory capital supply).

The second pillar addresses the supervisory review process, which is an overall assessment of the risks faced by banks in addition to the risks covered in Pillar 1 (BCBS, 2009). Banks are required to have an internal capital adequacy assessment (ICAAP), in which it is expected to set capital targets that are commensurate with the bank's risk profile, complexity and operating environment. The process is undertaken to ensure that the bank has adequate capital to support its risks beyond the core minimum requirements, as specified under Pillar 1 (BCBS, 2006).

The third pillar relates to the disclosure requirements to the market to contribute to a safe and sound banking environment.

Pillar 2 assessments are generally referred to as economic capital, as opposed to regulatory capital considered in Pillar 1. Banks have to identify the risks they are exposed to and usually include risks such as interest-rate risk, model risk, insurance risk, concentration risk and business risk. Economic capital has no statutory minimum requirements as regulatory capital does under Pillar 1, but is an internal assessment of available financial resources (economic capital supply) and financial resources required due to risks undertaken (economic capital demand) by the banks.

Business risk is defined by the BCBS in the "Range of Practices and Issues in Economic Capital Frameworks" paper released in March 2009 as follows:

"Business risk captures the risk to the firm's future earnings, dividend distributions and equity price. In leading practice banks, business risk is more clearly defined as the risk that volumes may decline or margins may shrink, with no opportunity to offset the revenue declines with a reduction in costs. For example, business risk measures the risk that a business may lose value because its customers sharply curtail their activities during a market down-turn or because a new entrant takes market share away from the bank. Moreover, this risk increasingly extends beyond balance-sheet items to fee-generating services, such as origination, cash management, asset management, securities underwriting and client advisory services." (BCBS, 2009)

Business risk is a Pillar 2 risk, which can simply be expressed as the risk of reduced revenue or increased operating expenses which can lead to a reduction in firm value. All businesses (including banks) face business risk since future revenues and expenses are largely uncertain. This is further exacerbated by management strategies and the operational efficiencies of the firm.

Management choices that give rise to business risk can be operational (e.g. marketing, IT, etc.) or strategic (e.g. organisational design, choice of target markets, acquisition targets, etc.). Business risk occurs when disparities exist between management choices and the realities of the external environment. The "loss" or shortfall due to business risk arises when

management is unable to respond timeously and adequately to changing external circumstances. This, in turn, not only affects the earnings, but as a consequence impacts retained earnings, and thus affects the capital adequacy and/or shareholder value of the bank.

In South Africa, some banks hold capital against business risk and some do not. The methodologies employed to quantify the risk and the capital required to hold against this risk type are also very different. Given the attention on the Pillar 2 Supervisory Process by the South African Reserve Bank, banks are forced to re-evaluate their business risk frameworks and to justify their assessments of this risk type.

1.2. Problem Statement

Business risk can be seen as the risk that the quantum of revenue driven by customer and client volumes and margins may be lower than expected together with operating costs which cannot be reduced in response and which are higher than expected. From our experience, we know that this risk exists. Customer volumes change throughout time and have a certain expected volatility, which leads to uncertainty regarding future income and expenses.

Banks hold capital in the advent of unexpected losses in order to protect itself against insolvency. The unexpected losses that a bank may experience due to business risk events should be thoroughly considered. Given that the risk exists and that regulators do not impose capital requirements for business risk, banks need to assess it internally. But there is no consistent view in the industry of what exactly business risk is and as such, no consistent measurement and treatment of the risk type exists. This paper aims to define business risk comprehensively, taking into account the different views and consolidating these into one unified definition.

1.3. Objectives

A study by McKinsey&Company in 2011 stated that banks, internationally, were under pressure from regulators to integrate Pillar 1 and Pillar 2 processes. Given the limited guidance from regulators, this integration has been found to be difficult and has resulted in widely varying approaches and inconsistencies. In the past, most of the banks' and regulators' focus were on the Pillar 1 risks. However, the 2008 economic crisis revealed that this focus was insufficient, as Pillar 1 risks tended to underestimate the risks and it ignored other risks such as business risk, concentration risk and liquidity risk. (McKinsey Working Papers on Risk Number 27 2011)

The focus of this paper is on business risk and how it should be incorporated in the ICAAP framework as part of the supervisory process.

The first problem we resolve is the definition of business risk. Banks use very different definitions of business risk and thus use different methodologies to assess and capitalise the risk. There is no consistent view of what exactly business risk is and as such no consistent measurement and treatment of the risk type. This paper defines business risk comprehensively, taking into account the different views and consolidating these into one unified definition.

Business risk is driven by earnings volatility which is determined by revenue and expense realisations. However, volatility of income and expenses is driven by other risk types as well and it is thus difficult to isolate true business risk in the income statement. Deviations from budgeted forecasts result from various causes, which need to be stripped out of the income statement before business risk can be assessed. This is one of the difficulties of assessing and measuring this risk type. A methodology to isolate business risk is developed in this paper with a recommendation on how best to quantify business risk and the required capital to cushion against it.

1.4. Research Questions

First, the paper deals with the theoretical questions around business risk. This includes an industry analysis of the five major banks in South Africa, as well as international banks, and how these banks currently assess business risk in the Pillar 2 supervisory process. It also assesses the economic capital frameworks and the importance of business risk in the risk assessment and measurement process in the global and local industry.

Various methodologies have been researched to determine which statistical methods are best suited in the measurement of this risk as well as the quantification of the capital levels required. This study compares the available statistical methodologies currently used in the industry and concludes which is best given the issues pertaining to the modelling of business risk quantification. Methodologies (such as scenario analysis, time-series analysis, regression analysis, Monte Carlo Simulation analysis, etc.) are compared and assessed.

A business risk model has been developed, using the methodology considered to be best suited, for a particular South African bank. The methodology developed quantifies business risk for a specific bank using bank specific data. The bank offering the data will remain anonymous. Although the model is developed using a specific bank's data, the methodology employed is relatively generic and could be applied widely across financial institutions. The model serves to illustrate the principles surrounding the quantification of business risk economic capital.

1.5. Significance of the Study

Business risk is a material risk encountered by all banks. Banks' primary business is the management of risks and the inability to adequately assess business risk means that the banks are not fully cognisant of the risks they face and thus are not in the position to adequately manage their risks.

This paper addresses an issue faced by all banks. Regulators all over the world are shifting the focus from Pillar 1 risks to Pillar 2 risks. There is not much guidance available from Basel

or from national regulators on how to measure business risk. This paper aims to provide necessary guidance on the measurement of business risk and its relevance in the internal assessment of risk as part of the ICAAP process.

Basel II introduced advanced measures of risk (such as the advanced internal ratings based approach (AIRB) for credit risk and the advanced measurements approach (AMA) for operational risk), which resulted in more risk-sensitive capital requirements. This paper will devise a risk-sensitive model for business risk, which can be applied by any financial institution in order to understand its sensitivity to market volatilities on its earnings. Having a risk-sensitive model to compute capital for business risk ensures that banks identify the factors that drive risk and as such provides banks necessary information to mitigate these risks.

In order to develop the methodology, one bank's data will be used. However, the methodology is not bespoke to one bank. The intention was to build a model which is generic and widely applicable, not only to banks, but any financial institution. Thus the significance of this study is that a risk-sensitive methodology has been developed, which can be used by any financial institution that needs to calculate business risk capital requirements. The methodology can also be applied to other risk measurement requirements in financial institutions, such as risk appetite and stress testing for business risk, since the model incorporates macroeconomic factors and produces a loss distribution.

1.6. Organisation of the study

The study is arranged to provide full coverage of business risk and its relevance in a sound economic capital framework. The purpose is that it not only develops a methodology to quantify business risk but that a framework for the treatment of business risk is developed.

A background of banking and capital, specifically economic capital, is provided to set the scene of where business risk fits into a bank's assessment of risk and its importance. After the discussion of capital, the concept of business risk is discussed. Herewith, we provide a

comparison of business risk frameworks and methodologies across the global banking industry.

Thereafter a generic business risk model is developed, using a specific bank's data in order to showcase the application of the theory discussed. The results of the model are discussed and analysed.

The research is concluded with a summary of the findings and future work that may be embarked upon in finessing the treatment and assessment of business risk economic capital.

2. Literature Review

2.1. Overview of Banking and Capital

Banks are one of the most important financial intermediaries in the financial system. Financial intermediaries include insurance firms, securities underwriters and brokers and investment managers (Golin and Dehaise 2013). These financial intermediaries serve as a conduit between entities that have funds to invest (or deposit) and those entities in need of funds.

At the heart of the banking business, banks convert deposits from savers into loans for borrowers. But this act of intermediation comes with risks. In times of uncertainty, or when there is a lack of confidence in the banking system, it creates abnormal demand of customer deposits which banks may not be able to meet and thus causes solvency concerns. The liquidation of these assets at fire-sale prices, in order to meet the demand on the liabilities, could results in the banks not being able to meet its commitments and lead to banks seeking public assistance. For this reason, it is in the best interest of the community that banks be financially stable and regulated to some degree.

Banking regulation has the purpose of ensuring that banks are well managed and financially sound. The objective is to ensure market efficiency, but also in achieving social objectives. Over the years this has evolved into setting standards and regulations to ensure that banks are adequately capitalised in order to prevent insolvency.

Markets can fail in the following three manners:

1. Monopoly Power: If there is one or a few firms restricting competition, this results in a distortion of the markets with an increase in prices, restriction of supply and innovation.
2. Externalities and spill-over costs: This can lead to inefficiency when activities by some market participants negatively (or positively) affect the welfare of others.

