Mandatory disclosures: rationale, evolution and impact — An examination of the banking sector

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Dedication

This thesis is dedicated to

My late father Santosh Kumar Dasgupta

&

My Wife

Mandira Dasgupta

without whose encouragement and support this would never have been possible.

Abstract

This thesis explores mandatory disclosures provided by firms to markets, regulatory authorities and other bodies that have been increasing exponentially over the years with the corresponding increase in costs of such disclosures. Existing literature on mandatory disclosures fail to put information at the heart of the explanation, nor does it conform with the stylised view of a Principal-Agent relationship between the regulator and the firm. As a first step the thesis using a Principal-Agent framework develops an alternative explanation for the existence of mandatory disclosures that provides an information cost based economic rationale for their existence and is consistent with wider literature on regulations. As the next step the thesis explores disclosure regulation, in the context of banking, over time and the extent to which such regulations are aligned with the rationale for mandatory disclosures provided by the aforementioned explanation. The analysis of regulatory pronouncements suggests that such pronouncements are aligned with the criterion outlined in the aforementioned explanation thereby providing credence to the same. Finally, the thesis using event study methodology and a portfolio of systematically important banks empirically evaluates the impact of mandatory disclosures, more specifically Pillar 3 risk disclosures, on the behaviour (or actions) of external suppliers of capital, more specifically bond market investors - a key set of stakeholders who are expected to benefit most from such disclosures and who are expected to impose market discipline on firms, where necessary. The results suggest that for the sample of systematically important banks considered, Pillar 3 disclosures do not have an impact on bond investors, investors most expected to benefit from such disclosures and also critically who are expected to impose market discipline on banks. The empirical analysis also draws on and improves upon the state of the art in bond market event study analysis.

Acknowledgement

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List of Abbreviations

ABSR	Abnormal Standardised Bond Return
ASF	Available Stable Funding
BCBS	Basel Committee on Banking Supervision
BKMX	Bessembinder, Kahle, Maxwell and Xu (2009)
CD	Certificates of Deposit
CRM	Credit Risk Mitigation
EAD	Exposure at Default
EAR	Extended Auditors Reports
EGY	Ederington, Guan and Yang (2015)
GAAP	Generally Accepted Accounting Practices
HQLA	High Quality Liquid Assets
IFRS	International Financial Reporting Standards
IPO	Initial Public Offering
IRB	Internal Ratings Based Approach
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
M	Effective Maturity
MRA	Market Risk Amendment
NSFR	Net Stable Funding Ratio
OBS	Off Balance Sheet
PA	Principal – Agent
PD	Probability of Default
RSF	Required Stable Funding
RWA	Risk Weighted Assets
SBM	Standardised Benchmark Return
SRR	Standardised Raw Return
TRACE	Trade Reporting and Compliance Engine

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

The volume of disclosure provided by firms to markets, regulatory authorities and other bodies have been increasing over the years and exponentially with the corresponding increase in costs of such disclosures. In some cases, managers voluntarily disclose information about firms for example in their financial statements. In many other cases, the disclosure requirements are mandatory. For example, banks in many countries are required to disclose voluminous risk and financial information every quarter mandatorily. As an example, for the year 2020 the Pillar 3 report of HSBC runs into 105 pages (*HSBC Holdings plc Pillar 3 Disclosures at 31 December 2020*) while its financial statements for the same year run into 382 pages (*HSBC Holdings plc Annual Report and Accounts* 2020).

The theoretical rationale for voluntary disclosures is well established in literature and has been, to an extent, the primary focus of literature in the area to date (Healy & Palepu, 2001). In essence these theories focus on the signalling effects that disclosures have in an economy, given the information asymmetry prevailing between the managers and other stakeholders – specifically, owners or outside investors. The core argument is that companies have an incentive to signal their (asset and other) quality to the investors and this results in voluntary disclosures. This is consistent with the argument that there is informational asymmetry between firms (or their management) and outside investors, with attendant implications for the cost of capital of these firms (Myers & Majlouf, 1984). The empirical literature, by and large, establishes the existence of this incentive. It finds that voluntary disclosures by firms can result in lower cost of capital and/or higher market value of the Firm.

However, it is difficult to explain why there has been a significant increase in items that have to be disclosed by firms mandatorily. The central argument in the existing literature to explain the existence of mandatory disclosures is one of market failure (Leuz & Wysocki, 2008). Specifically, if a firm is in fragile financial health, there is a significant benefit for its stakeholders and other market participants to know about it but little private benefit to the firm should it decide to disclose this information. In other words, there is considerable externality in the market for financial disclosures. Hence, the literature argues that this externality calls for government (or regulatory) intervention and mandatory requirements about the financial health of the firm is the tool that the government (or regulator) uses to address this externality.

Whilst we observe the proliferation of mandatory disclosure requirements for all industries over the past 50 years, especially for highly regulated sectors such as banking, the theories explaining such requirements by relying on externalities fail to put information at the heart of the explanation. Nor do they conform with the stylised view in literature about the Principal-Agent relationship between regulator and firm. Accordingly, they also do not explore the process through which mandatory disclosure requirements are set, and how this process results in the observed level of mandatory disclosure requirements. Similar conclusions have been arrived at Healy & Palepu, (2001) and Leuz & Wysocki, (2008) in their survey of literature in the area.

This thesis explores mandatory disclosures that have become so prevalent in today's regulatory environment and starts by asking the question why do we need mandatory disclosures in an economy. A review of literature in the area demonstrates that existing explanations, using market externalities as the underlying reason, fall short of addressing all aspects of such disclosure requirements. Consequently, the thesis

instead of taking a markets-based view approaches the issue from an information asymmetry perspective. It also addresses the lacuna in current literature by specifically capturing the process by which such disclosures are set in an economy using a principal – agent model. The result is a heuristic framework that provides an alternative explanation for the existence of mandatory disclosures, which extends literature by offering an alternative to the externalities-based approach that has thus far been used in the literature to explain the existence of mandatory disclosures (Lambert, Leuz & Verrecchia, (2007a)). It should be noted that the heuristic framework developed explores the issue from the perspective of the regulator and provides an alternative explanation using a regulatory perspective.

Having constructed the heuristic framework, the next question the thesis addresses is whether the features / characteristics of regulatory contracts as posited by the heuristic framework are actually present in regulation. The aim is to test the veracity of the heuristic framework using actual regulation that is present in an economy. To address this question the thesis analyses global banking regulatory requirements to evaluate whether such features / characteristics are actually present in regulatory contracts. The thesis finds that the features / characteristics posited by the heuristic framework are indeed present in such regulatory contracts. This provides the necessary credibility to the heuristic framework that proposes an explanation for mandatory disclosures that is at variance with existing literature.

Having established the role of information content in mandatory disclosures, the thesis as a final step, examines the efficacy of mandatory disclosure requirements again in the context of the banking. Such disclosures are expected to provide the information necessary for market participants to respond to the changing risk profiles

of banks i.e. have information content on a bank's risk position – the stipulated aim of banking regulators. The surprising result from the research is that contrary to expectations such disclosures do not seem have an impact on investors. The research subsequently provides possible explanations for the observed results.

1.2 Objectives and Methodology

1.2.1 Objectives

The objectives of the research are as follows:

1. In light of the discussion in the earlier section, provide an alternative explanation for the existence of mandatory disclosures that provides an information cost based economic rationale for the choice of such disclosures as the form of government (or regulatory) intervention, and is also consistent with the wider literature on regulations.
2. Explore mandatory disclosures regulation over time and the extent to which such regulations are aligned with the rationale for mandatory disclosures that is provided by the aforementioned explanation.
3. Investigate the impact of mandatory disclosures on the behaviour (or actions) of external suppliers of capital, a key set of stakeholders who are expected to benefit most from such disclosures and who are expected to impose market discipline on firms, where necessary.

A brief summary of how the dissertation addresses these objectives and the contributions that it makes by addressing these objectives are discussed in the subsequent sub-sections.

1.2.2 Methodology

The thesis, to achieve its objectives, employs three different methodological approaches to address the three related objectives mentioned above.

Chapter 2 explores the rationale for the existence of mandatory disclosure requirements. As mentioned above, this thesis provides an alternative to the externalities-based explanation for these types of disclosures. Specifically, it approaches mandatory disclosures from the perspective of the regulators and provides an explanation that is based on the optimality of such disclosures in the presence of information asymmetry between regulators and the firms that they regulate. In keeping with the literature (e.g., Dewatripont and Tirole, 1994), the thesis adopts and uses the principal-agent framework in which the principal (i.e., the regulator) maximises its objectives subject to the participation and individual rationality constraints of the agent (i.e., the representative firm). The use of the principal-agent framework is also consistent with the class of problems in which a principal has to decide on an optimal contract to align its own interests with those of the agents, in the presence of information asymmetry and moral hazard (Laffont and Tirole, (1993)).

The aim of the next phase of the thesis is to evaluate the veracity of the propositions outlined in the heuristic framework. It does so by evaluating requirements in existing regulation to determine if such regulation contain features as posited by the heuristic framework. More specifically, for the purposes of the research the thesis evaluates banking regulations over three decades. Given that all regulation is encapsulated as text, the thesis employs ‘textual analysis’ of regulatory pronouncements to achieve its objectives.

As the final step the thesis explores if mandatory disclosures provide the necessary

information to key market stakeholders, more specifically bondholders, who are expected to benefit from such disclosures ie whether or not such disclosures have information content. Given the objective of the thesis to determine the impact of such disclosures from a market perspective the research employs the empirical method of event study using bond market data.

1.3 The Dissertation

Mandatory disclosure requirements are imposed on firms by regulators who act on the behest of stakeholders who may find it difficult to individually engage with a firm because of the costs involved with such engagement and to undertake appropriate collective action against the firm on account of freeriding by some (or many) of these stakeholders, and yet who may be adversely affected by a firm's actions, especially if these actions lead to the failure of the firm. Specifically, a regulator wants each firm to be well governed and to disclose its financial strengths and, especially, weaknesses accurately and truthfully. In the (corporate) governance domain this has led to regulatory requirements about board independence and composition of key committees such as the audit, risk and remuneration committees (for example the Cadbury Report on *The Financial Aspects of Corporate Governance* (1992). This dissertation argues that the evolution of mandatory disclosure requirements can be similarly explained.

Specifically, in Chapter 2, I set up a heuristic (principal-agent) framework in which a regulator is the principal and a company that has to comply with such regulations (and incur a cost) is the Agent. In keeping with the nature of principal-agent models (Laffont & Tirole, 1993), the objective of the principal (i.e., the regulator) is to design an optimal incentive contract that would make the agent (i.e., the firm) to act in line

with regulatory objectives even when such objectives are in conflict. I demonstrate, using the PA framework, that the regulator will require the firm to make mandatory disclosures. As part of this discussion, I also touch upon the nature of information that has to be disclosed, which has implications for subsequent analyses in the dissertation.

Next, in Chapter 3, I analyse the BCBS regulatory pronouncements to (a) explore the evolution of mandatory disclosure requirements in the banking sector, and (b) examine whether the regulatory pronouncements contain requirements that meet the criteria developed by the aforementioned explanation. The choice of the banking sector as the context of analysis was deemed appropriate because of a variety of factors. First, the nature of risk and maturity transformation that lie at the heart of the business model of banks makes banks inherently risky (Diamond & Rajan, 2001), such that there is greater incentive for regulators to ensure that banks disclose information about their financial health accurately and truthfully. Second, as evident from the financial crisis of 2008, bank failures and banking crises generate significant costs for the real economy[1] such that there is significant pressure on regulators to ensure that they have all relevant information about banks to pre-empt such crises, in general, and bank failures, in particular. The research evaluates banking regulations over three decades and finds support for the propositions in the heuristic framework in all key BCBS pronouncements (Basel 1, MRA, Basel 2 and Basel 3) thereby demonstrating that the propositions in the heuristic framework apply irrespective of the drivers and circumstances behind such regulations.

[1] It is estimated that he combination of increased expenditures and decreased revenues resulting from the crisis from 2008 to 2010 is likely to cost the United States government well over $2 trillion. Broader measures such as those measured by decrease in per capita United States GDP compared to the pre-crisis trend, show that by 2016 the crisis had cost the country 15% of GDP, or $4.6 trillion (Mukunda, 2018).

Finally, in Chapter 4, I use event study analysis to explore the impact of Pillar 3 disclosures by banks using a portfolio of systemically important banks. The rationale for this exercise lies in both the discussion in the literature on market discipline (Nier & Bauman, 2006) and my professional experiences in the broad area of regulation. As such, while a regulator acts on behalf of stakeholders to help mitigate collective action problems etc, it also relies on market participants to discipline financially fragile firms. In the context of the banking sector, for example, the cost of bailing out a bank in the event of failure (or extreme financial weakness) can be fairly high. It is more reasonable to attempt to resolve the problem with a financially weak firm by incentivising it to wind down or strengthen its balance sheet, whether because depositors are less willing to keep their money in the bank – a prospect that is less likely on account of deposit insurance – or because the cost of capital is higher. I focus on the bondholders (and bond yields) as being the investors targeted by such disclosures. I draw on and improve upon the state of the art in bond market event study analysis (Ederington, Guan & Yang, 2015), and the results suggest that such disclosures do not have an impact on bond investors, the investors most expected to benefit from such disclosures and also critically who are expected to impose market discipline on banks.

To summarise, the dissertation provides an alternative explanation for the presence of mandatory disclosure requirements, one that specifically puts information at the heart of the narrative. As I discuss later, the framework associated with this explanation also enables us to discuss issues such as the balance of information and noise associated with disclosures that has been discussed in other contexts (Gutierrez et al. (2018)), and one that has implications for classical accounting questions about what we should disclose, why we should disclose it, and how we should measure it. The

research subsequently evaluates banking regulations over three decades and finds support for the propositions in the heuristic framework in all key BCBS pronouncements (Basel 1, MRA, Basel 2 and Basel 3). The result of the empirical analysis shows that the disclosure requirements mandated by the BCBS do not have an impact on bondholder behaviour. In other words, our sample of banks and bonds do not provide any indication of market discipline, in response to Pillar 3 disclosures. This, in turn, has implications for the efficacy of the principle of market discipline, and opens up a discussion about the political economy of regulatory decisions (Calomiris & Haber, 2014) that lies outside the scope of this dissertation.

1.4 Contributions to the Literature and Regulatory Practice

As such, the dissertation makes the following contribution to the academic literature on mandatory disclosures:

1. Firstly, by positing an alternative explanation with information at its core, the dissertation adds to literature on the theoretical rationale for mandatory disclosures in an economy. Secondly, by positing an explanation that puts information at its core the dissertation opens possibilities for further investigation into how such disclosures and the processes employed for their creation can be optimised in an economy. A facet that is considerably more challenging to consider if the reason for the existence of such disclosures is market failure. Thirdly the research by considering the entire regulatory process also widens the literature on regulations.
2. The analysis of BCBS regulatory pronouncements provides evidence in support of the aforementioned explanation thereby providing credence to the same and broadens existing literature on mandatory disclosures and

regulations. Also, by evaluating the regulatory requirements using an information lens, the research also widens literature on banking regulation.

3. The event study by evaluating the information content of Pillar 3 disclosures for bond markets, the target of such disclosures, extends the existing literature on the information content of Pillar 3 disclosures. The results of the event study question the impact of such disclosures on bond market investors as the sample of banks and bonds considered in the study do not provide any indication of market discipline, in response to Pillar 3 disclosures. A conclusion that has significant regulatory implications. In addition, the research uses the latest recommendations in literature on bond market event studies thereby widening the literature on the bond market event studies.