3. Information Asymmetries: The imbalance of information may lead to adverse selection problems which creates failures in market mechanisms. (Schooner and Taylor 2009)

Besides the reasons mentioned above which require regulation to ensure the safety and soundness of the banking industry, systemic risk and the inter-connectedness of the financial industry and its impact on the social structures, necessitates regulatory intervention at times. Systemic risk arises when financial distress in one financial institution affects the financial soundness of another institution. In particular for banks, this contagion is exacerbated due to the nature of the banking business.

A bank's equity is the difference between its liabilities (deposits) and its assets (loans). Bank equity is known as capital and acts as a cushion between assets and liabilities. Thus a fall in its asset value results in a reduction in capital. If this decline is large enough, it could wipe out the bank's capital and result in insolvency. The requirement for adequate capital is thus essential in preventing insolvency.

However, banks search of optimal capital structures. Without incentive to hold more capital, banks prefer debt and thus tend to be undercapitalised (Schooner and Taylor 2009). The Basel Capital Accord was introduced in 1988 to set the international standard for bank capital. This regime was partly put in place in order to protect depositors from losses and also due to the fact that banks play such an important role in the financial system (Schooner and Taylor 2009). The Basel Committee noted that bank failure was due to economic, financial, legislative, regulatory, supervisory and managerial deficiencies (Basel Committee on Banking Supervision 2004).

The Basel I accord was known for its simplicity. But as the financial industry has grown and developed, the accord has had to evolve with it. Basel II was established in 2006 and Basel III was established in 2012. The evolution of the Basel accord has introduced more risk sensitive capital as well as more specific capital instruments that may be recognised as capital in order to ensure that banks are more solvent and are able to meet their commitments.

The capital requirements prescribed by agencies such as BIS are known as "regulatory capital". It is, however, a well-established fact that regulatory capital is standardised and not all-encompassing. Regulatory capital does not assess all risk types and capital measurement for certain risk types is not bespoke. For example, credit risk correlations used in Basel II models are fixed and not bespoke to the specific bank and the environment in which it operates.

For this reason, Basel II has three pillars:

- Pillar 1: Minimum Capital Requirements
- Pillar 2: Supervisory Review Process
- Pillar 3: Market Discipline

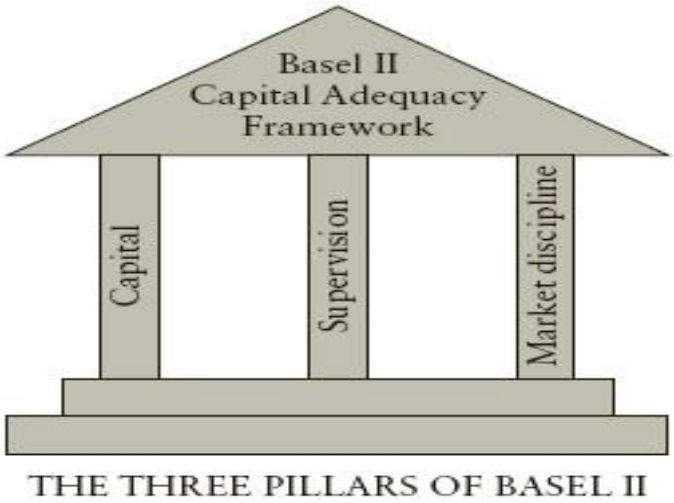

Figure 1 Basel II Capital Adequacy Framework

The minimum capital requirements are not sufficient in ensuring the safety and soundness of banks. For banks to operate efficiently in the financial markets, a more holistic approach is necessary and thus BIS has added Pillar 2 (which relates to the internal assessment of risk and capital) and Pillar 3 (which relates to market discipline and the disclosures banks need to make public).

In this study, we focus on Pillar 2. The short-comings of Pillar 1 capital have been widely documented. The focus of Basel II is on the calculation of adequate regulatory capital which enables banks to withstand unexpected losses; but the accord also implicitly identifies that

banks, based on their own experience and objectives, will inevitably calculate the requisite economic capital in somewhat different ways, which is expected from the supervisory process.

The BIS defined economic capital as follows: “Economic capital can be defined as the methods or practices that allow banks to consistently assess risk and attribute capital to cover the economic effects of risk-taking activities” (Range of Practices and Issues in Economic Capital 2009). The definition is broad and Basel does not prescribe any methodologies or minimum requirements; the computation and derivation is left to the individual banks.

It is therefore up to the bank to assess their own risks and compute the required capital for these risks. If the objective of capital is to cushion against unexpected worst-case loss scenarios, effective risk management is required in order to assess what these scenarios might be. Thus capital management and risk management are synonymous: risk informs capital.

More and more the bank is a “risk machine.” It takes risks, it transforms them, and it embeds them in banking products and services… They take risks more consciously, they anticipate adverse changes, they protect themselves from unexpected events, and they gain the expertise to price risks. . . . (Bessis 1998)

The task of identifying risks and the derivation and computation of required capital is extremely complex. A bank must identify, classify, and estimate the risks it is exposed to and while protecting them from insolvency, also maximize returns borne from taking the risks. Thus the objective of the bank management is to maximize risk-adjusted profits and in the process to optimize risk exposures relative to returns. (Golin and Dehaise 2013)

Bank management needs to balance the risks they take on relative to the returns generated, while ensuring that the bank is able to withstand potential unexpected worst-case scenarios, which are plausible yet severe. Effectively balancing these risks and returns fulfils the bank

management's ultimate responsibility and objective to its stakeholders, which is to make certain that the bank continues to survive and prosper.

2.2. Overview of Economic Capital

Capital management and risk management have become synonymous in the world of banks. Risk underpins capital, which determines not only the solvency of banks, but also their performance, and as such shareholder value. It has been found by Froot and Stein (1998) that value-maximising banks are noticeably concerned with risk management and are aware that not all risks can be hedged, which requires adequate capital management. Capital allocated to investments is used in pricing tools to determine risk adjusted returns. To adequately price, the true risk of transactions should be quantified. The inability to fully quantify risks, leads to sub-performance relative to the expectation.

Economic capital was first introduced in the 1970s by Bankers Trust where it was used as a uniform measure to evaluate the profitability of transactions (Klaassen and van Eeghen, Economic Capital 2009). This measurement was developed over time to take into account the volatility of returns caused by market factors such as interest rates and exchange rates. In order to manage this volatility, value-at-risk (VaR) models were developed to measure the worst loss that can be suffered over a given time with a specified probability. As financial institutions became more complex, this type of measurement extended to measure more risk types and was used to manage risk comprehensively across organisations (Klaassen and van Eeghen, Economic Capital 2009).

Klaassen and van Eeghen (2009) define economic capital as an "estimate of the worst possible decline in the institution's amount of capital at a specified confidence level, within a chosen time horizon". However, this capital level is not bound by any regulations, but is what the bank's shareholders would choose in the absence of any regulation. Also, it is referred to as *economic* capital, since the asset and liability values are economic values and not accounting values. Thus is it as internal view of the capital required to protect the bank against insolvency as well as reductions in shareholder value.

The specified confidence level discussed above usually relates to the desired credit rating from ratings agencies. For example, if a bank desires an 'A' Standard & Poor's credit rating, with an associated default frequency of 0.06, it implies a confidence level of 99.94%. In contrast, regulatory capital uses 99.9% confidence level.

Standard & Poor's 1981–2007	AAA	AA	A	BBB
Average one-year default rate (%)	0.00	0.01	0.06	0.23
Moody's 1970–2007	Aaa	Aa	A	Baa
Average one-year default rate (%)	0.00	0.01	0.02	0.17

Figure 2: Standard & Poor's and Moody's historic average one-year corporate default frequencies by investment-grade credit ratings (Sources: Standard & Poor's, 2007 Annual Global Corporate Default Study and Rating Transitions; Moody's, Corporate Default and Recovery Rates, 1920-2007)

More generally, economic capital is the amount of capital a bank should hold to absorb large unexpected losses from a portfolio over one year at a given confidence level $\alpha\%$ (see Figure 3).

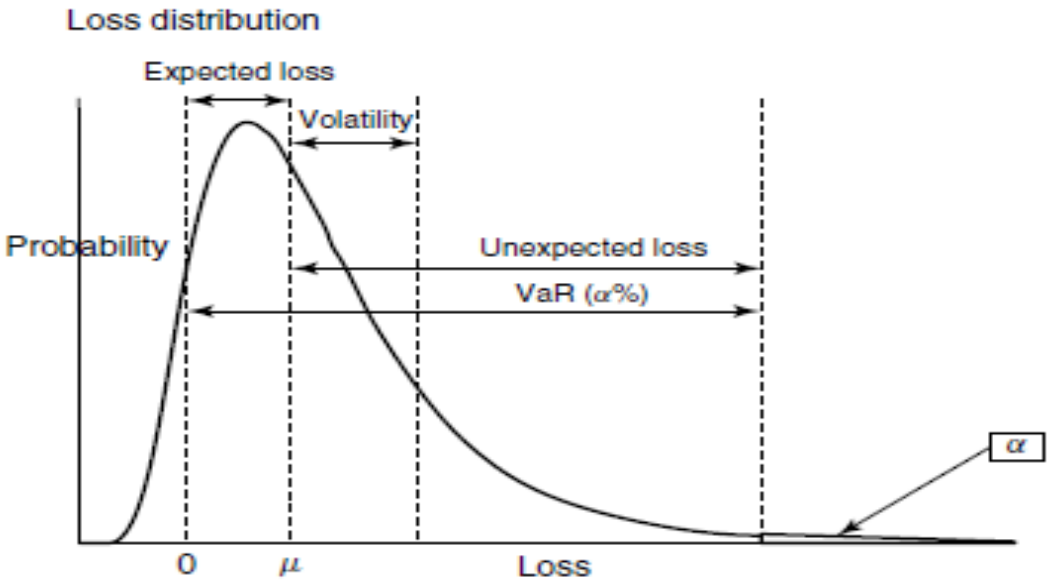

Figure 3: Economic Capital Calculation

Unexpected losses and therefore EC can be calculated as:

Economic Capital (Unexpected Loss) = Value at Risk (VaR_{α}) - Expected Loss (EL)

Economic capital is of importance since it is an internal measure and is not restricted by regulations. It assists the bank in determining its risks and computing the required capital to ensure that shareholders are adequately protected from insolvency. Regulatory capital has a different objective. It is not to protect shareholders, but instead to protect deposit-holders of banks as well as contributing to financial stability of the industry.

In order to prevent failure and insolvency, adequate risk management is imperative. Regulatory capital as prescribed by regulators is computed from VaR measures for the three specific risk types (credit risk, market risk and operational risk). Given that the risks covered under Pillar 1 are incomplete, regulatory capital would be insufficient as a tool to use to measure risk-adjusted returns. Risk measurement under the regulatory capital framework is not all-encompassing, thus an economic capital framework is crucial.

In a study conducted by McKinsey&Company in 2011, this importance was reiterated. Two specific metrics were used as examples of why economic capital should be considered important by banks, which were Return-on-risk-adjusted-capital (RAROC) and Economic-Value-Added (EVA). These were both expressed as economic capital measures and found to be central metrics in maximizing banks' return on capital. (McKinsey Working Papers on Risk Number 24 2011)

So not only is an economic capital framework important in the assessment of all potential risks, but it allows for more accurate information for use in optimizing pricing and strategy.

2.3. Overview of Business Risk

Financial risk management is the cornerstone for all banking activity. Banks' business is taking on risks and ensuring the ability to profit from it. Banks are faced with a myriad of risks and uncertainty; and in order to stay solvent banks need to manage these risks effectively.

In order to manage risks, risks first need to be identified. Doff (2008) divided uncertainties into the following categories:

1. Risk: Where enough historical events have occurred to enable estimation of probabilities of future outcomes.
2. Structural uncertainties: Where the likelihood the possibility of an event cannot be judged.
3. Unknowables: Events that occur, but prior to the event we could not even imagine that it would occur.

All three categories are risks faced by banks. All of these have happened in the past, and it would be safe to assume that they will continue to occur in the future. The first category is one which banks can, with much more accuracy, predict and make provisions for. The second and third categories present more difficulties in the measurement of these risk types and as such, the provisions that need to be made to assist in the mitigation of these risks.

Doff (2008) has classified business risk as a structural uncertainty. This is due to the fact that business risk events continuously occur, but the causes of the events are unique and thus difficult to attach likelihoods to those events.

Some risk types may span across all three these categories. Credit risk, for example, contains elements that are “risk”, “structural” and “unknowables”. “Risk” elements can be provided for by means of specific provisions in the income statement (in the case of credit risk, these would be Impairments), whereas “Structural” and “Unknowables” are better suited to capital requirements, since these are not expected losses.

Business risk events occur across all industries. It is not specific to banks or financial firms. These events can be anything from market growth rate changes, technology changes or margin changes due to competition. For a bank, some business units may be more

susceptible to this risk type than others. How susceptible they are to business risk depends on the nature of the business (banking) market as well as the type of strategy employed by business line.

The nature of the banking market affects the degree of business risk exposure in the following ways:

- The competitiveness of the market.
- The degree of systemic risk in the market.

The type of strategy tactics employed has little to do with the nature of the market, but more to do with the management of strategy. Business risk has to do with bank management's ability to easily adapt their strategy and cost structure in the face of a required strategy change.

Both these components are important to address in the identification of business risk. Doff (2008) calls these two components "competitive environment" and "internal organisation". These two components determine how susceptible a business is to business risk as follows:

Competitive Environment	*Internal organization*	
	Adapt quickly	Adapt slowly
Dynamic	Business Risk Medium	Business Risk High
Stable	Business Risk Low	Business Risk Medium

Figure 4: Two components of Business Risk (Doff 2008)

In 1980 Lynge Jr. and Zumwalt defined business risk as the risk which arises due to variability in sales and its operating leverage (Lynge Jr. and Zumwalt 1980). At this time, business risk was not generally seen as a risk faced by banks. But in this particular study, it was indeed found that due to large fixed costs, commercial banks are indeed faced with business risk.

In this context the risks were decomposed into financial risks and business risks. Financial risks for commercial banks, in the current environment, are the well-known and familiar risks, such as credit risk, market risk and interest-rate risk. A large focus in the recent years has been placed on these risk types. However, non-financial risk types, i.e. business risk, are also of importance. Various definitions of business risk are found in literature. The section below will compare the various definitions.

2.3.1. Business Risk definitions

Lynge Jr. and Zumwalt used the following definition for business risk: "The uncertainty inherent in projections of future operating income, or earnings before interest and taxes (EBIT)" (Lynge Jr. and Zumwalt 1980). The financial structure of banks is very different to other industries, thus it is important to assess business risk faced by banks, and to be cognisant of the difference between banks' operational income and expenses compared to other industries, and as such be aware of different measurement approaches. Also, this definition brings about two different constructs of business risk: (1) strategic business risk (future projections) and (2) operational business risk (EBIT).

Bank sales and income vary over time for different reasons. These could be due to financial risks undertaken or business risks undertaken. In the context of capital and the requirement to capitalise against unforeseen circumstances, it is important for bank management to have a firm grip on both these risk types.

Business risk was defined by Klaassen and van Eeghen (2009) as follows: "Business risk is the risk of lower revenues and/or higher operating costs than expected." This however does not mean that business risk should be a measure of the volatility of volumes or earnings, but the volatility of profits, i.e. the adaptability of the cost base in response to changes in volumes and earnings. Also important in this definition is the notion of "expected" revenues and costs. It implies that budgeted costs and revenues should be taken into account, which in turn means that both strategic and operational business risks are included.

Siata (2010) defined business risk as the "risk of losses deriving from profit volatility for fee-based businesses". This definition excludes volatility from other sources and is only based on a specific type of business. Non-fee-based business could also pose business risk. Profit volatility can have various causes (such as credit risk that has already been capitalised) and may not be specifically attributed to business risk. According to Doff (2008), business risk is simply the earnings-related potential losses not yet contributed to other risk types.

It is important to frame business risk holistically, to ensure that banks are fully cognisant of the risks they are exposed to in order to manage it effectively. From the literature it is clear that the following considerations need to be made when defining business risk:

- Should business risk include only operational events, or should strategic risk be included?
- Should non-fee-based business lines be included?
- Should the business risk definition exclude the volatility observed from other risk types in revenues and costs?

2.3.2. Comparison of Business Risk frameworks in the global and local industry

In South Africa, only two of the major six banks hold economic capital for Business Risk. Only Standard Bank and Nedbank publically disclose business risk economic capital. Standard Bank holds 6.6% and Nedbank holds 11.9% (business risk economic capital as a percentage of total economic capital required). (Nedbank Group Limited 2014) (Standard Bank Group 2014)

None of the other major banks in South Africa hold capital for business risk. First Rand Bank and Capitec Bank both disclose business risk as a material risk, but neither bank requires capital as a buffer against this risk. Barclays Africa and Investec do not mention business risk in their public disclosures, thus it is not certain whether these banks consider business risk

at all. (Investec Ltd 2014) (Barclays Africa Group Limited 2014) (First Rand Bank 2014) (Capitec Bank 2015)

The definitions and capital requirements can be seen in Table 1 below:

Bank	Definition	Total Economic Capital (R'm)	Business Risk Economic Capital (R'm)	Business Risk Allocation %	Reporting date
Standard Bank Group	"Business risk is the risk of loss due to **operating revenues not covering operating costs.** Business risk is usually caused by the following: - inflexible cost structures - market-driven pressures, such as decreased demand, - increased competition or cost increases group-specific causes, such as a poor choice of **strategy,** **reputational damage** or the decision to absorb costs or losses to preserve reputation."	88.1	5.8	6.6%	Dec-14
Nedbank Group	"It is the risk caused **by uncertainty in profits** due to changes in the competitive environment that damage the franchise or operational economics of a business. In other words, it is the risk the bank faces due to **fluctuations in earnings**, readily observable and driven mainly by volumes, margins and fees. In the extreme, business risk can be seen as the risk of being unable to cover one's cost base should all or most of an entity's earnings fall away."	41.4	4.9	11.9%	Dec-14
First Rand Bank	"Business risk is the **risk to earnings** and capital from potential changes in the business environment, client behaviour and technological progress. Business risk is often associated **with volume and margin risk**, and relates to the group's ability to generate sufficient levels of revenue to offset its costs. **Strategic ris**k is the risk to current or prospective earnings arising from inappropriate business decisions or the improper implementation of such decisions."	n/a	0.0	n/a	n/a
BAGL	Not defined	n/a	n/a	n/a	Dec-14
Investec	Not defined	n/a	n/a	n/a	Mar-15
Capitec Bank	"This is the risk that: • non-performance against **planned strategic** objectives; • the consequences of **inappropriate strategy** or; • a decline in sales **volumes** or prices; will have a negative impact on **profitability"**	n/a	n/a	n/a	Dec-14

Table 1: South African Banks' business risk definitions and economic capital as per annual reports

The banks have similar definitions. Most of the banks refer to both earnings volatility and strategic risk in its definition of business risk. Only Nedbank's definition does not refer to strategic risk.