The conclusions of the above research have the following regulatory practice implications:

1. The heuristic framework by putting information at the centre of the explanation for the existence of mandatory disclosures enables the discussion to focus on the information content of mandatory disclosures or their value relevance be it for regulators or for markets. This shift in focus enables better design and implementation of mandatory disclosure requirements by regulatory authorities.
2. The research demonstrates that disclosure requirements mandated by the BCBS do not alter bondholder behaviour – a result that brings into question the efficacy of the principle of market discipline, one of the key Pillars of banking regulation today.
3. The empirical findings raise the question for regulators as to whether or not

the revisions made to Pillar 3 disclosure regulations, as a result of the financial crises, have been effective. The research using the heuristic framework is able to point to some possible explanations for the above result that can be used by regulators to address possible future revisions to such disclosure requirements.

1.5 Dissertation structure and Format

The dissertation follows a monograph style and consists of five (5) chapters including this introduction chapter. Chapter 2 is the development of the alternative framework, Chapter 3 presents the findings of the analysis of BCBS pronouncements, whilst Chapter 4 presents the results of the empirical evaluation of Pillar 3 Disclosures. Given the different approaches and methodologies used in the research (Contract Theory, Textual Analysis and Empirical study) each chapter contains the review of relevant literature on the area. The final chapter, Chapter 5, provides the overall conclusions and summary of the work described in the thesis.

CHAPTER TWO: CONTRACT THEORETIC APPROACH TO MANDATORY DISCLOSURE REQUIREMENTS

2.1 Introduction

In a market economy with private outside investors, the drivers for disclosure of information can and do arise from market pressures. Managers disclose information about their respective companies – for example, about the nature and quality of the companies' assets – to signal their quality to the market. However, a significant and ever-growing number of disclosures in an economy result from mandatory disclosure requirements. The direct and indirect costs of such disclosure are significant for any economy. This begs the question as to why in an economy we need to have mandatory disclosure requirements when it can be argued that there exist market forces that ensure firms produce the required amount of disclosure at equilibrium because of such forces.

Literature on the theoretical rationale for disclosures has primarily focused on voluntary disclosures. In essence these theories focus on the signalling affect that disclosures have in an economy, given the information asymmetry prevailing between the managers and other stakeholders – specifically, owners or outside investors. As such, the core argument is that companies have an incentive to signal their (asset and other) quality to the investors and this results in voluntary disclosures (Healy & Palepu, 2001). The empirical literature, by and large, establishes the existence of this incentive. It finds that voluntary disclosures can result in lower cost of capital and/or higher market value of the firm.

Whilst we observe the proliferation of mandatory disclosure requirements for all industries over the past 50 years, especially for highly regulated sectors such as

banking, the theories behind explaining the proliferation and reliance on mandatory disclosure requirements by regulators, is only able to explain their need in particular circumstances and does not put information at its centre. It also does not explore the process through which mandatory disclosure requirements are set, and how this process results in the observed level of mandatory disclosure requirements. Similar conclusions have been arrived at Healy & Palepu, (2001) and Leuz & Wysocki, (2008) in their survey of literature in the area.

This section of the research aims to provide an alternative explanation for the existence of mandatory disclosures with information at its centre and that is consistent with the wider literature on regulations.

2.2 Literature review

2.2.1 Voluntary disclosure

Literature on the theoretical rationale for disclosures has primarily focused on voluntary disclosures. The *Corporate control contest hypothesis* posits that boards of directors and investors hold managers accountable for current stock performance and this provides the necessary incentive to managers to disclose information to influence stock performance. Warner, Watts & Wruck, (1988), and Weisbach, (1988) show that CEO turnover is associated with poor stock performance. Poor stock price performance is also linked with the probability of hostile takeovers, which results in high CEO turnover (Morck, Shleifer & Vishny, 1990). Voluntary disclosure theory hypothesizes that, given the risk of job loss accompanying poor stock and earnings performance, managers use corporate disclosures to reduce the likelihood of undervaluation and to explain away poor earnings performance.

The *Stock compensation hypothesis* asserts that since managers are also directly

rewarded using a variety of stock-based compensation plans (Healy & Palepu, 2001), such as stock option grants, and stock appreciation rights these types of compensation schemes provide incentives for managers to engage in voluntary disclosures. Managers interested in trading their stock holdings have incentives to disclose private information not only to increase the liquidity of the stock but also to meet the requirements imposed by insider trading rules.

The *Litigation Cost Hypothesis* explores the impact of the threat of shareholder litigation on managers' disclosure decisions. First, legal actions against managers for inadequate or untimely disclosures can encourage firms to increase voluntary disclosure. Second, litigation can potentially reduce managers' incentives to provide disclosure, particularly of forward-looking information. These, in turn, can be the drivers behind voluntary disclosures by firms.

Under the *Management talent signalling hypothesis* Trueman, (1986) argues that talented managers have an incentive to make voluntary earnings forecasts to reveal their type. A firm's market value is a function of investors' perceptions of its managers' ability to anticipate and respond to future changes in the firm's economic environment.

The above hypotheses do not add to the fundamental proposition that firms have private incentives for providing disclosures to markets and instead provide a hypothesis for the existence of such an incentive. By and large empirical studies have established the existence of such an incentive in markets but given their very nature i.e., private incentives, such studies have not established whether or not there exists a specific reason for the existence of such an incentive in markets as posited by the above hypotheses.

The second strand considers the firm wide benefits that accrue to the firm from providing such information to the markets in the form of reduced cost of capital, for example. Healy & Palepu, (1993, 1995) hypothesize that investors' perceptions of a firm are important to corporate managers expecting to issue public debt or equity or to acquire another company in a stock transaction. Myers & Majluf, (1984) point out that if the information asymmetry between managers and investors cannot be resolved, such firms will view making public equity or debt offers to be costly for existing shareholders. Consequently, managers who anticipate making capital market transactions have incentives to provide voluntary disclosure to reduce the information asymmetry problem, thereby reducing the firm's cost of external financing. Corporate disclosure can also mitigate the adverse selection problem and increase market liquidity by levelling the playing field among investors (Verrecchia, 2001)[2].

The work of Brown, (1979), Barry & Brown, (1984, 1985) and Coles & Loewenstein, (1988) evidences the direct link between disclosure and the cost of capital. Their work show that firms with longer time-series of returns, which are based on their disclosures, have lower betas and expected returns thereby lowering their cost of capital. However, they are unable to demonstrate this effect unambiguously for firms with a short time-series of returns.

Jorgensen & Kirschenheiter, (2003), Hughes, Liu, & Liu, (2007), and Lambert, Leuz & Verrecchia, (2007a) have also looked at the issue of estimation risk and a firm's cost of capital. Lambert, Leuz & Verrecchia, (2007b) model estimation risk using an

[2] Information asymmetry and adverse selection can reduce the number of shares that uninformed investors are willing to trade. More information in the public domain makes it harder and more costly for traders to become privately informed. Also, more disclosure reduces the uncertainty about firm value, which in turn reduces the potential information advantage that an informed trader might have. Both effects reduce the extent to which uninformed investors need to price protect and hence increase market liquidity.

information-economics approach. They consider a firm's disclosures as noisy signals to investors about their future cash flows. They find that the covariances of a firm's cash flow with other firms actually decrease as the quality of their disclosures increase. They also show that this effect unambiguously reduces a firms cost of capital and brings it closer to the risk-free rate. This information effect is not diversifiable because it is present for all covariance terms and only the firm-specific variance term is likely to be diversified in "large economies" where investors can form portfolios of many stocks.

Miller, (1999) shows that there exists an abnormal return of 1.15% when a firm announces a US listing. Doidge, Karolyi & Stulz, (2004) find that for firms that are already exchange-listed and also choose to cross-list their shares are worth up to 37% more than firms that choose not to cross-list. Greenstone, Oyer & Vissing-Jorgensen, (2006) document positive and significant returns from increasing mandatory disclosure requirements through the 1964 Securities Acts Amendments. Lambert, Leuz & Verrecchia, (2007a) show that if higher quality disclosure reduces the amount of managerial appropriations, this can lead to a reduction in the cost of capital for the firm.

The above results show the link between disclosure and the firm-wide benefit that arise either from a reduced cost of capital because of the presence of a longer history of information or by reducing the uncertainty associated with their future cash flows. The results provide evidence that there exist firm-wide benefits associated with disclosure that arise when firms are able to distinguish themselves from others in the market through improved signalling.

In sum, the literature suggests that there is incentive for firms and their managers to disclose private information about the firms voluntarily. The available empirical evidence at least in part, validates the conceptual arguments about this incentive[3]. This is also encapsulated in the theoretical premise called the 'disclosure principle' (Dye, 1985) that stipulates that if managers of firms possess non-proprietary information then managers will disclose the same to stakeholders because of adverse selection, as managers are encouraged to disclose the information in the absence of which investors will assume the worst thereby impacting the value of the firm.

The proposition that managers will provide full disclosure of information is also supported by what is termed the 'revelation principle' (Grossman, 1981; Milgrom, 1981; Grossman & Hart, 1980; Myerson, 1979). According to the 'revelation principle', any contract can be written (between managers and stakeholders in this instance) in a way that induces full revelation of all private information held by the parties without affecting the payments they receive. In other words, an optimal incentive contract can be designed such that each contracting party has no incentive to make distorted claims regarding their private information (Myerson, 1979). Assuming firms can make credible disclosures of private information – every firm will disclose its information and there is no distinction between economies in which all information about firms is public from economies where all information is private. This result, also known as the Full Disclosure Theorem, also requires that it is common knowledge[4] that the firm knows its type (the value of its assets for example). Okuno-Fujiwara, Postlewaite & Suzumura, (1990) have generalised the above result

[3] Empirical work on managerial incentives as the driver behind voluntary disclosures has been limited because in most circumstances data concerning managerial compensation is not publicly available.
[4] By common knowledge we are referring to the standard assumption of much of contract theory literature that the firm actively reveals its type (eg asset quality).

to where the firm does not know its type perfectly but knows it belongs to subset of all possible types.[5]

This then begs the question as to why then do we observe the existence, indeed growth, of mandatory disclosure requirements in almost every sphere of economic activity? Could it be because of the costs associated with such disclosures? Without differentiating between mandatory and voluntary disclosures at this stage, we can make certain inferences about the cost of disclosures from observations in literature. For example, even though there are returns to increasing disclosure that is associated with cross-listing in the US capital market, Doidge, Karolyi & Stulz, (2004) report that only one in ten large firms choose to embrace disclosure-enhancing cross-listing of shares on the US market. These findings suggest that the decision by firms to increase disclosures is done only after considering its associated costs. In the same vein, Bushee & Leuz, (2005) find that imposition of additional disclosure requirements on firms listed on the OTCBB (Over the Counter Bulletin Board) implied that many firms delisted corroborating that disclosure is associated with significant costs.

While the direct cost of disclosure could, therefore, be a factor in explaining the existence of mandatory disclosures, given the level of costs incurred to provide such disclosures, it is unlikely to be the only reason. Hence, the rationale for the existence of mandatory disclosures requires some other explanation, the key to which may lie in the way the rationale for voluntary disclosures is modelled in literature. As with all

[5] They provide two sufficient conditions under which full disclosure is obtained as well as instances where it fails when these two conditions are not met. In essence, their first condition requires that the set of certifiable statements is rich enough for the manager to prove that the assets in place are worth at least their true value and their second condition is the monotonicity conditions on beliefs which essentially requires that the managers payoff is higher when market beliefs are more optimistic about the value of the assets of the firm.

signalling based arguments, the theoretical arguments underpinning this literature focus on the incentive of a single firm, or its managers, without taking into consideration the behaviour of other firms and their managers in a competitive context. The presence of other firms may impose a cost on an individual firm and its managers that offsets the benefits from the signalling effect of voluntary disclosures.

2.2.2 Mandatory disclosures

Dye in *Disclosure of Nonproprietory Information,* (1985) argues that the 'revelation principle' does not hold true because in essence investors are often not sure whether the manager has nonproprietory information and consequently it is difficult for them to conclude whether or not management is withholding such information. As argued later in the research to assume that investors can determine the complete set of information available to managers would imply that the investors have the same capabilities and resources as management, which is not true. Dye shows that no policy of full disclosure is an equilibrium when investors may be unaware that managers have received any private information; given that managers cannot make any credible announcements that they have not received information. In addition, Dye argues that managers possess a vast array of information, some which is proprietary. If non-proprietary information is part of this array of information that a manager holds, then the manager will not disclose this information.

Dye also goes on to provide three situations under which the revelation principle may not apply. In the first instance Dye demonstrates that if subsequent to one Agent's announcement of the true value of his/her private information other Agents could recontract so as to take advantage of this newly revealed information then this possibility would be a disincentive for the Agents to disclose the true value of their

private information. Consequently, under such situations the revelation principle or the 'Full Disclosure Theorem' would not hold. Secondly, in the instances where rewriting contracts is costly and so is sending messages, the truth telling contract or the full disclosure contract maybe more costly to write than the original contract thereby invalidating the full disclosure theorem. Lastly Dye shows that it is possible that Agents may not be able to communicate all dimensions of their private information for example due to contractual commitments thereby again invalidating the full disclosure theorem.

Mahoney, (1995) and Rock, (2002) argue that mandatory disclosures exist because they serve as a low-cost commitment device. Consider the idea in an IPO setting. At the time of the IPO firms have strong incentives to provide information and assurances to investors. However, once the IPO is over these incentives might and do often change and actually the incentive post IPO could be to withhold information from investors (e.g. when performance is poor). Therefore, a promise alone at the time of the IPO to provide high-quality disclosures in the future is unlikely to be credible. Given high transactions cost associated with these ex-post deviations from ex ante promises – such costs can lead to investors withdrawing from the IPO market and leading to a market failure. It is easy to see how mandatory disclosure requirements can alleviate the situation in such cases. Mandatory disclosure requirements specify which information a firm has to provide irrespective of its incentives, and thereby force it to reveal this information in both good and bad times. This can mitigate information asymmetries, both when going public and in secondary markets. The argument proposed in essence is what would be considered as a solution to a hold up problem in economics as mandatory disclosures allow for trade or investments to continue in the absence of any contractual provisions or commitments

from the firm under such circumstances. Whilst the argument does provide a logical framework for the existence of mandatory disclosure requirements, it does so only for limited circumstances i.e., in the context of IPOs and does not readily extend itself to other situations. Nor does it explain as to why the regulatory solution under such circumstances is mandatory disclosure requirements and not some other requirement. This may be on account of the complexity of formally modelling hold up problems (Salanie, (2005)).

Other studies on mandatory disclosures focus on the market-wide effects of disclosures that impose an indirect cost on firms. These costs arise because information provided to capital market participants can also be used by other parties (e.g., competitors, labour unions, regulators, tax authorities, etc.). One example of such a cost arising is from information about line-of-business profitability revealing proprietary information to competitors (Feltham, Gigler & Hughes, 1992; Hayes & Lundholm, 1996). The fact that other parties may use public information to the disclosing firm's disadvantage can dampen its disclosure incentives (Gal-Or, 1985; Verrecchia, 1983). Literature also evidences this in the financial services sector where more transparency through additional disclosures can be expensive to existing financing relationships, especially with banks (Leuz & Oberholzer-Gee, 2006; Rajan & Zingales, 1998). The argument is that in banks it is relationship financing that makes financing arrangements viable whereby in good times firms pay above market rates and this is what allows them access to funding during bad times. Such an arrangement is only possible through private information flows as neither the firm nor the bank have any incentive to provide any signals to market through disclosures about the firm's type during good or bad times. Any disclosures that remove this private information and put financiers on a level playing field is unlikely to survive

the forces of competition in good times. Consequently, firms engaging in such forms of financing would be reluctant to provide full disclosure as there is a clear cost for the same.