In a global study by McKinsey&Company, in which the study assessed the Pillar 2 processes of 19 international banks, significant short-comings were revealed with regards to business risk. Specifically, the report found that banks should attempt to quantify business risk (amongst other non-Pillar 1 risks). Only 60% of banks analysed considered business risk in their economic frameworks, as can be seen in the graph below. (McKinsey Working Papers on Risk Number 27 2011)

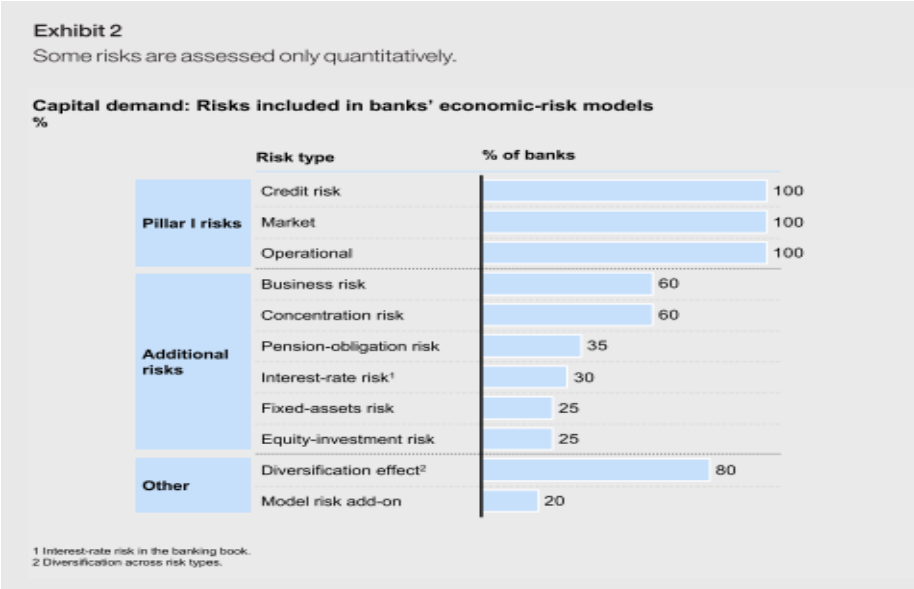

Figure 5: Risks considered by global banks (McKinsey Working Papers on Risk Number 27 2011)

The figure above shows that globally, business risk is considered more frequently by banks than it is in South Africa. It receives as much attention as concentration risk and diversification. All banks are forced by Basel Pillar 1 to consider credit, market and operational risk. But given that business risk, a Pillar 2 risk, is not regulated, 60% of the banks in the sample consider it a material risk and includes it in economic capital models.

Business risk definitions as sought from annual reports for various international banks are shown in Table 2 below:

Bank	Country	Definition
Nordea Bank	Sweden	"Business risk represents the **earnings volatility** inherent in all business due to the uncertainty of revenues and costs due to changes in the economic and competitive environment. Business risk is calculated based on the observed volatility in historical profits and losses that are attributed to business risk, i.e. not related to loan losses as well as trading income and expenses." [EC allocation (EUR): 1.9% of total]
ING Group	Netherlands	"The exposure to value loss due to **fluctuations in volumes**, margins and costs, as well as customer behaviour risk. These fluctuations can occur because of internal, industry, or wider market factors. It is the risk inherent to strategy decisions and internal efficiency, and as such **strategic risk** is included in business risk. Measured using two separate calculations and combined using VCV - Expense risk - Customer behaviour risk and its impact on deposits and mortgage repayments"
Royal Bank of Canada (Europe)	Canada	" Business risk is the risk of loss or harm due to **variances in volumes**, prices and costs caused by competitive forces, regulatory changes, reputation and **strategic** risks"
Rabobank	Netherlands	"Business risk: the risk of loss due to changes in the competitive environment or events **which damage the franchise or operating economics of a business"**
HSBC		"Business risk is the potential negative impact on profits and capital as a result of the group not meeting its **strategic** objectives, as set out in the rolling operating plan, owing to unforeseen changes in the business and regulatory environment, exposure to economic cycles and technological changes. The group does not explicitly set aside capital against business risk as a distinct category."
Deutsche Bank	Germany	"Business risk describes the risk we assume due to potential changes in general business conditions, such as our market environment, client behaviour and technological progress. This can affect our results if we fail to adjust quickly to these changing conditions. Business risk consists of **strategic** risk, tax risk and refinancing risk, of which only strategic risk is assessed as material."
UBS	Switzerland	"Business risks: the potential negative impact on **earnings** from lower than expected business volumes and / or margins, to the extent not offset by a decrease in expenses"
Credit Suisse	Switzerland	"Our expense risk measures the **potential difference between expenses and revenues** in a severe market event, excluding the elements captured by position risk and operational risk, using conservative assumptions regarding the **earnings** capacity and the ability to reduce the cost base in a crisis situation."
SEB	Sweden	"Business risk is the risk of **lower revenues due to reduced volumes**, price pressure or competition. The definition includes **venture decision** risk, i.e. risks related to large undertakings such as acquisitions, large IT projects, transformations, outsourcing etc."
Banco Santander	Spain	**"Strategic** risk: risk that the results are significantly different from the strategy or the entity's business plan as a result of changes in the general business conditions and risks associated with strategic decisions. It includes the risk of badly implementing decisions or the **lack of response capacity** to changes in the business environment"

Table 2: Business Risk definitions by international banks (as per annual reports)

The definitions used globally vary more vastly than local definitions. Some banks only refer to strategic risk as business risk, but for most the earnings volatility remains the dominant risk. Even though these banks have defined business risk as a material risk considered by the banks, it does not necessarily mean that these banks all hold capital against business risk.

The table below (Table 3) shows the disclosed business risk economic capital held for the various banks.

Bank	Total EC	Business risk	Allocation %	Total Loans and Advances	EC intensity (TOTAL)	EC intensity (Business risk)	Modelling Technique	Reporting date
Nordea Bank	23.9	0.454	1.9%	348.1	6.87%	0.13%	Bottom-up Volatility Model	Dec-14
ING Group	30.1	1.500	5.0%	517.5	5.82%	0.29%	Bottom-up Volatility Model and VCV model	Dec-14
Banco Santander	66.785	3.339	5.0%	734.7	9.09%	0.45%	Not disclosed	Dec-14
Royal Bank of Canada (Europe)	45.6	2.900	6.4%	2,773.0	1.64%	0.10%	Not disclosed	Oct-14
Rabobank	23.4	0.000	0.0%	45,962.0	0.05%	0.00%	None	Dec-14
HSBC			0.0%				None	
Deutsche Bank	31,866	3,084	9.7%	405,612	7.86%	0.76%	Not disclosed	Dec-14
UBS		0	0.0%	315,757	0	0	Not disclosed	Dec-14
Credit Suisse	33,195	0	0.0%	273,421	12.14%	0.00%	None	Dec-14
SEB	108	10	9.3%	1,355.68	7.97%	0.74%	Bottom-up Volatility Model	Dec-14

Table 3: Business Risk Capital Requirements and Modelling Technique (Source: Annual Reports)

The table shows that the business risk allocation percentage (business risk capital as a percentage of total economic capital) is between 1.9% and 9.7% for the sample of banks selected. Of the ten banks, four banks do not disclose any business risk economic capital. The results shown above correspond with Doff's findings in 2008. This could also imply that there has not been much development in the treatment of business risk in recent years.

According to Doff (2008), banks that consider business risk in their economic capital frameworks, generally allocate between 5-10% of total economic capital to this risk, but

their expectation of this risk is that it should be closer to 20%. Doff's paper also revealed how weakly business risk is defined and the disparity between these definitions.

2.3.3. Comparison of statistical methodologies used in the quantification of Business Risk

Doff addresses various methodologies which could be employed to measure business risk in his paper. These are generally peer group analyses, statistical methods and scenario analysis (Doff 2008). Earnings volatility models can be classified as statistical methods in this case.

In another paper, Bocker (2008) attempts to model business risk using discounted cash flows in a stochastic model. This is more complex than the methodologies assessed by Doff (2008).

Siata (2007) listed the following method as a possible economic capital estimation procedure for business risk:

1. Benchmark capital requirements with other financial institutions.
2. Use expert judgment to estimate a probability distribution of the operating result.
3. Use expected revenues and the historically observed volatility of these revenues to estimate a probability distribution of the operating result.
4. Model the relationship between revenues and the identified revenue-driving factors.
5. Identify business risk economic capital with earnings at risk (EaR)
6. Translate EaR into a different measure of capital at risk.

In essence, the business risk economic capital is the difference between expected fair value of equity and the stressed fair value of equity (given lower revenues and/or higher costs than expected), excluding the difference in equity caused by other risk types. Thus in computing the capital requirement, the stressed fair value of equity needs to be calculated by modelling volatilities of revenues and costs using historic data. This is what is meant by earnings volatility modelling. (Klaassen and van Eeghen, Economic Capital 2009)

Table 3 indicated the various methodologies disclosed by the banks in their annual reports. Very little information is included in the annual reports. But from the available information, the three banks that mention the methodology used all use bottom-up volatility models.

Nedbank uses an earnings-volatility methodology. Long-term strategic risk is excluded in Nedbank's definition as the bank does not believe that capital should be held against poor strategic decisions. Nedbank's model uses two parts: a top-down calculation and a bottom-up scenario based allocation approach. The top-down approach determines the level of capital to be used to buffer against business risk using peer data and internal data. The bottom-up approach determines the allocation mechanism (to various business units in the banks) using revenues as the anchor point. Nedbank seems to be using a mix of peer group analysis and scenario analysis. (Nedbank Group Limited 2014)

Standard bank does not disclose any information regarding the methodology used to quantify the business risk economic capital. Given the definition of business risk, it is also likely to be an earnings volatility methodology. (Standard Bank Group 2014)

The only international banks in the sample that provided information regarding the methodologies used were Nordea Bank and ING Group. Nordea Bank uses an earnings-volatility model, using observed volatility in historical profits and losses attributed to business risk. ING Bank also uses earnings-volatility, but the model is in two parts. The first part models the expense risk which relates to earnings, but the second part takes into account changes in customer behaviour as well. It is not clear how the bank distinguishes between customer credit behaviour and business risk volatility. The bank then combines these two elements in a variance-covariance matrix in order to determine the diversification between the two components in calculating the final business risk economic capital. (ING Group 2014)

In Siata's study (Saita 2007), total business risk capital as a proportion to total risk capital was also between 4% and 12%. This corresponds with previous findings.

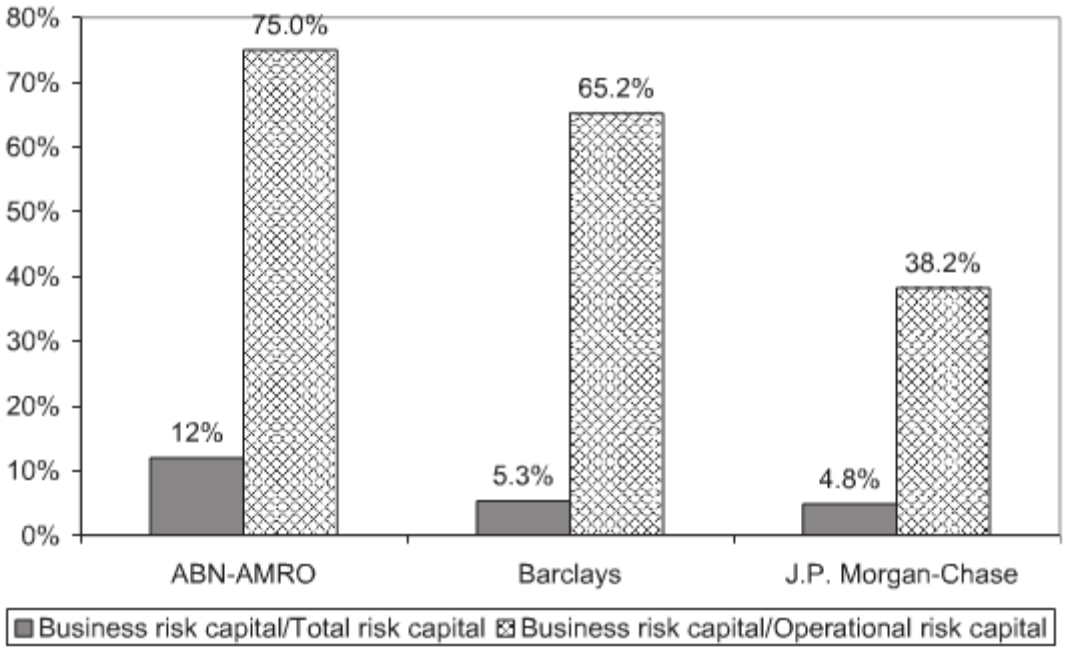

Figure 6: Business risk over total risk capital and relative to operational risk capital (Saita 2007)

The methodologies provided by Doff (2008) and Bocker (2008) do not seem to be used widely in the industry, but instead, the methodology recommended by Siata (2007) is. This research paper also recommends a method similar to what Siata (2007) recommended. The next section discusses the methodology selected in more detail.

3. Empirical model for Business risk

3.1. Business Risk Definition

In order to develop a model to calculate economic capital for business risk, it first needs to be defined. The literature review established that there are two specific aspects regarding the definition that needs to be assessed:

i. Earnings volatility risk
ii. Strategic risk

Most banks include either one of these risks or both in its definition of business risk. Both are material risks that require consideration, thus banks should consider these risk types either separately or combined. An attempt to construct an inclusive and complete definition is suggested as follows:

"Business risk is the potential negative impact on shareholder value and capital due to earnings volatility caused by changes in the business environment which can't be met by a reduction in expenses or non-performance against the bank's strategy."

3.2. Business Risk Economic Capital Model

Economic capital was defined above as "an estimate of the worst possible decline in the institution's amount of capital at a specified confidence level, within a chosen time horizon" (Klaassen and van Eeghen, Economic Capital 2009). Thus a business risk economic capital model needs to measure the worst possible loss a bank can suffer due to business risk at a specified confidence level.

The definition that has been constructed includes both earnings volatility due to changes in the business environment as well as losses incurred due to strategic objectives not being met. These two aspects are seemingly different and could possibly require two separate models. In terms of data alone, the earning volatility risk requires historical financial statement information in order to assess the various volatilities present in earnings; but for strategic risk, historic budgets would also be required in order to assess how often or likely it

is for strategic objectives (in the form of budgets) not to not have been met by actual results. The difference between budgeted financial statements and actual financial statements can be analysed to assess potential future losses.

3.3. Earnings Volatility Model

An earnings volatility model can be applied to any income statement. The method developed is generic and widely applicable.

In order to assess potential losses due to earnings volatility, past earnings should be used, i.e. analysis of historic financial statements. Specifically, the income statement of the bank where earnings and expenses are recorded should be utilised. The income statement comprises all sources of earnings volatility and is thus a good place to start.

It should be remembered, however, that earnings volatility is not only caused by business risk events. For example, credit risk cycles cause volatility in impairments figures which affect the profitability of the bank. Care should be taken that volatility in earnings driven by business risk excludes volatility introduced by other risk types which are already capitalised.

3.3.1.Data

The first step in building the business risk model is the assessment of the individual line items of the financial statements. All line items in the balance sheet and the income statement that are perceived to be related to business risk should be analysed. This may require expert judgment and consultation, since it would not always be clear, nor obvious, which line items in the financial statements are susceptible to business risk.

Specifically, it should be assessed which line items are fixed or variable. Variable costs in the income statement will change with the business cycle, and thus do not pose

business risk. Only fixed and semi-fixed costs contribute to business risk. These are the line items that need to be identified and assessed.

These line items selected will be different to each financial institution. This ensures that the model applied is bespoke to the institution. Due consideration needs to be applied to each line item in order to guarantee that the model accurately identifies the drivers of business risk specific to the financial institution.

Historic financial statements from a South African bank have been collected. Monthly data is available and spans 8 years (1 January 2008 – 31 December 2015).

The following process has been followed in order to categorise financial statement line items into business risk items and non-business risk items:

1.1. All income statement line items that are non-business risk related were removed. These would be line items such as Impairments (credit risk), Fraud and Losses (operational risk) and Foreign Exchange Differences (foreign exchange risk). A list of these is shown in the table below (Table 4). Care needs to be taken to ensure that line items for which capital is already provided are excluded.
1.2. Exclude all line items that are completely variable and can be stopped at any time, such as bonuses, which do not require capital.
1.3. All other income statement line items are considered business risk.
1.4. Once business risk line items are identified, risk drivers for these line items should be determined.

The line items below do not affect business risk capital and can thus be discarded going forward. It is important to note, however, that these exclusions will differ from institution to institution. It depends heavily on the definition of business risk in use as well as the risk coverage of the bank. For example, if a bank does not hold economic capital for foreign exchange risk, then items such as “Foreign exchange differences” cannot be excluded from business risk capital. This list of items should be consulted

between the Finance departments and the Risk departments, in order to ensure that the correct distinctions are made between what should be considered business risk and what should not.

Excluded Financial Statement Line Items	Reason/ Risk Type	Excluded Financial Statement Line Items	Reason/ Risk Type
Interest Received - Cash, cash balances and balances with central banks	Interest Rate Risk	Net gains on investments from insurance activities	Insurance Risk
Interest Received - Fair value adjustments on hedging instruments	Interest Rate Risk	Foreign exchange differences	Foreign Exchange Risk
Interest Received - Other interest	Interest Rate Risk	Income from investment properties	Fixed Asset Risk
Interest Paid - Fair value adjustments on hedging instruments	Interest Rate Risk	Profit on disp of intangibles assets (non-headline earnings)	Fixed Asset Risk
Interest Paid - Other interest	Interest Rate Risk	Income from maintenance contracts	Fixed Asset Risk
Identified impairments non performing book	Credit Risk	Profit on disposal of property and equipment (non-HE)	Fixed Asset Risk
Identified Impairments delinquent book	Credit Risk	Profit on sale of developed properties	Fixed Asset Risk
Identified Impairments - Net Present Value Adjustment	Credit Risk	Profit on sale of repossessed properties (PIPS)	Fixed Asset Risk
Unidentified Impairments	Credit Risk	Rental income	Fixed Asset Risk
Recoveries of advances previously written off	Credit Risk	Administration fees	Fixed Asset Risk
Gross insurance premiums	Insurance Risk	Amortisation of intangible assets	Not to be capitalised
Premiums ceded to reinsurers	Insurance Risk	Depreciation	Fixed Asset Risk
Gross claims and benefits incurred on insurance contracts	Insurance Risk	Fraud and losses	Operational Risk
Reinsurance recoveries	Insurance Risk	Bonuses	Not to be capitalised
Insurance liabilities	Insurance Risk	Share-based payments	Not to be capitalised
Investment liabilities	Market Risk	Training costs	Not to be capitalised
Valuation fees	Variable Cost	Cheque processing fees	Variable Cost
Amortised cost instruments	Market Risk	Net trading result	Market Risk
Associates and joint ventures	Market Risk	Available-for-sale unwind from reserves	Market Risk
Insurance commission paid	Variable Cost	Trust and other fiduciary service fees	Variable Cost
Net gains on investments	Market Risk	Transaction-based legal fees	Variable Cost

Table 4: Excluded Financial Statement Line Items

3.3.2. Risk Drivers

The volatility of these line items is caused by other external macroeconomic factors, such as inflation, credit extension, profitability, etc. It is important to determine the

risk drivers and the volatility of these risk drivers instead of the individual line items themselves, since the source is external and thus those drivers should be modelled.

The next step is the determination of risk drivers for the business risk line items. These should preferably be external macroeconomic factors that depict the business environment, and as such impact the earnings volatility of a bank. These risk drivers should also be consulted between the Risk and Finance departments to ensure that the risk drivers are appropriately selected and that all risk drivers are considered.