The *Proprietary cost hypothesis* encapsulates the above arguments pertaining to the financial services sector in a more generalised setting by arguing that the firms' decisions to disclose information to investors is influenced by concern that such disclosures can damage their competitive position in product markets (Gigler, 1994; Darrough, 1993; Newman & Sansing, 1993; Feltham & Xie, 1992; Darrough & Stoughton, 1990; Wagenhofer, 1990). These studies also conclude that firms, even if their action results in an increase in the cost of raising additional equity, have no incentive to disclose information to markets that will hamper or reduce their competitive position. However, this incentive appears to be sensitive to the nature of the competition, in particular, on whether a firm faces competition from existing competitors or merely the threat of entry, and on whether firms compete primarily on the basis of price or long-run capacity decisions. Unlike the hypotheses on voluntary disclosure, the proprietary cost hypothesis assumes there are no conflicts of interest between managers and shareholders, i.e., rather than focus on agency problems and information asymmetry, it focuses on the externalities associated with disclosures.

Some other studies that examine the rationale for mandatory disclosures focus on the related issue of externality arising from voluntary disclosures made by individual firms. Most notably, Admati & Pfleiderer, (2000) consider a setting in which firms cannot fully internalise the social value of voluntary disclosures. Specifically, disclosures made by one firm can benefit other firms, in much the same way as described in the *Proprietary Cost Hypothesis*, thereby generating positive

externalities[6]. They show that if firm values are correlated, in equilibrium, an individual firm makes a level of disclosures that is sub-optimal from the social point of view. They suggest that there is scope for mandatory disclosure regulations to improve welfare, but such a scope only exists in circumstances where such correlation exists. In essence, the authors argue that when the value of firm A is positively impacted by say, the disclosures of firm B and firm B does not get any additional benefit from such disclosures, firm B will not have any incentive to provide disclosures that would be welfare improving. Consequently, it is only in these circumstances that mandatory disclosure requirements become necessary.

The literature also examines the social benefits that can arise because of mandatory disclosures. A potential benefit of a mandatory disclosure regime is that it makes it easier for new entrants to commit and hence to raise capital, which in turn increases competition and reduces social losses from private benefits consumption. In promoting the development of financial markets, mandatory disclosure can also benefit investors, e.g., in creating new investment opportunities for their savings. Existing firms would not necessarily create such opportunities as they may make it easier for entrants to raise finance (Rajan & Zingales, 2003). Ross, (1979) argues that mandatory disclosures can be beneficial if it is limited to disclosures that almost all firms are willing to provide voluntarily. The requirement saves firms the cost of negotiating disclosures when the result does not vary much across firms and hence the costs of complying with a one-size-fits-all regime are relatively low.

The flip side of this argument is that there can also be negative effects or costly externalities to firms reporting and misreporting activities. For example, assuming

[6] Positive externalities of firm-specific disclosures can arise for example when they eliminate duplicative efforts of information intermediaries and investors (Coffee, 1984; Diamond, 1985; Easterbrook & Fischel, 1984).

that information processing can be costly, increase in disclosure by one firm can attract investors away from other firms as shown by Fishman & Hagerty, (1989). In markets that are not perfectly competitive this can reduce price efficiency of other firms and actually create a negative externality. The same argument can be extended to apply across geographies and markets and between markets in the same geography. It is possible that an increase in disclosure or transparency in one market can attract investors from another market in the same region thereby reducing overall price efficiency.

Empirical evidence, to an extent, backs the above hypotheses regarding the presence of externalities. Lambert, Leuz & Verrecchia, (2007a) find that each firms disclosure has a (small) impact on investors assessment of the covariances associated with other firms which can lower their estimation risk and cost of capital. Similar externalities about a firm's sensitivity to market-wide risk factors is also shown by Jorgensen & Kirschenheiter, (2007). Although, these effects are likely to be small individually, they could be large across all firms in the market or economy.

In essence, the central argument that explains the existence of mandatory disclosure requirements is one of market failure. Whether on account of externalities, or high transactions costs, or unequal ability of firms and their stakeholders to negotiate and enforce contracts, private incentives to disclose information may be insufficient to generate a socially optimum level of disclosure by the firms. Hence, we need external intervention, and this results in mandatory disclosures. Whilst we observe the proliferation of mandatory disclosure requirements for all industries over the past 50 years, the above discussion makes it evident that literature lacks an explanation as to why disclosure and reporting regulation is so pervasive i.e. why do the largest and,

arguably, most successful capital markets exhibit strong disclosure and securities regulation. Second it fails to consider the process by which such disclosure and reporting regulation arise. Similar conclusions have been arrived at Healy & Palepu, (2001) and Leuz & Wysocki, (2008) in their survey of literature in the area.

The aim of this research is to fill this gap in literature. The heuristic framework developed provides an alternative explanation for the existence of mandatory disclosures by putting information at the core of the explanation without relying on market externalities. It does so by using a PA framework of regulation that encapsulates the process by which such mandatory disclosure regulations arise in an economy; an approach that is consistent with the current view on regulations in literature (see Laffont and Tirole, (1993)) .

2.3 Contract Theoretic Approach to Regulation

All of the above arguments concerning the economic rationale for the existence of voluntary and mandatory disclosures in an economy are essentially market-based arguments, which are the result of one of the most impressive achievements in economic thought – the theory of general equilibrium. The proof of the existence of general equilibrium using an Arrow-Debreu framework and the close correspondence between this equilibrium and Pareto optimum allowed for the expansion of economic theory around these concepts. However, over time it became evident that such a framework was not a fully satisfactory descriptor of the economy. The general equilibrium framework heavily constrains strategic interaction between Agents in an economy, as Agents only interact through the price system, which they normally cannot influence. Similarly, the organisation of many institutions that govern economic relationships is absent from the model. As a result one of the key

constraints that arise from such general equilibrium models is the ability for such models to accommodate information asymmetry.

Arrow-Debreu in their seminal work show that it is indeed possible to extend the general equilibrium model to cover uncertainty as long as information is kept symmetric. However, information asymmetries are pervasive in economic relationships. Customers know more about their tastes than the firms and the firms know more about their risks and costs than governments and regulators. So rational expectations was conceived, in part, to encompass asymmetric information. However, while they offered interesting insights on the revelation of information by prices, their treatment of asymmetric information did not prove to be satisfactory.

Arrow, (1963) in his study of the medical insurance industry analyses the impact of information asymmetries in the form of 'moral hazard', from an ethical standpoint, on the existence of markets for risk-bearing products. Akerlof, (1970) in his seminal paper 'On the market for Lemons' demonstrates using simple utility functions, how the presence of asymmetric information can lead to complete market failure where no trade happens at all. Using the insurance industry as an analogy he argues that it is the presence of asymmetric information that explains the absence of medical insurance products for over 65s at any price ie because only those who are more certain of claiming insurance are the ones who are willing to pay the high premiums, leading to certain losses, thereby preventing a market from emerging for such products.

The theory of contracts evolved to address this shortcoming of general equilibrium theory. The objective of this section is not provide a overview of the literature on contract theory, which is voluminous, but to provide a short sketch of the key developments that lead to the development of the canonical Principal-Agent (PA)

model in literature and to outline the application of the same in the regulatory context, the approach taken in this research.

Contract theory addresses these shortcomings by specifically focussing on the interactions between Agents in an economy in the presence of information asymmetry using a PA framework. Moral hazard, a specific form of such information asymmetry, was formally incorporated in a PA framework by Ross, (1973) and is considered to be the canonical model. Ross derives the properties of the optimal incentive function in the presence of moral hazard by optimising the Principal's utility subject to the Agent's participation constraint and a 'motivational constraint'[7] to reflect moral hazard. Grossman & Hart, (1983) in their seminal paper *An Analysis of the Principal-Agent Problem* present the modern form of the model incorporating continuous action choice by the Agent in the model. Grossman & Hart, (1983) derive the properties of the optimal incentive contract considering a risk neutral Principal and a risk averse Agent.

Around the mid-1980s the above developments started being incorporated in regulatory economic theory through the application of the PA framework, mechanism design and information economics. The first step in this new theory of regulation was to formulate regulation as an agency problem and stressing the role of informational asymmetries (Laffont, 1994). Laffont & Tirole, (1993) in their seminal work '*A Theory of Incentives in Procurement and Regulation*' apply the PA framework to the study of regulation concerning natural monopolies and oligopolies whilst Dewatripont & Tirole, (1994) apply the same framework to the prudential regulation of banks.

Previously, regulatory theory had largely ignored incentive issues because exogenous

[7] Also called the incentive constraint.

constraints rather than limited access to information of regulators were considered to be the source of inefficient regulatory outcomes. Consequently, the theory of regulation did not meet the newly developed PA theory, whose aim is to highlight the informational limitations that impair agency relationships. Laffont & Tirole, (1993) are by no means the first to analyse regulation as an agency relationship. In the early 1980's work by Baron & Myerson, (1982) and Sappington, (1983) demonstrated that certain techniques of PA framework could be fruitfully employed to analyse the control of natural monopolies as an asymmetric information problem. However, it is Laffont & Tirole, (1993) who combine the various aspects of the PA framework in a comprehensive manner and apply the same to the study of regulation. Given their objective of developing a theory of incentives in procurement and regulation they assume that both the firm and the regulator are risk neutral, as this is ideal to study the trade-off between rent extraction and incentives without bringing in effects arising from differences in risk attitudes of the participants. They assume a benevolent regulator whose objective is to maximise social surplus. Under the above assumptions they derive the properties of the optimal compensation contract for various scenarios for natural monopolies and oligopolies.

Dewatripont & Tirole, (1994) on the other hand in *The Prudential Regulation of Banks* use the PA framework to study banking regulation. They contend that banking regulation stems primarily from the desire to protect ordinary uninformed free-riding depositors (the representation hypothesis). In their analysis banks like most companies are subject to substantial moral hazard and adverse selection. In their view regulation essentially aims at an optimal trade-off between incentives for quality and competitiveness of bank services and the solvency and stability of the industry. Consequently, one of the key areas of focus of banking regulation is the solvency of

banks. In their framework regulators have the power to wrest management control of the bank in certain circumstances based on the solvency of the bank, something that bank management naturally want to avoid. Their model incorporates the different risk reward perspectives of the different claim holders of the bank (e.g., depositors, bond holders, equity investors) and focuses on external intervention as a managerial discipline device. Using a PA framework, they derive the optimal incentive scheme whereby poor performance by the bank trigger more external interference in the absence of contract renegotiations. They also go on to apply their framework to examine the efficacy of different existing regulatory frameworks including a consideration of private regulation.

Although the genesis of Contract Theory is recent, the last 25 years have seen it being applied to a number of areas from determining the boundaries of the firm, internal organisation design, corporate finance, industrial organisation design and international trade to name but a few areas. Harstad, (2016) has applied the theory of incomplete contracts to political treaties, whilst Roland, (2016) has considered the application of incomplete contracts in the context of political economy and Persson & Tabellini, (2003) have considered the design of constitutions using an incomplete contracts perspective.

2.4 Objectives

Whilst contract theory has been successfully applied to a number of areas, literature to date has not considered its application in the context of mandatory disclosure requirements. In addition, although moral hazard has been a long-term concern in the insurance industry and is increasingly being recognised as a concern in the area of regulation, its application in the context of mandatory disclosure requirements has not

been considered in literature to date.

This research applies, following literature, a contract theoretic approach to the area of mandatory disclosure requirements. The research using a PA framework arrives at a heuristic framework that provides an alternative explanation for the existence of mandatory disclosures requirements in markets without appealing to market externalities. The research using a PA framework establishes that in any regulatory mechanism, the regulator has to bear an information cost that cannot be eliminated. Consequently, to minimise this cost it is rational for the regulator to include information requirements in the regulatory contract which are the mandatory disclosure requirements that we see in an economy. The research argues that it is this effort at cost reduction that can be seen as providing a rationale for the existence of mandatory disclosures requirements. The arguments advanced in this research by putting information at its heart is able to explain the existence of mandatory disclosure requirements in situations other than those normally covered by existing literature on the topic.

It should be noted that the aim of the research is not to use the PA framework to examine the properties of an optimal incentive contract, as is often the case in literature. The ambition of this research is more limited; it applies the PA framework as developed in literature, with certain modifications, to provide an alternative rationale based on information asymmetry for the existence of mandatory disclosure requirements.

Although the research uses the canonical PA model as established in literature to analyse mandatory disclosure requirements, it takes a different view concerning the risk attitudes of the Principal (the regulator) and the Agent (the firms). It considers the

Principal to be risk averse and the Agent to be risk neutral. As explored later in the research, I believe this to be a better reflection of actual risk attitudes and also enables the heuristic framework to accommodate a greater range of possible interactions between the regulator and the firm.

2.5 Model

The arguments in this research proceed through a number of steps. Firstly, the research explores the process by which mandatory disclosure requirements are set in an economy, focussing on the interaction between the regulator who sets the mandatory disclosure requirements and the firm that complies with the same. Secondly, the research captures this process of setting mandatory disclosure requirements using a PA framework. Using the PA framework, thirdly the research explores the optimal incentive contract that is offered by the regulator to the firms. The result that emerges from this analysis is that in the presence of moral hazard the optimal incentive contract is second best i.e., there is an additional cost, an information cost, that is borne by the regulator.

Having established the presence of such an information cost, fourthly the research explores the methods available to the regulator to minimise this cost. The research relies on the argument in literature, following Grossman & Hart, (1983) that one way of reducing this information cost, within the bounds of the constraints, is to improve the information content regarding the Agent's actions that are unobservable. Finally, the research posits that it is for this reason i.e., improving the information content of Agent's actions that regulators impose mandatory disclosure requirements on firms.

Although mandatory disclosure requirements are usually associated with financial statements prepared by a firm, the heuristic framework put forward in the research

apply more generally. The premise developed in the research can be used to explain the existence of mandatory disclosure requirements in most regulated environments – be they be the regulated returns required for financial services firms, the returns required to be filed by Utility companies or indeed the disclosure requirements under securities regulation.

The question inevitably arises as to why does the regulator then not require full disclosure through the optimal incentive contract so that the information asymmetry between the regulator and the firm is removed completely. At the limit the regulator can ask for additional information that, theoretically at least, completely removes this information gap ie remove all noise from the observed signal regarding the Agent's actions. Firstly, this effectively implies that the management of the firm and the regulator have the same level of expertise, time and resources, which is impossible in practice. This is also the argument proposed by Dye, (1985) when he argues that often external stakeholders don't know what is the information available with management.

Secondly, even if such a situation were possible there is an inherent limit to the amount of information a regulator can ask the firm to provide. All requirements, including additional information requirements, impose a cost on firms that increases with additional requirements. Consequently, there will be a point where this additional cost will outweigh the benefit accruing to the firm by participating in the regulatory contract. Consequently, firms will not take up such a contract. In addition, the firm selects its effort level under the contract based on the costs of compliance and the expected compensation/incentives under the contract for that effort level. As the cost of compliance increases through additional disclosure requirements, so does the compensation/incentive that the regulator needs to provide to not only ensure firms

participate in the contract but also to ensure that the firms put in the required effort level to meet the regulatory objectives. This also limits the level of additional information or mandatory disclosures that a regulator can stipulate in the optimal incentive contract. The level of additional information that can be stipulated by a regulator and one that will be accepted by the firms, given their objectives, cost considerations and the available incentives for participating in the contract, is the level stipulated in the optimal incentive contract, which is the result of the constrained optimisation of the regulator's objectives given the firm's participation and incentive constraints.

2.6 The Regulatory Process

All mandatory disclosure requirements arise by their very definition from regulations or laws. It is the regulator that designs the contract, albeit with input from the firm, and monitors adherence of the firm to the contract. Consequently, in an economic setting one can envisage such disclosure requirements to be arising from contracts between the regulator and the firm and such a contract is enforceable in law in most jurisdictions.

It is important to note that a firm does not have to agree to comply with any mandatory disclosure requirements i.e., sign up to such a contract. They do so voluntarily. This choice is clearly evidenced in any economic setting for example in case of financial services - a firm agrees to participate in a supervisory regime by obtaining a banking license or in the case of corporates by agreeing to list their shares on an exchange it agrees to comply with the listing requirements.

Any regulatory compliance imposes both direct and indirect costs on the firm. In the context of disclosures, any mandatory disclosure requirements impose both direct

costs on the firm through the allocation of resources for compliance and indirect costs that can arise from negative externalities, as evidenced in literature on the topic. In view of the above, the explanation for why firms agree to be bound by regulation is that they obtain a benefit from participating in the contract, a view also corroborated in regulatory literature[8].

Such benefits arise either directly by means of transfers from the regulator to the firm or indirectly for example by allowing the firm to access benefits that would otherwise have not been available. Examples of such benefits/incentives can be seen in most regulated environments; in the most common setting of securities regulation this can be seen as the benefit accruing to the firm by being able to access capital in the cheapest and most efficient way i.e., through stock and bond markets. In case of certain industries, it can be the ability of the firm to access certain types of business models, for example insurance or being able to engage in a business model that relies on an zero or low cost of funding through the raising of customer deposits as in retail banking. Although more rare direct transfers from the regulator to the firm can also be seen in extreme instances for example in the form of bailout payments.

The bonding hypothesis as proposed by Coffee, (1999, 2002) provides a rationale for one of the benefits that accrue to firms from participating in regulation. The bonding hypothesis proposes that firms from weaker protection regimes that participate in jurisdictions with stronger protection and enforcement regimes, for eg through the cross-listing of securities in such markets, end up legally bonding themselves to such requirements thereby improving corporate governance and as a consequence valuations and their chances of being able to raise finance. Work by La Porta et al.

[8] See Laffont & Tirole, (1993) A Theory of Incentives in Procurement and Regulation; Dewatripont & Tirole, (1994) The Prudential Regulation of Banks.

(1997, 1998) provide evidence to this fact and their work shows that countries institutional frameworks, of which regulatory frameworks are a critical part, play an important role in equity valuations and access to finance. Lel & Miller, (2008) find that there is direct evidence of the same - firms from weaker investor protection regimes with US cross listings are more likely to remove non-performing CEOs as compared to those that are not cross listed. They also find that cross listing on exchanges that do not require more stringent investor protection are not associated with a higher propensity towards removing non-performing CEOs. Similar evidence is also found by for Canadian companies with US cross listings by Charitou, Louca & Panayides, (2007)[9]. The above demonstrate that firms obtain benefits from being part of a regulated community, as being compliant with stringent regulations signals better corporate governance that in turn could potentially enable the firm to achieve better valuations for their securities along with better access to finance for example. Black & Khanna, (2007) demonstrate the relationship between better corporate governance and market valuations for Russia, Korea and India. In case of India, the improvement in corporate governance leading to an increase in market valuations arose directly from regulatory changes that brought in a higher degree of corporate governance.

Benefits that accrue to firms from participating regulation are more visible for certain industries for example financial services and utilities as compared to others such as those that arise from participating in listing regulations for example. In case of financial services participating in regulation allows firms to access certain business models like offering insurance products for regulated insurance companies or being able to access low or zero cost funding in the form of customer deposits for retail banks. In addition for SIFYs another key benefit that accrues from being part of

[9] It should be noted that not all aspects of the bonding hypothesis has been validated in literature.

regulation is the implicit guarantee of government support. Such an implicit guarantee offers a number of benefits, a key one being the ability to lower their cost of borrowings that include the value of such an implicit sovereign guarantee[10]. In case of utilities, for example the benefit arises from being in an oligopolistic position with returns guaranteed by the State.

At the extreme the firm can also receive direct transfers. Examples of direct transfers from the regulator representing the Government abound. The most recent experience of the same is the large-scale bank bailouts in the US and the UK during the financial crisis of 2008. Nor have such bailouts been restricted to the financial services sector although they in sheer scale overshadow others. Bailouts have also been provided to manufacturing firms – colloquially known as Main Street instead of Wall Street - the US government extended bailout payments to the automotive industry in 2008 and this is not the only instance of such transfers. The US government also extended guarantees and bailed out Chrysler in 1979.

This benefit accruing to a firm, following literature, can be considered as 'compensation' / 'incentive' that the firm receives from the regulator for participating in the regulatory contract.

In case of direct transfers, such as bailout payments, it is evident that the cost of such bailouts is borne by the regulator representing the taxpayer. This is also the case for other forms of compensation/incentives provided by the regulator to the firms. Implicit guarantees, which are credit enhancements, also involve a cost that is again borne by the regulator. The indirect benefits accruing to firms from being part of a

[10] By the 1990s the ratings received by the big US banks explicitly reflected this expected protection from government – banks received a stand-alone regulatory rating measuring their financial strength without governmental support and one overall rating that reflected the additional advantage of government support. (Calomiris & Haber, 2014).

regulated environment through signals of better corporate governance also imposes a cost on the regulator and such costs becomes evident in times of regulatory failure. Any inference of better corporate governance inherently arises from the reputation of the regulator. In case of any failure, the cost of the same is not borne just by the failing firm but the market as a whole. Any failure that impinges on the regulator's reputation causes the perception of better corporate governance to be questioned for all firms in the regulatory framework thereby impinging upon valuations and the ability to access finance for the economy as a whole – at the extreme it can cause markets to seize and liquidity to drain from markets. The cost of such failures on the economy as whole is again borne by the regulator representing the Government. An example of such a phenomenon is a run-on retail deposits or the inability of banks and corporates to refinance themselves through commercial paper as seen during the recent financial crisis – thereby putting the entire system in jeopardy through contagion effects. Consequently, again as done in regulatory literature, it is not unreasonable to consider the compensation/incentive received by the firm as being a cost that is incurred by the regulator.

Normally regulators have to regulate a non-homogeneous group of firms i.e., firms of different sizes, different industries, different geographical presence or having exposure to different risk factors. Also, the contracts offered by the regulator has to achieve different regulatory objectives. In addition, the regulator wants firms to participate in the regulatory contract and consequently wants to make it attractive for them to do so. To achieve these objectives a regulator will often provide a menu of contracts for firms to choose from according to their needs[11] and are also designed to

[11] Offering a menu of contracts also has another advantage from a regulatory perspective. The very act of choosing a particular type of contract over another elicits private information about the firm about its type thereby mitigating, to an extent, adverse selection. For example, by agreeing to the listing

address different regulatory objectives. Again, this is evidenced in reality by the different regulatory requirements that a firm can select from, for example when obtaining financing from public markets. Depending on its needs, the firm can either opt for debt or equity financing with different applicable listing and consequently disclosure requirements. In the context of banking, depending upon the size, complexity and available resources, a bank can choose between advanced approaches in demonstrating capital adequacy as compared to using standardised approaches that are less sophisticated and resource intensive.

Regulatory objectives are often multi-dimensional. Depending on the industry sector the regulatory goals could be economic stability, efficiency, social optimum, equitable distribution to mention but a few. Focussing on financial services as an example one key regulatory objective is the stability of the system whereby the regulator will work towards preventing build-up of high-risk assets in the system along with efficiency and delivery of affordable credit to individuals and businesses (Dewatripoint & Tirole, 1994). In case of utilities, it could un-interrupted supply of services at a reasonable price. In case of securities regulation the objectives could be considered to be the continued stability and reputation of the securities markets that the firm participates in by ensuring the firm provides timely and accurate information to market participants, such that investors can make their own value judgements based on such information in a timely manner. Consequently, it is reasonable to assume that the regulatory contracts encapsulate the objectives of the regulator in any regulatory setting.

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regulations for equity instruments a firm displays its ability to comply with a higher level of disclosures as compared to that for debt listings and therefore its level of expertise and sophistication in such matters.

Similarly, the firms will also have their objectives that they will consider in evaluating whether or not to participate in the regulatory contract. The research assumes normal profit maximisation objective for the firm. Such an objective is not necessarily congruent with that of the regulator. Again, using financial services as an example, the firms' objective would be for example to select an investment portfolio that maximises profits or returns. On the other hand, the regulatory objective would be to ensure that the firms achieve their objective of profit maximisation without taking on high risk investments even though such investments provide higher returns. The regulator will through the regulatory contract try and ensure that the banks follow a strategy that ensures financial stability even at the cost of their profitability i.e., the firms design their actions such that the regulatory objective is achieved even at a cost to itself. In case of securities regulation, the objective of the regulator would be to ensure that the firm invests resources in ensuring that it has systems and processes to ensure that information is provided timely and accurately to investors, especially when that information is not necessarily favourable for the firm. Consequently, as in literature, the research assumes that the regulator and the firm have their own objectives and also that they are usually in conflict.

Since the regulatory objectives are not congruent with those of the firms and because the actions of the firm are not observable[12], the regulator cannot enter into a contract that directly stipulates the desired action. Consequently, the regulator has to incentivise the firm to alters its objectives so as to be compliant with the objectives of the regulator and the regulator does this through the compensation/incentive that the firm receives from participating in the regulatory contract. The incentive has a

[12] Not allowing the Principal to observe the Agent's actions is an extreme assumption as the Principal can monitor and audit the Agent. But any such action is expensive and also critically often the signals arising from such monitoring are difficult to interpret. Consequently, the assumption of non-observability used in literature does capture reality albeit in a stylized manner.

twofold function – one is to compensate the firm for incurring the costs associated with compliance and the other is to provide the necessary incentive to the firm to amend its strategies or actions to be compliant with those of the regulator at a cost to itself. The regulator achieves this by making the level of compensation/incentive dependent on the degree to which the firm's actions are in compliance with regulatory objectives. Since these actions are unobservable, the compensation has to be based on an observable variable that provides a signal of the firm's actions – for example by varying the level of capital that a bank is required to hold based on its risk weighted assets or by varying the liquidity requirements or by specifying the level of liquid assets that the bank needs to hold. In case of securities regulation, it could be withholding permission for future issuances or imposing fines for non-compliance. Any observable variable that provides a signal of the firm's actions is one that is a noisy signal of the firm's actions as it aggregates the results of the firm's actions and the realisation of luck. Consequently, any observable variable that is included in the contract on which compensation/incentive is based represents a noisy signal of the firm's efforts or actions and this plays a critical role in the PA framework employed in the research.

It is important to note that in the context being considered high effort on the part of the firm implies actions that are in line with regulatory objectives i.e., selecting an investment portfolio within acceptable risk limits even at the cost of returns, for example. It is not, as usually implied in PA literature, about the level of work or 'effort' expanded by the firm or Agent on the project. Similarly low effort implies actions that do not necessarily result in the attainment of regulatory objectives.

2.7 The Principal Agent (PA) Framework

The process of regulation outlined above is captured using a PA formulation where the Principal offers a menu of contracts, and the Agent selects the contract that meets its objective. Viewing regulation through the lens of a PA framework is well established in literature (see literature review in section 2.3). Such a formulation has the advantage of focussing the attention on the issue of private information held by the Agent or the presence of information asymmetries in the interaction between the Principal and the Agent. In the framework the regulator is considered to be the Principal as the regulator designs, offers and monitors the contract under consideration and the firm as the Agent. The nomenclature used follows literature on regulatory models that use a P/A framework and is not intended to imply that regulator is the apex body in an economic setting. Regulators are indeed appointed by governments, international bodies and /or organisations that have an interest in the area that the regulators have been designated to regulate. Consequently, the regulators are themselves in a sense acting as agents of the appointing bodies, and as discussed later (see Section 4.9), this has an impact on regulatory objectives that is captured in a stylised manner through the regulatory objective function in the model and the resulting mandatory disclosure requirements.

Moral hazard problems are generally developed so that there is a conflict between the Principal and the Agent over the action the Agent should take. As argued in section 2.6, in any regulatory environment these are not unreasonable assumptions. However, this conflict in and of itself does not cause moral hazard, but it does so when combined with private information on the Agent's part. The role of private information is better understood by considering the opposite situation of full

observability of the Agent's actions. In case of full observability, the Principal and the Agent could simply enter into a contract that fixes the level of action the Agent would take. Whilst the level and type of action would depend on a number of factors, nevertheless once the parties agree upon the action and such action is observable, it can be explicitly contracted upon obviating the challenges from moral hazard[13]. However, as argued above in the regulatory context this is not the case. The Agent's actions are not observable and so the observable variable used in the contract aggregates the Agent's actions and the realisation of luck and any variable used in the contract can only represent a noisy signal of the Agent's actions.

First and foremost, I denote the observable variable in the model by z. The Principal specifies the performance measure that will be used to determine the compensation/incentive of the Agent in the contract, and this is based on the observable variable z and I assume z can take values between $\left[\overline{z}, \underline{z}\right]$. z can be profits, net assets, equity or risk weighted assets of the firm depending on the objectives of the Principal. The incentive function in the model, a function of z, is denoted by $c(z)$.

Next, I consider the action that the Agent takes. Let e denote the Agent's choice of action and the set of all possible actions is denoted by E. In the simplest case e can be interpreted as a one-dimensional measure with $E \in \mathbb{R}$. e can also be multi-dimensional and can be represented as a vector with $E \in \mathbb{R}^M$ for some M. I consider two effort or action levels e_L and e_H where e_L represents low effort or actions that do not necessarily ensure compliance with regulatory objectives and e_H representing high effort or actions that are more likely to ensure regulatory compliance or

[13] Private information literature assumes that if both parties observe a variable, then they can write an enforceable contract on it. Clearly contracting is not so simple and the literature on incomplete contracts addresses this problem – Hart, (1995).

$e \epsilon \{e_L, e_H\}$.

z is stochastically related to e by the conditional probability distribution function F(z/e) with F(z/e) > 0 for all e ϵ E and all z ϵ $\left[\overline{z}, \underline{z}\right]$. So, any potential realisation of z can arise following any given action choice by the Agent. More specifically it is assumed that the distribution of z conditional on e_H first-order stochastically dominates the distribution of z conditional on e_L. This implies that the level of expected z, when the Agent chooses e_H, is larger than when the Agent chooses e_L ie $\int zf(z/e_H)dz > \int zf(z/e_L)dz$. This simply captures that given the right actions by the Agent, ie high effort, the probability of attaining the regulatory objectives is higher as compared to the situation when the Agent does not put in high effort or the right actions.

As done in literature, I capture the regulatory objectives in a stylised manner using the regulator's or the Principal's Utility function. For the purposes of this research, it is assumed that the regulator is a benevolent regulator[14]. The objective of the Principal is to maximise the expected surplus arising from regulation. The Principal is assumed to be an expected Utility maximiser with a Bernoulli Utility function over z with $u'(z) > 0$, which implies that the Principal prefers more utility to less. The Principal's objective is to maximise the surplus which can be represented as $u\big(z - c(z)\big)$ and the expected surplus as $\int u\big(z - c(z)\big) f(z \mid e) dz$. As the Principal is considered to be risk neutral the maximisation problem can be considered as a cost minimisation problem which can be written as: $Min \int c(z) f(z \mid e)\, dz$. The Principal wants to issue a contract that maximises its utility based on some metric of social

[14] It is possible to relax the assumption of a benevolent regulator to include objectives other than that of a social optimum. This has not been considered for the purposes of this exposition (Laffont & Tirole, 1993).

welfare (or some monotonic transformation thereof) represented by z in the model at minimum cost.

The cost that the Agent incurs in complying with regulation is captured in the model in a stylised manner by a dis-utility function for the Agent that is dependent on the Agent's actions and denoted by $g(e)$ where e represents the effort or action of the Agent. In the context of this research the strategy preferred by the regulator or Principal would be e_H representing high effort whilst that preferred by the Agent would be e_L representing low effort.