It should be noted again that these risk drivers need to be adequately assessed by individual financial institutions. The drivers will be different for various institutions, since unrelated businesses are susceptible to different risks.

The risk drivers need not be standardised. Preferably, the risk drivers should be bespoke to introduce risk sensitivity to the model. This ensures that various institutions will be able to identify its business risk drivers and as such mitigate the risk. Also, the usage of macroeconomic risk drivers means that the methodology can be adapted for stress testing. Using stressed macroeconomic variables allows the model to calculate stressed economic capital values.

A summary of the key input variables required as a minimum are as follows:

- Cumulative year-to-date income statement balances for each line item given in Table 5 for each legal entity under consideration.
- Annualised growth rates for the selected risk drivers
- Annualised volatilities of logarithmic returns for the selected risk drivers
- The effective tax rate for the bank.
- The annualised cost of equity is used as a discounting rate in the EC calculation.

Table 5 shows a list of included financial statement line items and the recommended risk drivers.

Financial Statement Line Item	Risk driver
Interest Received - Investment securities	Market Volatility (e.g. JSE/FTSE indices)
Interest Received - Loans and advances to banks	Credit Extension to Wholesale Customers
Interest Received - Loans and advances to customers	Credit Extension to Retail Customers
Interest Paid - Borrowed funds	Credit Extension to Wholesale Customers
Interest Paid - Debt securities in issue	Credit Extension to Wholesale Customers
Interest Paid - Interest incurred on finance leases	Credit Extension to Retail Customers
Asset management and other related fees	Credit Extension to Retail Customers
Consulting and administration fees	Credit Extension to Retail Customers
Credit-related fees and commissions	Credit Extension to Retail Customers
Insurance commissions received	Credit Extension to Retail Customers
Investment banking fees	Market Volatility (e.g. JSE/FTSE indices)
Merchant income	Market Volatility (e.g. JSE/FTSE indices)
Other fees and commissions	Credit Extension to Retail Customers
Trust and other fiduciary services	Market Volatility (e.g. JSE/FTSE indices)
Cash transportation costs	Credit Extension to Retail Customers
Equipment costs	CPI Volatility
Information technology	CPI Volatility
Investment properties charges - change in fair value	CPI Volatility
Salaries and current service costs on post-retirement benefits	CPI Volatility

Table 5: Included Financial Statement Line Items and Risk Drivers

Great care needs to be taken in the selection of the risk drivers. The list above is merely an illustration of what could be considered when selecting risk drivers. It is important to ensure that data is available in order to model the volatility of these risk drivers. Essentially, business risk economic capital will be calculated by measuring the volatility of these risk drivers and as such, a loss distribution of earnings.

3.3.3. Model Methodology

The next step is building an earnings volatility model once the data has been collected and risk drivers have been identified. It is important to understand what needs to be measured in order to determine the best methodology.

Business risk has been defined as “the potential negative impact on shareholder value and capital due to earnings volatility caused by changes in the business environment which can’t be met by a reduction in expenses or non-performance against the bank’s

strategy". In other words, we are trying to assess the losses a bank can sustain due to volatility in earnings, at a certain confidence level. If we were to choose a confidence level of 99.95%, that means that we want to calculate our worse anticipated loss every 2000 years.

Humans are rarely capable of imagining or anticipating such rare losses. Thus the best method to predict losses at such high confidence levels would be to produce a probability distribution of losses using available data. For business risk economic capital, this should be a distribution of profits or earnings, using the risk drivers' volatilities to produce this distribution.

A Geometric Brownian Motion (GBM) process has been used to produce the distribution. A GBM process is a continuous stochastic process which we can be used to forecast future values of the Profit After Tax (PAT), simulated many times in order to create a distribution of PAT values which can be used to calculate the VaR. A distribution of losses, instead of a point-estimate of a loss, is always of more use since it can be applied at any confidence level and as such, can be used widely and for different applications (i.e. risk appetite or solvency).

A Brownian motion is defined as follows (Baxter and Rennie 2002):

The process $W = (W\text{t}: t \geqslant 0)$ is a $\mathbb{P}$-Brownian motion if and only if

i. Wt is continuous, and $W0 = 0$,
ii. the value of Wt is distributed, under $\mathbb{P}$, as a normal random variable $N(0,t)$,
iii. the increment $Ws+t - Ws$ is distributed as a normal $N(0,t)$, under $\mathbb{P}$, and is independent of $\mathcal{F}s$, the history of what the process did up to time s.

A Brownian motion has zero mean. The PAT of a bank would normally be expected to grow (as we generally see this historically), so thus a standard Brownian motion cannot be used. We need to introduce a drift (a growth rate) where $S_t = W_t + \mu t$, for some constant μ reflecting nominal growth. This is known as a Geometric Brownian Motion (GBM). (Baxter and Rennie 2002)

For our model, we will assume that the selected Income Statement line items (*i*) in Table 5, all follow a GMB with growth rate (μ_i) and volatility (σ_i). The growth rate can be understood as the trend followed by the income statement line item whilst the volatility represents the shocks that cause deviation from the trend or expectation. The parameters (μ_i and σ_i) for each line item *i* will be derived from the selected risk drivers. This will enable us to forecast a future value at horizon date for each of these line items.

This will be simulated many times, where a new PAT will be calculated for each simulation. A distribution of the PAT can then be derived.

Consider an income statement with N line items, $IS_i(t)$ with the relative change in each line item at time t being described by a geometric Levy process of the form [7]:

$$dlnIS_i = \left(\mu_i - \frac{\sigma_i^2}{2}\right) dt + \sigma_i dW_{i,t} \tag{3.1}$$

Where μ_i is a constant growth rate and σ_i is the volatility. The Wiener process $\Delta W_{i,t}$ follows a standard geometric Brownian motion defined by:

$$dW_{i,t} = \varepsilon_i \sqrt{dt} \tag{3.2}$$

Where ε_i has a standard normal distribution ($\varepsilon_i \sim N[0,1]$).

From equation (6.1) it follows that the value of $IS_i(t)$ after time step Δt is given by:

$$IS_i(t + \Delta t) = IS_i(t) exp\left[\left(\mu_i - \frac{\sigma_i^2}{2}\right)\Delta t + \sigma_i \Delta W_{i,t}\right] \tag{3.3}$$

The profit after tax (PAT) at time $t + \Delta t$ can be calculated as:

$$PAT(t+\Delta t) = \sum_{i=1}^{N} IS_i(t+\Delta t) - MAX[TR \times \sum_{i=1}^{N} IS_i(t+\Delta t), 0] \quad (3.4)$$

Where TR is the effective rate (percentage) at which tax is deducted from any profit.

For those income statement line items considered to be sensitive to business risk, the underlying drivers of uncertainty can be identical for different line items. For example, a portion of interest income from loans and advances to customers is sensitive to changes in customer volumes, as is income derived from credit related fees and commissions. When measuring business risk the model therefore applies a single, common Levy process, D_j, as defined in equation (3.1), which will drive changes in their income statement balances:

$$\Delta lnD_j = \left(\mu_j - \frac{\sigma_j^2}{2}\right)\Delta t + \sigma_j \Delta W_{j,t} \quad (3.5)$$

$$IS_i(t+\Delta t) = IS_i(t)\exp[\Delta lnD_j] \quad (3.6)$$

For the business risk EC model presented in this paper four common drivers have been selected:

- The proportional change in income attributed to variability in customer volumes and margins. This has a proxy value set equal to the proportional change in loans and advances to customers;
- The proportional change in income attributed to variability in banking client volumes and margins. This has a proxy value set equal to the proportional change in loans and advances to banks;
- The proportional change in the rate of inflation base on the Consumer Price Index (CPI); and
- The proportional change in the level of the main stock market index;

If a common driver is not selected for a particular income statement line the geometric Levy process is defined on a standalone basis for that line item.

To simulate the PAT for a one year time horizon, independent normally distributed changes in each driver D_j are generated using equation (3.5) and applied to equation (3.6) such that a new value for each income statement line item is calculated. For each scenario the resulting values of income statement line items are summed and a PAT is calculated according to equation (3.4). By running multiple simulations a distribution of possible PAT values can be developed which is used to inform an estimate of the maximum downward deviation in PAT from expectation at different confidence levels. The EC at a confidence level α is then defined as:

$$EC = (E[PAT] - VaR_{1-\alpha}[PAT]) \times DF_{1y} \quad (3.7)$$

Where $VaR_{1-\alpha}[PAT]$ (i.e. value-at-risk) is the $(1-\alpha)$ quantile measure of the cumulative distribution function of the PAT, $E[PAT]$ is the expected or average value and DF_{1y} is the discount factor for one year.

To simplify the modelling process, changes in balances for income statement line items which have a common underlying driver in the context of business risk are assumed to be perfectly correlated. Changes in balances for income statement line items which have a different underlying driver, are assumed to be independent (i.e. zero correlation).

Figure 7 shows a conceptual view of the model. The current PAT is represented by S_0 where $t_0 = 0$. S_T represents the market value at time t = T. In the model the time horizon is taken to be T = 1 year ($\Delta t = 1$).

The value at risk of business risk is defined as the difference between the current PAT and the projected PAT at the target horizon.