The actions of the Agent are often considered to be a vector of managerial effort. As argued previously, for the purposes of this model high effort on the part of the firm implies actions that are in line with regulatory objectives and low effort implies actions that do not necessarily result in the attainment of regulatory objectives. Therefore for the purposes of this research I take a more general interpretation of effort where effort would include non-effort related management decisions such as the strategies that are adopted to be more compliant with regulation at the cost of others that would be more in line with say the profit maximising objectives of the Agent[15]. Consequently, the Agent for the purposes of this model would be for example the Board, the senior management, the chief executive officer i.e. the bodies/person or persons entrusted with decision making within a firm - an approach that is consistent with the upper echelon theory of management (Hambrick and Phyllis, (1984)).

It is assumed, as argued previously, that e_H leads to a higher z and vice versa and also implies a higher level of difficulty for the Agent ie $g(e_H) > g(e_L)$. It is worthwhile noting that in the multi-dimensional effort case e_H need not be high effort in every

[15] See Mas-Colell, Whinston & Green, 1995

dimension: what is critical is that it leads to a higher z and entails a larger $g(e_H)$ for the Agent as compared to e_L ie the relationship $g(e_H) > g(e_L)$ holds.

The Agent cares about his/her compensation and effort. Consequently, the Agent is also considered to be an expected Utility maximiser with a Bernoulli Utility function $v(c, e)$ over his/her compensation and effort levels. As done in literature, I focus on the special case of such an utility function that is additively separable between compensation and action and is represented by $v(c, e) = v(c) - g(e)$ with $v'(c) > 0$ which implies that the Agent prefers more compensation to less.

The relationship between Principal and Agent does not exist in a vacuum. Since the Agent has other activities that he/she can do, the Agent will only sign the contract if it is at least as good as the best outside possible opportunity[16]. Consequently, any contract offered by the Principal has to meet at a minimum the participation utility level of the Agent. This is captured in the PA framework through the participation constraint also sometimes referred to as the individual rationality constraint. This is captured as follows in the model: $\int v\big(c(z)\big)f(z/e)dz - g(e) \geq \overline{U}$, where $\overline{U}$ represents the utility that can be attained by the Agent without participating in the regulatory contract. The participation constraint ensures that the Agent is guaranteed a minimum level of utility (attained by a market or negotiation process). In reality we see anecdotal evidence of how the constraint works in a regulatory environment if we consider for example the delisting by firms from exchanges more specifically overseas exchanges that bind the firm to more stringent listing requirements. It can argued that one reason firms delist their securities from an exchange is when the

[16] Although not explored explicitly in the model the level of outside utility can have an effect on the optimal incentive contract. The higher this level, the less is the surplus the Principal can extract from the contract.

benefits accruing from participating in the regulation i.e., the overseas listed environment are not enough to compensate for the cost/effort required to maintain such a listing.

The *incentive constraint* is the formal method for incorporating private information in the model. The Principal cannot observe the Agent's actions and consequently has to ensure that the Agent takes the appropriate action or implements the appropriate policy that are in line with the Principal's objectives. The Agent on the other hand will take action that is in the Agent's best interest, which is defined by the Agent's maximisation problem. Consequently, given the conflict of interest, the Principal has to incentivise the Agent to take the action that is in line with the Principal's objectives. This constraint ensures that feasible contracts are compatible with the Agent's incentives. The *incentive constraint* ensures that the action that the Principal wants to induce yields the same or higher level of utility for the Agent as compared to the action that the Agent would have undertaken in the absence of such incentives in the contract.

This can be represented as:

$$\int v\big(c(z)\big)f(z \mid e_H)dz - g(e_H) \geq \int v\big(c(z)\big)f(z \mid e_L)dz - g(e_L)$$

Assuming the Principal wants to implement e_H, the above constraint ensures that if the Agent chooses e_H, the Agent's Utility under e_H must be at least equal to or greater than the Agent's utility under e_L. The *incentive constraint* reflects that fact that the Principal can only observe the signal from the contract but not the effort of the Agent.

The entire process of interaction between the Principal and the Agent is captured mathematically through a constrained optimisation problem where the Principal's

objective function is optimised subject to the constraints. The objective of the exercise is to find the best feasible incentive contract that satisfies some criterion. The objective function ranks alternative contracts according to some criterion whilst the constraints describe the set of contracts that are feasible. The constrained maximisation problem represents the problem facing a Principal who is trying to determine the best feasible incentive contract to give to the Agent.

2.8 Formal Development of the Model

There are five sequential stages to the model. First the Principal offers a menu of contracts to the Agent. Second the Agent selects a contract from the menu with a specified compensation/incentive scheme. Third the Agent chooses his/her effort under the contract. Fourth the output is realised and last the Principal compensates the Agent.

Following literature, it can be demonstrated that when effort is observable the optimal incentive contract is first best irrespective of the risk attitudes of the Principal or the Agent i.e., when the agent's actions are observable, we can always get first best with a risk neutral Principal and risk averse Agent and vice versa. In case of unobservable effort as well, if there is no conflict of interest between Principal and Agent ie they have the same risk preferences, it can be shown that the optimal incentive contract is first best (See Appendix 1 for detailed workings on the same). Appendix 2 demonstrates that under the usual assumptions in literature of a Risk Neutral Principal and a Risk Averse Agent, the optimal incentive contract is not first best.

The literature on the analysis of regulation using a PA framework assumes, in most instances, the regulator or Principal to be risk neutral and the firm or the Agent to be risk averse. In most regulatory environments the impact of regulatory failure versus

regulatory success is asymmetric i.e., the regulator has to bear a disproportionate share of the costs whilst not getting many of the benefits of regulatory success. Consequently, it is not unreasonable to assume that the regulator is risk averse instead of being risk neutral. In addition, the regulator has a portfolio that is not diversified but concentrated focusing on a particular industry e.g., banking or a particular market type further reinforcing this risk attitude. Last but not least, assuming the regulator represents the general preferences of the public and consequently reflect their risk preferences, there is support to suggest the risk preference of the public/investors/depositors is risk aversion and not risk neutrality. Thus, when the regulator acts to maximise, the utility arising from such regulatory contracts, it can be argued that it is more appropriate to model the regulator or Principal to be risk averse.

In contrast in a regulatory context risk neutrality for the Agent can be natural given that they have the ability to diversify their portfolio through diversified operations e.g., by providing both banking and insurance services which normally have different regulators or through presence in different jurisdictions with different regulators. Consequently, for the purposes of this research it is assumed that the Agent is risk neutral (see Lewis & Sappington, (1995) for arguments on risk preferences).

As with all nomenclature used in the development of the heuristic framework, the terms risk aversion and risk neutrality have been used in the context of a PA formulation. The terms risk aversion and risk neutrality capture in a stylised manner the risk preferences of the regulator and the firm. For the purposes of the model the term risk aversion describes an investor who chooses the preservation of capital over higher returns and therefore is less willing to take higher risks. A risk neutral investor, on the other hand, is insensitive to risk and is driven by the expected return on the

investment i.e., if you present a risk neutral investor with two possible investments that carry different levels of risk, he or she considers just the expected return from each investment – their risks are irrelevant to him or her[17]. Accordingly, the above characterisations of risk preference of the regulator imply that, as compared to the firm, the regulator is less willing to bear higher risk for higher returns. It in no way implies that the regulator is unwilling to bear risk and nor is this assumption a requirement of the heuristic framework. The heuristic framework only requires that the regulator has a lower risk appetite as compared to the firm and it is this requirement of the heuristic framework that is captured through the above characterisations of risk preferences.

In such a setting, assuming the Principal wants to implement high effort or e_H the objective function to be optimised is given by:

$$Max_{c(z)} \int u\big(z - c(z)\big) f(\, z \mid e_H)\, dz$$

Since the Principal is considered to be risk averse, I cannot implement the minimisation approach as the Principal is risk averse over $\big(z - c(z)\big)$.

This is subject to first the participation constraint given by:

$$(i)\ s.t. \int v\big(c(z)\big) f(\, z \mid e_H)\, dz - g(e_H) - \overline{U} \geq 0$$

And second the incentive constraint given by:

$$(ii) Max_{e_H} \int v\big(c(z)\big) f(\, z \mid e_H)\, dz - g(e_H) - \int v\big(c(z)\big) f(\, z \mid e_L)\, dz + g(e_L) \geq 0$$

[17] More formally a decision maker is a risk averter (or exhibits risk aversion) if for any lottery $F(\cdot)$, the degenerate lottery that yields the amount $\int xdF(x)$ with certainty is at least as good as the lottery $F(\cdot)$ itself. If the decision maker is always [i.e. for any $F(\cdot)$] indifferent between these two lotteries, we say that the decision maker is risk neutral. (Mas-Colell, Whinston and Green, 1995)

Let $\lambda_1 \geq 0$ and $\lambda_2 \geq 0$ be the multipliers on constraints (i) and (ii) respectively. The Lagrangian[18] can be written as:

$$\mathrm{L} = \mathrm{u}\big(z - c(z)\big)\mathrm{f}(\, z \mid e_H\,) + \lambda_1\big[v\big(c(z)f(\, z \mid e_H\,)\big) - g(e_H) - \bar{U}\big] + \lambda_2\big[v\big(c(z)\big)f(\, z \mid e_H\,) - g(e_H) - v\big(c(z)\big)f(\, z \mid e_L\,) + g(e_L)\big]$$

L must satisfy the following Kuhn-Tucker first-order condition for every z belonging to $\big[\overline{z}, z\big]$:

$$\frac{\partial L}{\partial c(z)} = -u'\big(z - c(z)\big)f(\, z \mid e_H\,) + \lambda_1\big[v'\big(c(z)\big)f(\, z \mid e_H\,)\big] + \lambda_2\big[v'\big(c(z)\big)f(\, z \mid e_H\,) - v'\big(c(z)\big)f(\, z \mid e_L\,)\big] = 0$$

Re-arranging I get:

$$u'\big(z - c(z)\big)f(\, z \mid e_H\,) = [\lambda_1 + \lambda_2]v'\big(c(z)\big)f(\, z \mid e_H\,) - \lambda_2 v'\big(c(z)\big)f(\, z \mid e_L\,)$$

$$\frac{u'\big(z - c(z)\big)}{v'\big(c(z)\big)} = \lambda_1 + \lambda_2\left[1 - \frac{f(\, z \mid e_L\,)}{f(\, z \mid e_H\,)}\right]$$

Intuitively λ_1, being the multiplier for the participation constraint, has to be binding at the optimum as otherwise the Principal could offer a contract that that is lower than $\bar{U}$, which will never be accepted by the Agent. More formally suppose $\lambda_1 = 0$. Because $F[\, z \mid e_H\,]$ stochastically dominates $F[\, z \mid e_L\,]$ (first order), the must exist a set of $\tilde{z}$ belonging to $\big[\overline{z}, \underline{z}\big]$ such that $f(\, z \mid e_L\,) > f(\, z \mid e_H\,)$ for all $\tilde{z}$. Given $\lambda_1 = 0$, this implies that $u'\big(z - c(z)\big)$ is negative as $v'\big(c(z)\big)$ is a constant given the assumption of risk neutrality of the Agent. This violates the utility specification for the Principal and consequently $\lambda_1 \neq 0$.

Assuming $\lambda_2 = 0$ implies a constant incentive for every realization of z in $\big[\overline{z}, z\big]$,

[18] Using point wise optimisation enables us to move from continuous time settings to the settings used above (Holmstrom, 1979).

which violates the incentive constraint. However, since the Agent is risk neutral it is possible for the Agent to have enough risk such that the incentive constraint does not bind. However, in all other circumstances it will be binding. Assuming the incentive constraint binds and $\lambda_2 \neq 0$, by Borch rule we know that for the contract to be first best $\lambda_1 + \lambda_2 \left[1 - \frac{f(z|e_L)}{f(z|e_H)}\right]$ has to be a constant (Salanie, (2005) Chapter 5). However, with $\lambda_2 \neq 0$ this cannot be the case and consequently the contract is second best.

The result in (5) confirms the intuition that in the presence of information asymmetry the incentive contract is second best leading to the Principal having to bear a cost arising from the non-observability of effort and risk sharing properties that are implemented under the optimal incentive contract. The above analysis can be augmented by considering an additional limited liability constraint to reflect the limited liability of Agents. The addition of such a constraint, which makes the participation constraint a linear combination of the incentive and the limited liability constraints (Laffont and Martimort, (2002) Chapter 4), adds to the richness of the possible types of feasible incentive contracts (Kim, (1997), Innes, (1990)). However, it does not alter the conclusion that such contracts in most instances are second best and will impose an information cost on the Principal. Consequently, given the objectives of this research the limited liability constraint has not been considered in the above analysis.

The analysis demonstrates that the Principal will bear an information cost in most instances as the optimal incentive contract is second best. Altering the risk preferences of the Principle and the Agent as compared to literature allows for circumstances where the optimal incentive contract is first best (when $\lambda_2 = 0$). Such instances, albeit rare, are possible in regulatory context when the set of strategies that

the Agent wants to employ are compatible with the risk preference of the regulator. Considering Accounting Standards as an example, there are instances where the proposed disclosure requirements were welcomed by firms as it met their communication objectives. However, as argued earlier such instances are rare and in general there exists a conflict of interest between regulator and firm and in most instances the optimal incentive contract will be second best thereby imposing an information cost on the Principal.

2.9 Information Cost

The model establishes that the Principal or the regulator bears a cost due to the presence of a conflict of interest and un-observable effort or action. The question that arises is what does this additional cost represent? As observed earlier this cost does not arise just from a presence of conflict of interest – if effort were observable the first best contract can be achieved even in the presence of conflict of interest. It is the combination of the two – unobservable effort and a conflict of interest that results in the Principal incurring this cost. Therefore, it is reasonable to posit that both impact this cost.

Intuitively the optimal incentive function shows that the compensation/ incentive under the optimal incentive contract does not depend on the value of the outcome for the Principal. Instead, the incentive depends on the Principal inferring the Agent's action from the observed outcome (Salanie, (2005)). The use of the outcome to deduce the action reflects its content about the Agent's unobservable actions and that the optimal incentive contract is related to the information content about the outcomes. Therefore, the additional cost incurred by the Principal can be considered to be based on this information asymmetry or as an information cost.

Grossman & Hart, (1983) show that one cannot unambiguously assert whether or not this cost depends on the degree of risk aversion i.e., whether or not it depends on the degree of the conflict of interest between Principal and Agent using the degree of risk aversion as a proxy for a measure of the conflict of interest. However, as explored in more detail below, they demonstrate that this cost does depend on the degree of informativeness of the contract regarding the Agent's actions and increasing the informativeness of the observable variable in the contract can reduce this cost.

It can argued that worse the quality of information about the Agent's actions that the Principal obtains from observing any outcome, the more serious is the incentive problem. More formally, following Grossman & Hart, (1983), consider two incentive problems denoted by $(E, v, \overline{u}, F(e), z)$ and $(E, v, \overline{u}, F'(e), z')$ where E denotes the Agent's action set, v the Agent's Utility, $\overline{u}$ the Agent's reservation utility level, F the probability function, z the observable variable with $z \epsilon \left[\overline{z}, \underline{z}\right]$ and $F'(e) = RF(e)$ for all $e \in E$. R is a (n X n) stochastic matrix (here $F(e)$ and $F'(e)$ are n dimensional column vectors and the columns of R sum to one). The transformation from $F(e)$ to $F'(e)$ corresponds to a decrease in information in the Blackwell sense ie if we think of the actions $e \in E$ as being parameters with respect to which we have a prior probability distribution, then an experimenter who makes deductions from observing $z \epsilon \left[\overline{z}, \underline{z}\right]$would prefer to face the function $F(e)$ than the function $RF(e)$ ie the transformation only adds randomness to the contract. In the above setting Grossman and Hart show that the cost to the Principal of implementing the unprimed incentive problem, $C(e)$ is lower than the cost of implementing the primed incentive problem $C'(e)$ or , $C(e) < C'(e)$. The above result by Grossman and Hart (1983) show that the optimal incentive contract can be implemented at less cost the more informative

model i.e., the loss in utility is higher when the signal is less informative. Consequently, the optimal incentive contract can be implemented at a cost that is lower for a contract that is more informative about the Agent's actions as compared to one that is less informative. Given that the Principal has to bear this information cost, it is also rational to assume that the Principal is aware of such a cost and will aim to minimise this information cost.