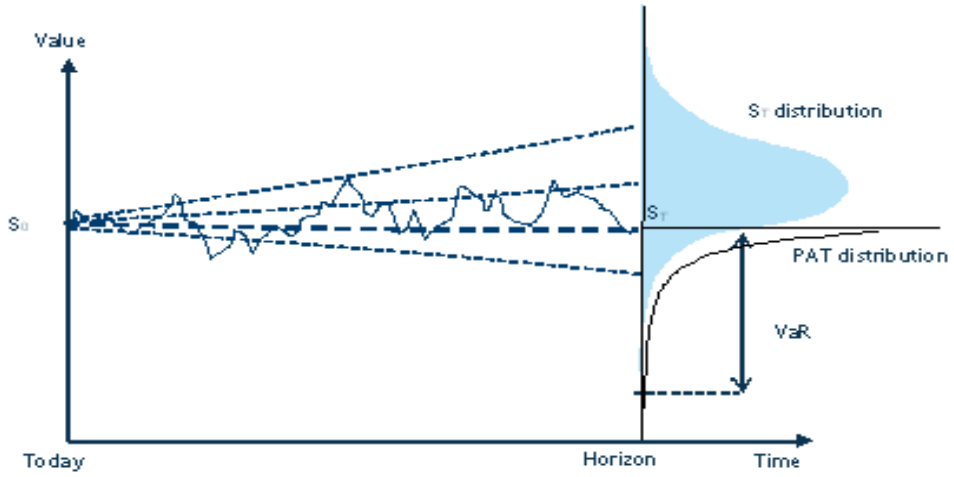

Figure 7: Illustration of the model assumptions. The PAT follows a geometric Brownian motion with a growth rate μ and a volatility σ.

The model has been built in Microsoft Excel VBA. The code can be found in Appendix A.

This model was applied and simulated 100 000 times. From this we obtain a distribution of the PAT. From this distribution we can calculate the Expected Loss, VaR and the Unexpected Loss.

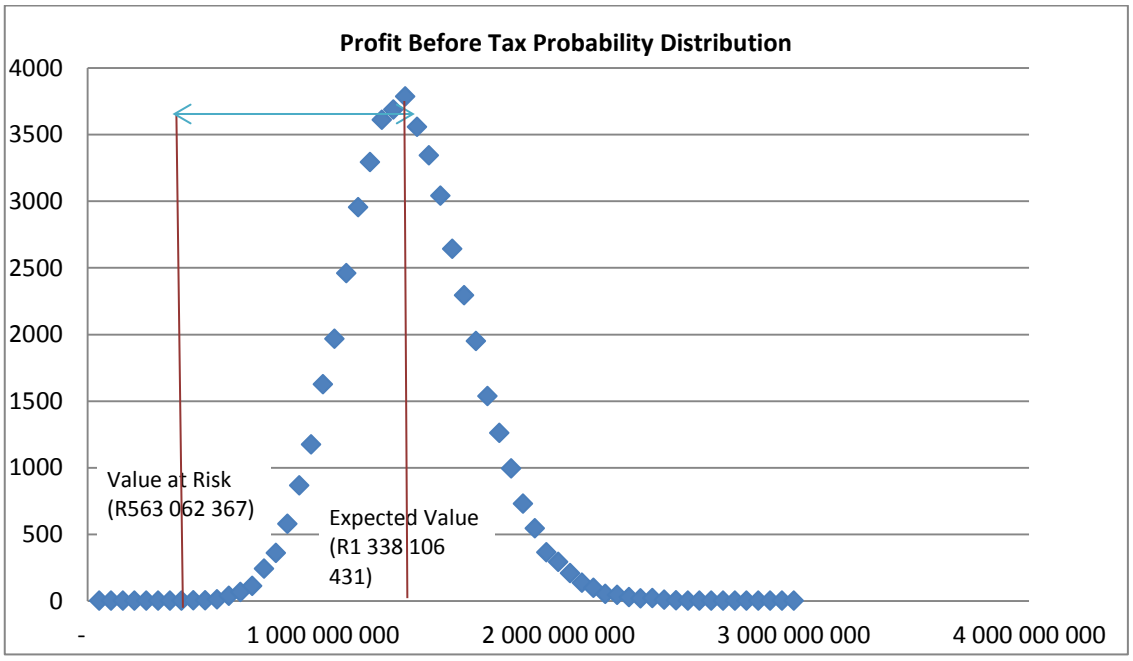

Figure 8: PAT Probability Distribution

The results of the simulation are shown above in Figure 8.

The Expected Value was calculated to be R 1 338 106 431 and the VaR was R 563 062 367, which means that given bank expects to make R 1 338 106 431 as its PAT in the next year, but if this specific year experiences a one-in-a-two-thousand year shock due to a business risk event, the profit will reduce to R 563 062 367. Thus the Unexpected Loss is R 775 044 063 (which is the difference between the two).

The development of this methodology allows a financial institution to model a distribution of losses. The GBM is a well-known model and used widely across industries and thus is easy to defend and justify. So even though the model is fairly simple and generic, given due consideration to the specific line items and risk drivers, ensures that the model is risk-sensitive and bespoke to the financial institution.

3.4. Strategic Risk Model

Business risk has been defined as both earnings volatility as well as strategic risk. We have showed the capital impact of earnings volatility in the section above.

Not all banks include strategic risk as part of their definition for business risk, as some banks don't believe that it should capitalise itself against strategic decisions. However, given that the implementation of an improper strategy may lead to losses or a reduction in shareholder value, it would be prudent to include this in the business risk definition.

To model strategic risk, we would require budgeted forecasts of financial statements. The budgeted forecasts include the banks' expectations of future earnings. To assess how incorrect these forecasts have been in the past, we can compare historic budgets to the actual historic financial statements. The differences between these two sets of financial statements would identify the accuracy of past budgeted forecasts. This will give us an indication of how "wrong" or strategic objectives have been in the past, and as such provide a prediction of possible errors in setting forecasts based on expectations going forward.

We have not been able to build this part of the model due to data unavailability. The bank that has provided the data for the analysis has not stored budgeted financial statements for long enough periods – only the last three years' worth of data has been stored. This results in only three data points per line item in the financial statements, which will give rise to higher volatilities and inaccurate predictions.

However, the model would be developed similarly as the Earnings Volatility methodology described in section 3.2.2.

Instead of modelling the volatility of the line items in the financial statement, the volatility of the difference between the historical budgeted forecasts and the actual historical financial statement should be modelled.

In the same way as before, the following steps should be followed:

- Retrieve budgeted financial statement for the following year.
- Calculate the growth rate μ_i and a volatility σ_i for each line item (defined as the difference between the budget and the actual).
- Each line item receives a forecasted value, using the Brownian motion process with parameters μ_i and σ_i.
- A new PAT is calculated using the forecasted values
- This is simulated 100 000 times, using a normal distribution (dW), which calculates 100 000 PAT values.

The value at risk of strategic business risk will then be defined as the difference between the budgeted PAT and the projected PAT at the target horizon.

4. Results and Analysis

The four risk drivers identified for the portfolio were as follows. The annual drift and the standard deviation are included for each risk driver in the table below:

Risk Driver	Data Source	Data Period	μ	σ
CPI Volatility	StatsSA	2009-2015	5.9%	24.6%
Credit Extension to Retail Customers	Bank Data: Loans and Advances to Customers	2008-2015	6.2%	9.1%
Credit Extension to Wholesale Customers	Bank Data: Loans and Advances to Banks	2008-2015	4.2%	13.4%
Market Volatility (e.g. JSE/FTSE indices)	JSE Index	2003-2015	6.0%	13.2%

Table 6: Risk drivers

This indicates that the Financial Statement line items that are driven by CPI will mostly drive the business risk economic capital since it has the highest volatility. Credit Extension to Retail Customers is the least volatile and thus has the lowest impact on economic capital.

Sensitivity analysis has been done to assess the volatility of economic capital for given changes in the growth rate (μ) and standard deviation (σ) for each of the risk drivers. The results are shown in the table below.

Sensitivity	EC	% Change in EC
Growth Rate (μ)	77,504,063	
+5%	81,844,291	5.60%
+10%	86,100,194	11.09%
+15%	90,491,304	16.76%
+20%	95,106,360	22.71%
+50%	99,956,784	28.97%
+100%	105,054,580	35.55%
Standard Deviation (σ)	77,504,063	
+5%	83,704,388	8.00%
+10%	93,748,915	20.96%
+15%	109,686,230	41.52%
+20%	134,914,063	74.07%
+50%	183,483,126	136.74%
+100%	293,573,001	278.78%

Table 7: Economic Capital sensitivity to growth rate and volatility changes

All of the risk drivers' parameters were simultaneously changed as illustrated above. From the results above we see that doubling the growth rates lead to a 36% increase in economic capital, whereas doubling the standard deviation leads to an almost threefold increase in economic capital. Thus the sensitivity to the standard deviation is much higher than the growth rate.

The business risk capital calculated should be compared to other risks' capital requirements. Doff (2008) indicated that the business risk capital as a percentage of total capital should be about 20%. Benchmarking exercises concluded that peer banks hold less than 10% business risk capital as a percentage of the total capital. For this specific bank, business risk compares to other risk types as follows:

Risk type	EC (R'm)	% total	EC intensity
Credit risk	4,352	60.7%	7.1%
Operational risk	773	10.8%	1.3%
Traded market risk	354	4.9%	0.6%
IRRBB	346	4.8%	0.6%
Equity risk	168	2.3%	0.3%
Fixed asset risk	278	3.9%	0.5%
Insurance risk	122	1.7%	0.2%
Business risk	775	10.8%	1.3%
Min requirement	7,168	**100.0%**	**11.6%**

Table 8: Total Business Risk Capital as percentage of Total Economic Capital Requirement

The table above shows that the capital requirement for business risk amounts to 10.8% to the total capital requirement. This compares well to benchmarks, but still lower than Doff's (2008) prediction. The capital intensity (business risk capital as a percentage of Total Loans and Advances) is 1.3%. This is significantly higher than peer banks. All banks showed a capital intensity level lower than 1%. This implies that this specific bank's income statement (assuming similar methodologies across banks) is more sensitive to external changes than other banks. Perhaps it indicates that this particular bank is not able to reduce its costs as efficiently as other bank, for simultaneous reductions in earnings. The economic capital calculated above also excludes strategic risk economic capital, which would increase the requirement.