The Principal or regulator can improve the information content about the Agent's actions through the introduction of additional variables in the contract or by improving the information provided by the variables in the contract. In case of the former, the Principal has the option to choose from a number of variables that can provide additional signals of the Agent's efforts. However, not all variables when included in the optimal incentive contract lead to an increase in the information content on the Agent's efforts. Assume that another signal of the Agent's efforts is available to the Principal in addition to z and let this signal be y. Consequently, the joint density function now is given by $f(z, y \mid e)$ and the incentive function can be made to depend on both z and y or $c(.) = c(z, y)$. The optimal incentive function now is given by:

$$\frac{u'(z-c(z,y))}{v'(c(z,y))} = \lambda_1 \left[1 - \frac{f(z,y|e_L)}{f(z,y|e_H)}\right] \qquad [6]$$

Now if z is a sufficient statistic for the pair (z, y) with respect to e ie that z carries all the relevant information (statistically speaking) about e then y adds nothing to the power of inference about e, we can write $f(z, y \mid e) = g(z \mid e).h(y)$ for almost every (z, y). Substituting in the optimal incentive function yields the original incentive function which is independent of y.

As long as z is a sufficient statistic for the pair (z, y) with respect to e, it should not be included in the contract. As long as z is not sufficient statistic for the pair (z, y) with respect to e, it should be included in the contract to an extent (*minimum statistic theorem)* (Holmstrom, 1979). Consequently, the Principal can improve the information content about the Agent's actions by incorporating additional variables in the contract that are not a sufficient statistic for any of the other variables in the contract with respect to the Agent's actions.

The above analysis establishes that the Principal ie the regulator will aim to improve the information content of the observable variable on which compensation/incentive is based in the optimal incentive contract. The regulator can achieve the same by incorporating additional variables in the optimal incentive contract that provide information about the Agent's actions. It is these actions by regulators that manifest themselves as mandatory disclosure requirements in an economy.

2.10 Conclusion

The research addresses the question as to why do mandatory disclosure requirements arise in an economy. Most existing hypothesises explaining such requirements rely on externalities or market failure to provide an explanation. They also do not provide an explanation that encompasses the regulatory process from which such requirements arise. Similar conclusions have been arrived at by Healy & Palepu, (2001) and Leuz & Wysocki, (2008) in their survey of literature in the area. This research argues that an intuitive explanation can be found if one considers the regulatory process by which mandatory disclosure requirements are set in an economy in the presence of information asymmetry.

This research instead of focussing on market dynamics to provide an explanation,

focuses on the existence of information asymmetry between regulators and firms and applies a Contract Theoretic Approach to the problem. The research proposes an alternative explanation based on information asymmetry that provide a heuristic framework for explaining the existence of mandatory disclosures. Using a PA framework, the research demonstrates that in the presence of moral hazard, which exist in most if not all regulated environments, a regulator will require additional information in the form of mandatory disclosures that are incorporated in the regulatory contract. The heuristic framework developed also demonstrates that the additional information requirements have to be agreed to by the firms i.e., be consistent with the incentive and participation constraints. Consequently, there is a limit to which any regulator can ask for such additional information from firms.

The risk preferences used in the research to demonstrate the existence of an information cost is one where the regulator is considered to be Risk Averse and the firm Risk Neutral and is different from the one usually used in regulatory literature. By doing so the research is able to incorporate those occurrences, however rare, where there exists goal congruence between regulator and firm. This enables the heuristic framework to better encapsulate the variety of interactions between the regulator and the firm, as seen in reality, in the heuristic framework.

In this manner the research makes a positive contribution to existing literature in the area. It also adds to existing regulatory literature that uses the PA framework by focussing on a setting different from the one normally used in literature.

CHAPTER THREE: INFORMATION ASYMMETRY AND BANKING REGULATIONS

3.1 Introduction

Section 2.0 provides an alternative information cost based economic rationale for the existence of mandatory disclosures in an economy. Using a Principal Agent framework, the heuristic framework demonstrates that in the presence of moral hazard the regulator will incur an information cost that cannot be eliminated. The heuristic framework demonstrates that since this information cost is dependent on the degree of informativeness of the contract about the Agent's actions, this cost can be reduced by increasing information about the Agent's actions. The heuristic framework argues that it is this objective of cost reduction on the part of the regulator that provides the rationale for the existence of mandatory disclosure requirements in an economy.

In any contract that compensates the Agent for his/her efforts, such compensation is based on an observable variable that can be contracted upon. The Principal will include such a variable in the contract on which the compensation is based. This variable has dual function – it enables the Principal to monitor the Agent (in a regulatory context monitor compliance or non-compliance with regulatory requirements) and also motivate the Agent to take actions that are 'high effort' or actions that are in line with the objectives of the regulator and not that of the Agent (given conflict of interest and captured by the incentive constraint). For the purposes of the analysis in this section this variable is called the 'key performance variable'.

3.2 Objectives

The aim of this research is to evaluate the veracity of the propositions outlined in the heuristic framework in the context of banking regulation. Banking as an industry

presents an ideal case for such an analysis - as an industry it is heavily regulated, has a complex business model generating complex information needs for regulators, is ever changing with significant growth in the form of new markets and products and is a global business with a global regulatory framework. The chapter appraises the final pronouncements of the Basel Committee on Banking Regulations (BCBS) to determine:

i. If such pronouncements contain a key performance variable or variables as postulated in the heuristic framework and if so if such key performance variables are subject to information asymmetry; and

ii. If such pronouncements require additional information to be provided to regulators on the key performance variable or variables as stipulated in the heuristic framework.

3.3 Approach

For banking, although regulation has been present in some form or the other in all jurisdictions in varying degrees, the first global regulatory contract was issued by the Basel Committee on Banking Supervision (BCBS) based in Basel, Switzerland in July 1988 and was initially known as the Basel 1988 Accord or as Basel 1. The BCBS was established by the central bank Governors of the Group of Ten countries at the end of 1974 in the aftermath of serious disturbances in international currency and banking markets (notably the failure of Bankhaus Herstatt in West Germany). Since its inception, the membership of the Basel Committee has expanded from the initial G10 members to its current membership consisting of 45 institutions from 28 jurisdictions. The Committee has been responsible for a series of pronouncements on banking regulations that have adopted by its members, most notably its pronouncements on

capital adequacy requirements and more recently on liquidity standards. These are commonly known as Basel 1, Basel 2 and Basel 3.

It should be noted that BCBS regulatory pronouncements in themselves do not have legal status and consequently are not contractual, as they cannot be legally enforced. It is the adoption of the BCBS pronouncements by signatory or member jurisdictions, whereby each jurisdiction includes the BCBS regulations in local law, that make them legally enforceable and consequently contractual. For example, in Europe BCBS regulations are captured in law through the Capital Requirements Regulation (CRR) and the Capital Requirements Directive (CRD), which are legal instruments.

As a first step in developing in any set of regulations the BCBS initially publishes a consultation document outlining the draft regulatory proposals for public comment. Based on comments received the proposals are subsequently modified and the final regulations published. It is the final version that is implemented by banks and monitored by regulators. The aim of this research is to evaluate whether banking regulations meet the conditions stipulated in the heuristic framework. Consequently, this research considers only the final pronouncements from BCBS. In addition, the aim of the research is to evaluate whether banking regulations meet the conditions stipulated in the heuristic framework and not whether just *a* specific pronouncement on banking regulation from the BCBS meet the conditions. Therefore, the research evaluates all the key pronouncements of the BCBS from its inception. More specifically, the research evaluates the following BCBS pronouncements[19]:

- Basel 1 (BCBS: *International Convergence Of Capital Measurement And Capital Standards*, July 1988);

[19] (The documents listed below were all obtained from the BCBS website - https://www.bis.org/bcbs/history.htm)

- Market Risk Amendment (BCBS: *Amendment To The Capital Accord To Incorporate Market Risks*, January 1996);
- Basel 2 (BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework*, June 2004); and
- Basel 3 (BCBS: *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, January 2013 and BCBS: *Basel III: the net stable funding ratio*, October 2014).

To achieve its objectives the research uses 'textual analysis' of the final regulatory pronouncements issued by the BCBS (Atkinson and Cofey, (2004)).

The documents selected for the study meet the quality criteria outlined by Scott, (1990). Being the only body empowered with the task of setting global standards on banking, BCBS pronouncements are representative as their pronouncements represent documents that would typically be used for matters pertaining to global banking regulations (Morgan, 2021). The credibility of the documents come from the status accorded to BCBS pronouncements by member jurisdictions, who implement such regulations in their specific jurisdictions by enshrining them in law. The consultation process followed by BCBS, often with multiple consultations being done for each pronouncement, ensures that the final pronouncements are materially free from error and distortion, further attesting to their credibility. They represent the most reliable and accurate source of banking regulations as of date. The evidence they provide in the context of banking regulation is clear and comprehensible as attested by their use across the globe by multiple jurisdictions. Lastly, as previously stated all pronouncements were obtained from BCBS, the primary source of such documents, thereby attesting to their authenticity. These documents represent a data set that is stable as they represent the published official positions of the BCBS and also can be considered to be free from potential bias given their unambiguous purpose - to set

global regulatory requirements for banks thereby attesting to their objectivity. Given that the aim of the research is to examine the documents in the context in which they were produced i.e., as the global regulatory requirements for banks, this significantly reduces the risk of potential bias in the study (Morgan, 2021)

The research aims to evaluate the veracity of the heuristic framework outlined above by ascertaining the 'documentary reality' as stated in the text of the documents. The approach taken is to perform a thematic analysis of the text to recognise patterns in the data from which emergent themes are selected for further analysis (Fereday and Muir-Cochrane (2006), Bowen (2009)). The selection of the themes is based on academic judgement informed by my understanding of the heuristic framework developed and also personal experience in working with banking regulations. The themes therefore emerge and evolve with the review of the documents (as in a reflexive approach to thematic analysis (Braun et al. (2019), Morgan (2021)))[20].

I initially review the pronouncements to gain an understanding of their content. Following the first review I perform a detailed review of the pronouncements to determine if the pronouncements contain requirements that enable regulators to monitor, incentivise banks to comply with regulations and also as and when required enforce the same i.e. the presence of requirements that can be considered as the key performance variable or variables. Given the volume and complexity of the material this thematic analysis is done separately for each risk addressed by the BCBS regulations – credit risk, market risk and liquidity risk. Having established the above theme regarding key performance variables, the pronouncements are reviewed again

[20] Whilst any reflexive approach is subjective, in this instance the subjectivity is to an extent countered by the specific criteria used for the selection of the themes i.e. the stipulations that enable the regulator to monitor, incentivise and also enforce the regulations using a legal framework. Also, as Morgan (2021) points out on occasion this subjectivity can be a resource.

to determine if they contain stipulations regarding the provision of additional information on items identified under the first theme of key performance variables ie to determine the presence of additional information requirements on key performance variables as stipulated in the heuristic framework. In this manner, through an inductive approach using judgement and the ordinary process of interpretation the main arguments in the research are distilled from the primary source material to arrive at its conclusions.

The analysis will show that the capital adequacy ratios can be considered as the key performance variables as posited by the heuristic framework and that these regulations do indeed require additional information to be provided to regulators on such variables. The heuristic framework in section 2.0 provides an alternative explanation for the existence of mandatory disclosures in an economy thereby adding to literature on the topic. This section by analysing the veracity of the heuristic framework in the context of banking further adds to the same.

In addition, the research also considers the use of the capital adequacy ratio from an information perspective. By analysing the use of the capital adequacy ratio from an information cost perspective, the research provides an explanation for the use of the capital adequacy ratio in banking regulation, the key regulatory measure in banking, that is different from existing literature thereby further adding to the literature in the area.

3.4 Basel 1 – Objectives and Requirements

Basel 1 was motivated by interacting concerns. Firstly, it was the risk posed to the stability of the global financial system by the low capital levels of internationally active banks. Secondly, the competitive advantage accruing to those banks subject to

low capital requirements thereby creating challenges for banks in high capital jurisdictions - commonly referred to as the 'level playing field' problem. These interacting concerns made the Basel 1 process a kind of hybrid of an international trade negotiation and regulatory exercise (Tarullo, 2008).

Overall, during this period there was a change in the industry structure of banking driven by the development of a significant new market – the euro-dollar market. Also, the period saw the expansion of banks from being regional entities to being global. At the end of 1964 only eleven US banks operated a total of 181 foreign branches. However, by the end of 1973 there were a total of 185 US banks operating a total of 699 foreign branches. In addition, the total assets of these branches had risen from US $ 7 billion to US $ 118 billion (Tarullo, 2008). Overall, in the decades leading up to Basel 1, banking became global. This was also a period of significant overall growth in the assets of all internationally active banks, with the large international banks growing extraordinarily rapidly. From 1974 to 1988 the assets of the top 300 banks in the world grew sevenfold, from US $ 2.2 trillion to US $ 15.1 trillion (de Carmoy, 1990).

Concerns about financial stability were brought to the forefront by the failure of the private German bank, Bankhaus Herstatt on 26th June 1974. This failure brought into sharp focus the security and stability of the international financial system. A further sense of urgency was injected into the process by the MAB (Mexico, Argentina and Brazil) crisis, starting in August 1982, that put bank profitability and capital levels under enormous strain (Goodhart, 2011).

The above events and circumstances created the groundwork for the determination of the key regulatory objectives of the BCBS and the BCBS issued a consultative paper

in December 1987 on proposed capital standards. In July 1988, the committee released the final version of the standard or Accord, which reflected only modest changes from the proposals. Basel 1's key aim was to improve the stability of the international financial system by increasing the capital levels of internationally active banks and moderating their risk-taking behaviour in the context of credit risk i.e. the risk of default in their loan portfolios. Consequently, the risk addressed by the Basel 1 regulatory requirements was the credit risk of internationally active banks (https://www.bis.org/bcbs/history.htm - History of the Basel Committee).

The approach taken by the BCBS to improve the overall stability of the financial system was to increase the amount of resources or eligible capital that would be available to banks in case of losses. The aim of the regulation was to force banks to hold resources to absorb losses thereby increasing their resilience and consequently improving financial stability of the system as a whole.

The amount of capital that a bank was required to hold under Basel 1 was based on the level of credit risk in their loan portfolios and was measured as Risk Weighted Assets or RWAs. What was considered as resources available to a bank to absorb losses was defined as 'eligible capital'. Basel 1 required that banks, at a minimum, maintained a certain level of capital at all times which was determined based on the banks level of RWAs. This minimum capital requirement was stipulated as a ratio that required banks maintain a minimum percentage of their RWAs as eligible capital or the minimum capital adequacy ratio. Basel 1 required two capital ratios that had to be maintained as minimum: a bank's core capital or 'tier 1' capital which had to be at least 4% of the RWAs of the bank and 'Tier 2' capital which set at 8% of the RWAs of the bank based on the total capital of the bank. Total capital could include

additional elements other than what was considered as core capital. The stipulated capital adequacy ratio had to be maintained by all internationally active banks as a minimum (BCBS: *International Convergence Of Capital Measurement And Capital Standards*, July 1988).