5. Summary of findings and future work

The results of this paper correspond largely to that of Doff (2008). We have seen that business risk has not seen increased exposure over the last ten years. A lot of banks still do not hold capital for business risk. It could probably be conjectured that all banks will not hold capital for business risk unless it is enforced by regulators or BIS.

Business risk is, however, a significant risk. This is seen by the level of capital required for this risk, as shown by the model for this specific bank as well as the benchmarking exercise. Approximately 10% of total economic capital is required for business risk. This is as much as the operational risk capital requirement and more that what is required for market risk for most banks. Both operational risk and market risk are seen as significant risks and receive considerable attention from both the market and regulators. Business risk seems to receive very little attention.

It is imperative for banks to assess the risks they are faced with. Business risk is one of these and requires the attention of both the banks and the regulators, since this risk is indeed significant.

This study describes one methodology for the computation of the capital requirement for business risk. The study does not compare this method to other possible methods. Different methodologies may result in varying capital requirements, but based on the literature review and the external benchmarking exercise, the result of this model is in-line with the results of other methods.

This study also did not quantify the capital requirement for strategic risk. If this were to be included in the business risk capital, we would have an even higher capital requirement. We are not sure of the quantum at present, but this could possibly promote the significance of business risk even further. Future work for this element of business risk is required.

Allocation of capital was also not considered in this discussion. As part of the ICAAP framework is it important to address the capital allocation mechanism. Business units that

are susceptible to business risk need to manage and mitigate business risk as far as possible. Allocation of capital to those business units that drive business risk will then encourage the business units to recognise the risk and thus manage it in order to alleviate the business risk capital imposition. The basis on which this capital should be allocated requires further research and investigation.

6. Bibliography

1. Barclays Africa Group Limited. “Risk management for the reporting period ended 31 December 2014.” 2014. http://www.barclaysafrica.com/barclaysafrica/Investor-Relations/Announcements-and-publications/Annual-and-interim-reports.
2. Basel Committee on Banking Supervision. *Bank Failures in Mature Economies.* Working Paper No. 13, Bank for International Settlements, 2004.
3. Baxter, M, and A Rennie. *Financial Calculus – An introduction to derivative pricing.* Cambridge, 2002.
4. Bessis, J. *Risk Management in Banking* . New York: John Wiley & Sons, 1998.
5. Bocker, K. “Modelling and measuring business risk.” In *Pillar II in the New Basel Accord: the Challenge of Economic Capital*, by A Resti, 179-200. London: Risk Books, 2008.
6. Capitec Bank. “Intergrated Annual Report .” 2015.
7. Credit Suisse. “Annual Report.” *Credit Suisse Financial Reports.* 2014. https://www.credit-suisse.com/za/en/about-us/investor-relations/financial-disclosures/financial-reports/finacial-reports-2014.html (accessed December 10, 2015).
8. Davison, Matt. *Quantitative Finance: A Simulation-Based Introduction Using Excel.* CRC Press, 2014.
9. Deutsche Bank. “Annual Review.” 2014.
10. Deutsche Bank Group. “Deutsche Bank Annual Report.” *Deutsche Bank Group Investor Relations .* 2014. https://annualreport.deutsche-bank.com/2014/ar/servicepages/downloads.html (accessed November 2015, 2015).
11. Doff, R. “Defining and measuring business risk in an economic-capital framework.” *The Journal of Risk Finance, 9(4)*, 2008: 317-333.
12. First Rand Bank. “Basel Pillar 3 Disclosure.” 2014. http://www.firstrand.co.za/InvestorCentre/Pages/capitaldisclosures.aspx.
13. Froot, K, and J Stein. “Risk management, capital budgeting, and capital structure policy for financial institutions: An integrated approach.” *Journal of Financial Economics, 47(1)*, 1998: 55-82.
14. Golin, Jonathan, and Philippe Dehaise. *The Bank Credit Analysis Book.* New York: John Wiley & Sons, 2013.
15. HSBC Bank plc . “Capital and Risk Management Pillar 3 Disclosures.” 2014.
16. ING Group. “Annual Report.” 2014.
17. “International Convergence of Capital Measurement and Capital Standards.” Basel: Basel Committee on Banking Supervision, 2006.
18. Investec Ltd. “Annual Report.” 2014. https://www.investec.co.za/about-investec/investor-relations/financial-information/group-financial-results.html.
19. Klaassen, P, and I van Eeghen. *Economic Capital.* Oxford: Elsevier Science, 2009.

20. —. *Economic Capital.* Oxford: Elsevier Science, 2009.

21. Lynge Jr., Morgan J, and J Kenton Zumwalt. *An Analysis of Business Risk in Commercial Banks.* University of Illinois at Urbana-Champaign: College of Commerce and Business Administration, 1980.

22. McKinsey Working Papers on Risk Number 24. *The use of economic capital in performance management for banks: A perspective.* Washington: McKinsey & Company, 2011.

23. McKinsey Working Papers on Risk Number 27. *Mastering ICAAP.* Washington: McKinsey & Company, 2011.

24. Nedbank Group Limited. "Pillar 3 Basel III Public Disclosure Report." 2014. http://www.nedbankgroup.co.za/financialBaselII.asp.

25. Nordea Bank AB. "Capital and Risk Management Report ." Stockholm, 2014.

26. Rabobank. "Rabobank ." *Rabobank Downloads .* 2014. https://www.rabobank.com/en/about-rabobank/results-and-reports/archive/archive-2014.html (accessed November 15, 2015).

27. "Range of Practices and Issues in Economic Capital." Basel: Basel Committee on Banking Supervision, 2009.

28. Saita, Francesco. *Value at Risk and Bank Capital Management.* Elsevier Inc, 2007.

29. Santander. "Santander Annual Report." *Santander Corporate Website .* 2014. http://www.santander.com/csgs/Satellite/CFWCSancomQP01/en_GB/Corporate/Shareholders-and-Investors/Financial-and-economic-information/Financial-report/Annual-Report.html (accessed November 15, 2015).

30. Schooner, Heidi Mandanis , and Michael W Taylor. *Global Bank Regulation: Principles and Policies.* Academic Press, 2009.

31. SEB Group. "SEB Annual Reports." *SEB Group.* 2014. http://sebgroup.com/investor-relations/reports-and-presentations/annual-reports (accessed December 10, 2015).

32. Shrieves, R, and D Dahl. "The relationship between risk and capital in commercial banks." *Journal of Banking & Finance, 16(2)*, 1992: 439–457.

33. Standard Bank Group. "Risk and capital management report and annual financial statements 2014." 2014. http://reporting.standardbank.com/resultsreports.php.

34. UBS Group AG and UBS AG. "Annual Report." 2014.

35. York, Jonathan, and Ida Kristensen. "Event risk is not your only operating risk." *The RMA Journal*, 2007: 34-38.

Appendix A: VBA Code

```
Option Explicit
Global ws_control As Excel.Worksheet
Global ws_output As Excel.Worksheet
Global ws_summary_is As Excel.Worksheet
Global ws_summary_is_growth_rate As Excel.Worksheet
Global ws_summary_is_volatility As Excel.Worksheet
Global g_num_sim As Long
Global g_num_legal_entity As Long
Global g_num_is_items As Long
Global g_rng_growth_rate As Excel.Range
Global g_rng_volatility As Excel.Range
Global g_rng_summary_is As Excel.Range
Global g_discount_rate As Double
Global g_tax_rate As Double

Sub Initialise()
Set ws_control = Excel.ThisWorkbook.Worksheets("Control")
Set ws_summary_is = Excel.ThisWorkbook.Worksheets("Summary IS")
Set ws_summary_is_growth_rate = Excel.ThisWorkbook.Worksheets("Summary IS Growth Rate")
Set ws_summary_is_volatility = Excel.ThisWorkbook.Worksheets("Summary IS Volatility")
Set ws_output = Excel.ThisWorkbook.Worksheets("Output")

g_num_sim = ws_control.Range("num_sim")
g_num_legal_entity = ws_control.Range("num_legal_entity")
g_num_is_items = ws_control.Range("num_is_items")

Set g_rng_summary_is = ws_summary_is.Range("rng_summary_is")
Set g_rng_growth_rate = ws_summary_is_growth_rate.Range("rng_summary_is_growth_rate")
Set g_rng_volatility = ws_summary_is_volatility.Range("rng_summary_is_volatility")

g_discount_rate = ws_control.Range("discount_rate")
g_tax_rate = ws_control.Range("tax_rate")
End Sub


Sub RunSimulationEC()

Dim sim_index As Long
Dim entity_index As Long
Dim is_index As Long
Dim results As Variant
Dim is_item As Double
Dim is_item_ret As Double
Dim norm_rand_num As Double

ReDim results(1 To g_num_sim, 1 To 12)

For sim_index = 1 To g_num_sim
    For is_index = 1 To g_num_is_items
      norm_rand_num = Functions.GetNormRand
      For entity_index = 1 To 1
        is_item_ret = g_rng_growth_rate.Cells(is_index, entity_index) + g_rng_volatility.Cells(is_index, entity_index) * norm_rand_num
        is_item = g_rng_summary_is.Cells(is_index, entity_index) * Math.Exp(is_item_ret)
        results(sim_index, 1) = results(sim_index, 1) + is_item
      Next
  Next


  For entity_index = 1 To 12
    'results(sim_index, entity_index) = -results(sim_index, entity_index) * (1 - g_tax_rate) * Math.Exp(-g_discount_rate)
    results(sim_index, entity_index) = -(results(sim_index, entity_index) - Min(results(sim_index, entity_index) * g_tax_rate, 0)) *
Math.Exp(-g_discount_rate)
  Next
Next

ws_output.Range(ws_output.Cells(1, 2), ws_output.Cells(g_num_sim, 13)) = results
End Sub
```