For the determination of RWAs, in essence, the approach taken was to assign each asset either on or off-balance sheet to one of five risk categories with a prescribed risk weighting to determine the RWA for the asset and them adding them up to arrive at the total level of RWAs for the bank (for details see Table 3.1 in section 3.11.1). Table 3.2 in section 3.11.1 outline the tier 1 capital requirements that consisted of universally recognised elements of shareholders equity and retained earnings. Other elements such as revaluation reserves, subordinated debt, general loan loss reserve and other hybrid instruments (instruments exhibiting characteristics of equity and debt such as convertible bonds) were designated as Tier 2 capital. The uneasiness with which Tier 2 elements were accepted by some Basel committee members is reflected in the restrictions imposed on them as outlined in Table 2.

The heuristic framework posits that regulatory contracts will include key performance variable/variables that is used by regulator to monitor and motivate firms. This variable / variables enables the regulator to not only ensure that the firm has complied with regulatory requirements but also to incentivise the firm to act in accordance with regulatory objectives especially in the presence of a conflict of interest. In case of Basel 1, the Tier 1 and Tier 2 capital adequacy ratios can be considered as the key performance variables. It is these ratios that enable regulators to monitor the banks actions for credit risk. Non-maintenance of the required capital adequacy ratio can and does lead to regulatory action whereby the errant bank has to either reduce their

RWAs through asset reduction that can lead to significant losses for the bank or increase their equity capital. At the extreme the bank's management can lose control of the Bank to regulators (Dewatripoint & Tirole, 1994). It is the compliance with this ratio that enables banks to continue to participate in the business model of banking.

The capital adequacy ratio by linking the required amount of capital with the riskiness of a bank's loan portfolio provides the necessary incentive to banks to manage their credit risk positions. For banks, assuming a profit maximising objective, a lower capital requirement implies a lower cost or higher profits or the ability to capture market share by offering products at a rate cheaper. The design of the capital adequacy ratio using the linkage mentioned above ensures that lower risk portfolios (with lower chances of losses) incur a lower capital cost as compared to higher risk portfolios, thereby encouraging banks to move towards a more prudent risk management approach in their credit operations.

Empirical literature has found evidence of impact of regulatory action on bank capital positions. Aggarwal & Jacques, (1998) investigate the impact of the prompt corrective action (PCA) provisions on bank capital ratios and portfolio risk levels. The Federal Deposit Insurance Corporation Improvement Act of December 1991 defined a series of capital thresholds. These thresholds were to be used to determine what supervisory actions bank regulators would take. The study finds that both adequately capitalised and undercapitalised banks increased their capital ratios and lowered portfolio risk in response to PCA during both the announcement period 1992 and the first year the standards were in effect. Ediz, Michael, & Perraudin, (1998) study the U.K. banking sector from 1989 to 1995. They consider whether supervisory pressures affect bank capital dynamics for banks whose capital ratios are near their regulatory minimum

(trigger) and also how these banks adjust their capital ratios when subject to regulatory pressure. With respect to their first question, Ediz, Michael, & Perraudin, (1998) find that capital requirements induce banks to increase their capital ratios even after one allows for internally generated capital targets. With respect to their second question, they conclude that banks do not significantly rely on asset substitution away from high-risk-weighted assets to meet their capital requirements as they approach the regulatory minimum. Instead, their results suggest that the adjustment comes through increases in narrow capital (Tier 1).

Basel 1 however was a blunt tool. The definition of risk weights was principally based on the generic nature of the borrowings, rather than the borrower specific characteristics. Thus, all loans to non-banking finance corporations were risk weighted 100% regardless of whether the borrower was General Electric or a start-up with no proven cash flows. This would be the primary driver behind the revisions brought in by Basel 2.

3.5 Market Risk Amendment (MRA) – Objectives and Requirements

Basel regulations on banking developed to respond to specific risks and over time new risks added. The Market Risk Amendments issued January 1996 added to the capital adequacy requirements and created the requirements that resulted in market risk being a regulated risk in banking. The Market Risk Amendments (MRA) focuses on risks arising from market exposures of banks or those exposures that arise from what is generally termed as ‘proprietary trading positions’ - positions entered into by banks to profit from market movements for example, changes in equity prices or movements in interest rates and/or foreign exchange rates. The BCBS was concerned with risks arising from market movements given the increased holding of equities by

banks arising from their market intermediation and proprietary trading activities - activities that also saw banks venturing into other asset classes such as commodities, foreign exchange and interest rate products.

The events of October 1987 added further impetus towards this move. In October 1987 the New York stock exchange crashed resulting in significant losses for banks from their market intermediation activities and also their proprietary trading positions in equities. This created a significant sense of urgency for regulatory intervention in the area (Goodhart, 2011).

The objective of the MRA was to address the risks arising from banks trading operations and it did so by imposing additional capital requirements for such risks. Consistent with Basel 1, the MRA required banks to hold resources or eligible capital that would be available to absorb losses arising from market risk.

The MRA was effective from end 1997 with early application permitted. It was applicable to portfolios held in the banks trading books that consisted of investments made by the bank with the objective of making profits from short-term market movements in prices or rates like equity prices, foreign exchange rates, commodity prices and interest rates. One new feature of the MRA was the provision of a choice of methodologies that banks could select in determining the capital requirement.

The amount of capital that a bank was required to hold under the MRA was based on the level of market risk exposure of a bank, which could be measured in different ways. Again, what was considered as resources available to a bank to absorb losses under the regulations was considered as ‘eligible capital’. The minimum capital requirement was stipulated as a ratio and banks were required to always maintain that

minimum level. This ratio was set at 8% by the MRA (BCBS: *Amendment To The Capital Accord To Incorporate Market Risks*, January 1996).

The principal form of eligible capital to cover market risks consisted of shareholders' equity and retained earnings (tier 1 capital) and supplementary capital (tier 2 capital) as defined in Basel 1. But banks could also, at the discretion of their national authority, employ a third tier of capital ("tier 3"), consisting of short-term subordinated debt for the sole purpose of meeting a proportion of the capital requirements for market risks.

The measure of the amount of market risk exposure was composed of two elements: a) specific risk - the risk of loss arising from price movements for that specific security and b) general market risk - the risk of loss arising from general market movements in equity prices and interest rates. The MRA allowed for two approaches or methodologies to determine this measure. The first approach or methodology was called the ‘standardised approach’ and required separate calculations of specific risk and general market risk that were then added to arrive at the total capital required for market risk.

The second approach focused on applying a bank’s internal models for market risk, the most common being Value at Risk (VaR) to determine the market risk capital requirement. The use of advanced internal models allowed for the determination of the market risk exposure as a single number i.e., without separately determining the requirements for specific and general risks as required under the standardised approaches.

This choice of methodology was provided on the grounds that not all banks had the ability to undertake the complex modelling required under the advanced approach.

The MRA however stipulated that the total specific risk charge using the advanced approach could not be less than half the specific risk charge calculated using the standardised approach - indicating the clear expectation that the model-based methodology could potentially lead to capital savings for banks. This also provided the necessary incentive to banks to move towards using the advanced approach i.e. to develop internal modelling abilities to capture such risks. Under both approaches the banks had to comply with the capital requirements on a continuous time basis i.e., ensure that they met the minimum capital adequacy ratio requirements for market risk on a daily basis.

As with Basel 1, the specified capital adequacy ratio for market risk can be considered the key performance variable. It is this ratio that enables the regulators to monitor the banks actions in the area of market risk. Non-maintenance of the required capital adequacy ratio can and does lead to regulatory action and it is the compliance with this ratio that enables banks to continue to participate in the business model of banking.

The capital adequacy ratio by linking the required amount of capital with the level of market risk exposure again provides the necessary incentive to banks to manage their market positions in a more prudent manner. The design of the capital adequacy ratio using this linkage ensures that lower risk portfolios (with lower chances of losses) incur a lower capital cost as compared to higher risk portfolios, thereby encouraging banks to move towards a more prudent risk management approach in their market operations.

3.6 Basel 2 – Objectives and Requirements

Unlike Basel 1, in the case of Basel 2 there was no explicit aim of increasing the capital levels of banks to improve financial stability. Instead, the need for reviewing Basel1 arose from its inherent limitations and the development of new credit instruments. As previously pointed in section 3.4 out the risk weights used in Basel 1 were to an extent arbitrary and represented a blunt tool for capturing credit risk. This led to persistent complaints from banks that the measurement failed to capture credit risk accurately. Banks pointed out that the uniform credit scoring of all assets for determining RWA's, irrespective of their credit quality, lead to excessive capital being retained for credit risk – a feature that was detrimental to the development and growth of the industry. This lacuna was further compounded by the development of new credit instruments during this period – primarily securitisations and credit derivatives. Over time differences started arising between the measure of credit risk used for Basel 1 and those being used by banks for their own risk management purposes.

Securitisation of assets and the availability of credit derivatives created sophisticated regulatory arbitrage strategies whereby banks could reduce their credit risk capital charge without actually reducing their credit risk exposure. For example, securitisations resulted in the banks retaining exposure to mortgage assets with much higher risk exposure to credit losses without any corresponding increases in capital requirements under Basel 1. Similar results were also being achieved through the use of credit derivatives or a combination of both instruments. By the mid-1990s the use of non-traditional credit instruments was considered to be a major concern for capital adequacy purposes leading to the statement by William McDonough[21], then chairman

[21] See William McDonough, *Issues for the Basel Accord*, remarks at the Conference on Credit Risk Modelling and Regulatory Implications, London, 1998.

of the Basel committee, that both securitisations and credit derivatives significantly complicated the task of understanding a bank's risk position thereby undermining the utility of Basel 1.

The years post Basel 1 also witnessed the development of new methodologies in the form of credit risk models for measuring and managing credit risk. These tools allowed credit risks to be measured with a greater degree of finesse as compared to the standardised risk weights of Basel 1 and were developed by banks to manage and measure credit risk arising from the non-traditional credit instruments.

In light of these circumstances, it became evident by mid-1998 that the BCBS would significantly alter Basel 1 to address these challenges. On June 26, 2004, the BCBS formally released Basle 2. Basel 2 radically changed the methods for computing RWA's for credit risk to address criticisms of Basel 1. It also addressed the informational complexities arising from new credit instruments such as securitisations and credit derivatives. Following the precedent set by the MRA, it allowed banks to choose from a menu of allowable methods for computing RWAs and was significantly more complex than Basel 1. In view of this complexity, it also allowed for significantly longer transition periods as compared to Basel 1.

The aim of Basel 2 was to improve the computation of RWAs for the purposes of measuring the capital adequacy ratio for credit risk such that the measure used was not only more accurate but also prevented regulatory arbitrage, as was prevalent in the markets at that juncture. The BCBS stated "The fundamental objective of the committee's work to revise the 1988 accord has been to develop a framework that will further strengthen the soundness and stability of the international banking system …."

(BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework,* June 2004).

Basel 2 allowed two options for measuring RWA's. It did not make any major changes to the level of capital required or to what was eligible capital under Basel 1. The two methodologies provided for calculating RWAs were as follows: a) the standardised approach using external credit ratings rather than fixed risk weightings as done in Basel 1 and b) the use of a bank's internal credit models for measuring credit risk or Internal Ratings Based approach.

Under the standardised approach, in determining the level of credit risk banks were allowed to use external credit assessment institutions or ratings by credit rating agencies as long as their national supervisor approved such agencies. This allowed banks to create a higher degree of segregation based on individual asset credit risk as compared to Basel 1, which grouped all assets based on sector as having the same credit risk irrespective of credit ratings. To convert the assets classified based on external ratings into RWA's, Basel 2 provided specific risk weights by rating category and by type of exposure. The second refinement introduced was to take into consideration the effect of Credit Risk Mitigation (CRM) activities of banks. BCBS recognised that banks often use collateral, guarantees and more recently credit derivatives to mitigate their exposure to credit risk. Consequently, Basel 2 explicitly allowed banks to reduce their credit exposure to counterparties in the presence of such CRM activities for the purposes of calculating their RWAs.

The second approach allowed banks to use their own internal models for determining RWA's and was called the internal ratings-based approach (IRB). This was further subdivided into a) the Foundation IRB approach and b) the Advanced IRB approach.

Under the Foundation approach banks provided their own estimates of probability of default (PD) and relied on supervisory estimates of the other risk components i.e. loss given default (LGD), exposure at default (EAD) and effective maturity (M). Under the Advanced IRB Approach banks were required to provide their own estimates of all the risk variables. This measure of credit risk was subsequently converted to RWAs using risk weight functions specified in Basel 2. There was one exception, however. For retail exposures there was no distinction between foundation and advanced approaches as banks had to use their own estimates for all the risk parameters. As with the standardised approach, for advanced approaches also Basel 2 provided significant guidance on how to consider credit risk management activities.

The other key element of Basel 2 was to outline specific capital requirements for securitisations. It only allowed for securitised assets to be removed from the computation of a bank's credit risk exposure under stringent conditions. It also introduced the concept of synthetic securitisations, whereby risk is either introduced or transferred not by means of sale or purchase of assets but by using credit derivatives or by the tranching of portfolios based on the risk of cash flows of underlying assets. Basel 2 captured a wide range of assets that could potentially be securitised. The capital charge for securitised exposures could be computed using either the standardised or the advanced approaches.

For market risk, Basel 2 effectively continued with the provisions of the MRA. Given the information challenges arising from the definition of the trading book, Basel 2 provided more stringent conditions for what had to be considered as trading book assets.

For the reasons outlined in the analysis of Basel 1 and the MRA, the capital adequacy ratios used for both credit and market risk can be seen as the key performance variables for Basel 2 as well.

3.7 Basel 3 – Objectives and Requirements

The objectives of Basel 3 could not have been more radically different from those of Basel 2. The landscape of the financial services industry had been shaken and altered by the financial crisis that engulfed the industry in 2008, even before Basle 2 had been implemented in certain key jurisdictions for example the USA. The objectives of Basel 3 can be considered as being twofold: i) in case of credit and market risk to increase the capital levels of banks and to address the lacuna in their measurement for purposes of capital adequacy as identified during the crisis and ii) to address the new risk that came to the forefront during the crisis – liquidity risk.

Whilst the amendments made to the capital framework for credit and market risks were significant with far-reaching consequences for banks, from the perspective of the heuristic framework they do not offer any new or significant insight further than what has already been demonstrated in the previous sections. Basel 3 continues to rely on the capital adequacy ratio as the key performance variable along with employing the similar measurement methodologies for quantifying such risks. Basel 3 increases the capital adequacy requirements for banks and imposes additional restrictions and additional information requirements on specific aspects of measurement, focusing on areas and asset classes where the measurement under Basel 2 had failed to provide the necessary information to regulators regarding the level of risk (BCBS: *Basel III: A global regulatory framework for more resilient banks and banking systems*, December 2010 (rev June 2011)).

In the context of liquidity risk, the analysis will show that the liquidity risk also meets the conditions of the heuristic framework. As with the market risk amendment, Basel 3 for the first time addressed the issue of liquidity risk, a risk brought to the forefront by the financial crisis. In essence through its lending activities a bank brings about 'maturity transformations' of funds in an economy. At its very basic a bank borrows or funds itself using short term funding and then converts them into long term assets by issuing long term loans. In the process, assuming an upward sloping yield curve - the normal case under most circumstances - the banks lock in a margin or profit. However, it is this very exercise of maturity transformation that exposes the bank to liquidity risk. In the event of a sudden decrease or in extreme cases the complete closure of short-term funding markets, as was seen during the crisis, a bank is unable to refinance itself due to the absence of liquidity in markets even in the absence of concerns regarding the bank's asset quality. Given the excess liquidity of the pre-crisis period, liquidity risk had almost become non-existent for banks and their supervisors. This changed dramatically during the crisis as liquidity dried up and wholesale funding became scarce. Banks found themselves unable to meet their obligations. To address this challenge, Basel 3 introduced for the first-time global liquidity standards - the Liquidity Coverage Ratio ("LCR") and Net Stable Funding Ratio ("NSFR").

The LCR tries to ensure that banks hold a defined buffer to allow them to be self-sufficient for up to 30 days should a bank-specific stress event and a market downturn occur at the same time. The aim is to ensure that banks have an adequate stock of unencumbered high-quality liquid assets (HQLA) that can be easily converted in financial markets, at no or little loss of value. The LCR has two components:

(a) Value of the stock of HQLA in stressed conditions; and

(b) Total net cash outflows, calculated according to the scenario parameters.

The ratio provides an indication of whether the stock of unencumbered HQLA will enable the bank to survive until Day 30 of the stress scenario, by which time it is assumed that appropriate corrective actions can be taken by management and supervisors, or that the bank can be resolved in an orderly way. Furthermore, it gives the central bank additional time to take appropriate measures, should they be regarded as necessary. Basel 3 requires that the ratio or HQLA over Total net cash outflows should be 100 percent or greater at all times other than during times of stress. During a period of financial stress, however, banks may use their stock of HQLA, as maintaining the LCR at 100% under such circumstances could produce undue negative effects on the bank and other market participants (BCBS: *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, January 2013).

The NSFR takes a longer view and aims to encourage banks to better match the funding characteristics of their assets and liabilities over a one-year period. The goal is to reduce the probability that shocks affecting a bank's usual funding sources might erode its liquidity position, increasing its risk of bankruptcy. The NSFR is defined as the amount of available stable funding (ASF) relative to the amount of required stable funding (RSF). Basel 3 requires this ratio to be at least 100% on an ongoing basis. ASF is defined as the portion of capital and liabilities expected to be reliable over the one-year time horizon. The amount of RSF of a specific institution is a function of the liquidity characteristics and residual maturities of the various assets held by that institution as well as those of its off-balance sheet (OBS) exposures (BCBS: *Basel III: the net stable funding ratio*, October 2014).

As with the other Basel pronouncements the above two ratios can be considered as key performance variables in case of liquidity risk. The two ratios can be used by regulators to not only monitor bank actions but also to motivate them in liquidity risk management. Non-maintenance of the required liquidity ratios can lead to regulatory action whereby the errant bank has to improve their liquidity position by either divesting assets that are not liquid or by reducing cash outflows from operations, both of which can entail costs for banks. It is the compliance with this ratio that enables banks to continue to participate in the business model of banking.

The liquidity ratios impose a cost on the bank by restraining their activities. The LCR requires banks to hold liquid assets that can be used to fund itself for 30 days in a stress scenario. Given these assets need to be highly liquid they usually carry lower returns and consequently maintaining of such a regulatory liquidity portfolio imposes an opportunity cost on the bank. The ratio also provides the bank with the necessary incentive to manage their operations so that the net cash outflow requirement is managed, as higher the net cash outflows during stress the higher will be the level of liquid assets required to maintain the ratio. However, it should be noted that the LCR requirements would have limited cost and incentive implications given its very short time horizon of 30 days.

However, the impact of NSFR, as compared to the LCR, is more significant as it will reduce the amount of “maturity transformation” provided by the financial sector (the ability of banks to borrow short and lend long). As outlined previously in this section banks make profits by funding their long-term loan portfolios by borrowing short term. The liquidity ratio requirements effectively limit this exercise by requiring banks to match their liquidity positions over a period of one year. The NSFR requires

banks to ensure that their fund outflow in the next 12 months is matched by fund inflows from their qualifying stable assets. In the absence of such a ratio requirement, banks could base their funding needs by assuming roll over of their short-term funding, as was done during the pre-crisis periods. Consequently, the matched funding position requirement imposes a cost on the bank, as it can no longer generate profits through its maturity transformation exercise. Again, the incentive effect arises from the fact that a bank could reduce this restriction on maturity transformation over a one-year period by reducing its cash outflows. However, again given the limited horizon of one year, the impact of this is not expected to be significant for banks.

3.8 Key Performance Variable - Credit Risk

As argued under the heuristic framework any contract that compensates the Agent for his/her efforts such compensation must be based on an observable variable that can be contracted upon. This also extends to regulatory contracts where the Principal will include such a variable in the contract on which the compensation is based. This variable has the dual function of enabling the Principal to monitor the Agent (in a regulatory context monitor compliance or non-compliance with regulatory requirements) and also motivate the Agent to take actions that are 'high effort' or actions that are in line with the objectives of the regulator and not that of the Agent. The heuristic framework also argues that this variable will be a noisy signal of Agent's actions or have information asymmetry. Such a variable or variables are termed 'key performance variables'. As argued above the capital adequacy ratios stipulated in Basel 1, Basel 2 and Basel 3 can be construed as such variables for credit risk in the regulatory contracts offered by the Principal, BCBS, to Agent's, global banks.

Previous analysis of BCBS regulatory pronouncements addressed how the capital adequacy ratio is used by regulator to monitor and motivate banks (see section 3.4) for credit risk. This demonstrates that the use and design of the capital adequacy ratios for credit risk meeting the first condition for such variables as postulated in the heuristic framework. However, the heuristic framework also argues that such variables represent a noisy signal of the Agent's actions or suffer from information asymmetry.

The presence of information asymmetry in bank assets is well documented in literature. Literature provides ample reasoning and evidence of the fact that banks have a significant information advantage in determining the level of credit risk in their loans as compared all other economic players (Diamond & Rajan, 2001). It is this information advantage that enable banks to maintain their economic position and is a critical success factor. The work of Morgan, (2002) and Iannotta, (2006) show the problems of information asymmetry in bank assets as being especially pertinent to investors due to the business focus of banks on financial assets, in particular loans. The fact that these assets represent an intrinsic source of opaqueness because of their illiquidity and informationally sensitive nature is also shown in the works of Berlin & Loeys, (1988) and Diamond, (1991) to mention but a few. More recently Flannery, Kwan & Nimalendran, (2013), show that bank opacity is very much present during financial crises. They examine bank equity's trading characteristics during ''normal'' periods and two ''crisis'' periods between 1993 and 2009 and find that whilst there was only limited or mixed evidence that banks are unusually opaque during normal periods, crises raise the adverse selection costs of trading bank shares relative to those of nonbank control firms. It is the bank's balance sheet composition that significantly

affects this equity opacity. They could not however detect specific balance sheet categories that have robust effects.

Liao, Chen & Lu, (2009) investigate the effects of agency and information asymmetry issues embedded in structural form credit models on bank credit risk evaluation, using American bank data from 2001 to 2005. Their findings show that both the agency problem and information asymmetry significantly cause deviations in the credit risk evaluation of structural form models from agency ratings again demonstrating the presence of significant information asymmetry in bank assets. Lu, Chen & Liao, (2010) demonstrate the impact of information uncertainty and information asymmetry on corporate bond yield spreads using American data from 2001 to 2006. Empirical results of their study show that investors charge a significant risk premium for both information uncertainty and information asymmetry when controlling for variables well known in the literature. Blose, (2001) study the impact of information asymmetry arising from loan loss provisioning and show that investors have a significant negative reaction to such announcements primarily from the information asymmetry arising from asset values and costs associated with capital adequacy regulations.

The measurement of RWAs, as required by Basel 1, aims to capture the level of credit risk in bank's assets. As evidenced by literature, such assets are subject to significant information asymmetry. In case of Basel 2 the change in methodology computing RWA's does not reduce this information asymmetry. By fine-tuning the measurement of credit risk Basel 2 adds significant complexity to the process of computing RWA's. The specificity of measurement used in the standardised approach is increased through the incorporation of external credit rating assessments and of course by the

recognition of CRM actions for the purposes of computing RWAs. This raises the issue of determining whether the external credit ratings capture risk accurately and consistently and second whether CRM activities actually reduce credit risk thereby justifying a lower capital charge for credit risk. With advanced approaches the information asymmetry is compounded by the complexity of the requirements. For both the foundation and the advanced approach, the information asymmetry arises from the estimation of the risk parameters as relevant for the approach – PD, LGD, EAD and M. In essence, the key argument outlined previously following Diamond & Rajan, (2001), that banks will always possess an information advantage in determining the credit risk in their portfolios applies equally for Basel 2 as all that is changed as compared to Basel 1 is the measurement of the risk and not the risk itself. The same logic also applies for CRM activities, as the banks undertaking such activities will have a lot more expertise, experience and knowledge about such activities and instruments used as compared to regulators.

From an accounting perspective, it should be noted that international GAAP (Generally Accepted Accounting Principles) was not widely adopted during the application of Basel 1 and during Basel 2 IFRS application was at its inception with only Europe having adopted IFRSs from 2005. As a result, there was no uniformity in the way internationally active banks accounted for their assets under GAAP. It was possible to have two banks accounting for the same asset in two different ways. This was further exacerbated by the treatment of off-balance sheet exposures. In most instances there was hardly any guidance available on the treatment of such exposures and where there was guidance it was rudimentary. In addition, accounting is not risk based. It considers all assets in the banking book uniformly for measurement purposes, in the absence of impairment. Therefore, accounting measures failed to

provide information about the riskiness of an asset from a credit risk perspective. Two assets with totally different credit risk exposures would be measured on the exact same basis[22]. In case of off-balance sheet exposures accounting in most instances did not provide any measurement criteria as these are not recognised in the financial statements. Often all that was included in GAAP were disclosure requirements outlining the details of such exposures. Consequently, any measure based directly on such numbers could misrepresent a bank's risk position.

In the case of what is eligible equity the definitions in accounting were no clearer. Given the absence of a uniform definition instruments with different loss absorbing capacities could be classified as equity in accounting. Therefore, it was possible to include instruments as equity that did not have loss-absorbing features – one of the key objectives of Basel 1. As a result, the accounting failed to provide the regulator with any additional information regarding 'eligible capital'.

Also, the lack of international GAAP meant that retained earnings, which are a part of Tier 1 capital, differed from bank to bank depending on the jurisdiction, as it is an accounting measure. Similar and more problematic challenges arise with Tier 2 capital due to the same reasons arising from the inclusion of revaluation reserve and general provisions, which are purely accounting constructs (which also explains the additional restrictions imposed on the level of Tier 2 capital in Basel 1). Consequently, information asymmetry was present in the measurement of eligible capital as well.

[22] For example, under IFRSs loans made to high-risk corporate borrowers and highly collateralized mortgage loans would both be measured at amortised cost even though the credit risk profile of such loans are completely different.

The analysis demonstrates that for credit risk it is the capital adequacy ratio that is used by regulators to monitor and motivate banks and that is there exists significant information asymmetry between regulators and banks regarding the measurement of the same. Given the cost implications arising from the ratio for banks (see section 3.4) the ratio also acts a motivational tool for banks to reduce their risk exposure, an objective that is consistent with that of the regulator. The capital adequacy ratio as stipulated in the BCBS regulatory contract therefore meets the two stipulations in the heuristic framework for the key performance variable.

3.9 Key Performance Variable - Market Risk

As with the capital adequacy ratio for credit risk, the analysis in section 3.5 shows why the maintenance of a minimum capital adequacy ratio for market risk imposes costs on banks either in terms of profitability or scale of operations and also how the variable is used by regulators to monitor and discipline banks.

The capital adequacy ratio for market risk also represents a noisy signal of the Agent's actions as it is also the result of a combination of the Agent's actions and the realisation of pure chance. The computation of a bank's exposure to future losses arising from adverse market movements is an inherently complex exercise even for the most sophisticated of banks. It is the banks that trade in multiple markets and have the requisite information and skills to determine how the values of such assets will behave in adverse market conditions. This knowledge is specialised by asset class with specialist trading teams for each asset class that usually do not overlap. Consequently, given the global nature of bank operations covering multiple markets and asset classes it is not unreasonable to argue that the banks have a significant

information advantage over regulators in the area. Literature, as previously discussed, also documents the opacity of bank assets.

This challenge is not reduced when we consider the use of internal model-based approaches for measuring market risk exposure. In case of VaR, the methodology preferred by regulators for determining the level of market risk exposure, the models have to essentially accurately capture forward looking estimates of losses arising from market movements. Consequently, for the regulator to determine whether or not the model actually captures possible losses arising from future market movements and is responsive to the riskiness of the banks portfolios creates information asymmetries.

Information asymmetry in case of the MRA arises not only from the computation of the market risk exposure but also from what can be considered as trading. Such activities were new and secondly there was a possible overlap between what could be considered as trading or lending. It is possible for a bank to exit portfolios of loans through market operations or purchase such portfolios again through market operations. In such circumstances the question arises as to whether such operations should be considered as a part of the trading book or the banking book[23]. Given that the banks business models for generating profit drive the determination of the correct classification of such activities for capital purposes, information that is only available with the bank, the accurate classification of such activities into the either the trading or the lending book creates significant information asymmetry from a regulatory perspective.

As with Basel 1, the capital or reserves the can be used to meet the capital adequacy requirement for market risk plays a critical role in ensuring that the regulatory

[23] Banking book represents those assets that are considered for the computation of credit risk for capital purposes.

objective of ensuring adequate reserves to meet losses is met. The definition of capital elements for allowable elements of capital in the computation of the capital adequacy ratio, as with Basel 1 creates the same information asymmetry challenges. In addition, the inclusion of Tier 3 capital further compounds this information asymmetry.

From an accounting perspective, firstly as noted earlier, accounting is not risk based and consequently does not assist or provide any additional information regarding the level of market risk in a bank. However, in case of market risk this is further compounded by the fact that accounting also did not assist with the distinction between assets in the banking book and those in the trading book. As with Basel 1, the lack of international GAAP resulted in a lack of uniformity in the way internationally active banks accounted for their assets and their inclusion in either the banking or the trading book. The same challenges arise for what is considered as eligible capital as with Basel 1, being further compounded by the addition of Tier 3 eligible capital.

As mentioned previously, Basel 2 did not make any fundamental changes to the market risk requirements as outlined in the MRA. However, it did add more detailed requirements for determining trading book assets and this was done to reduce the inherent information asymmetry arising from the trading book definition for measuring market risk.

As with the capital adequacy ratio for credit risk, the analysis demonstrates that for market risk as well the capital adequacy ratio meets the conditions outlined in the heuristic framework for the key performance variable.

3.10 Key Performance Variable - Liquidity Risk

As with the capital adequacy ratio, maintenance of the liquidity ratios creates costs for banks and also are used by the regulators to monitor and motivate banks in the area of liquidity risk management. For the ratios to provide a clear signal to the regulator about the bank's actions concerning liquidity risk management it must for both ratios:

- capture all relevant balance sheet and off-balance-sheet exposures (both assets and liabilities) of the bank at a particular point in time;
- ensure that the assets, for LCR, are liquid and can be disposed without significant loss in value during times of stress;
- ensure that the cash outflows accurately capture the run-off or pay down rates both in times of stress for LCR and over a one-year horizon for NSFR.
- ensure that the cash inflows for measuring ASF, as part of NSFR, are an accurate determination of both the timing and amount of such inflows.

In each of the above area's banks will have a significant information advantage given that firstly the estimation of the forward-looking cash inflows and outflows are dependent on the banks estimates and business models. Consequently, by their very construct banks will possess significant information advantage. In case of LCR a key element of the computation is selecting and determining assets that are first liquid and second which can be disposed without significant loss in value during times of stress. It is not unreasonable to posit that the banks again will have a significant information advantage in any such determination (see section 3.9 on Market Risk). It is the banks that trade these assets across multiple jurisdictions and deal with portfolios of such assets on a day-to-day basis. Activities that provide them with an information

advantage in not only determining which assets are liquid but in also determining their values under stress conditions.

Unlike Basel 1 and 2 and the MRA, for Basel 3 the accounting framework does provide information about the total inventory of assets and liabilities based on which such cash flows can be determined. Since 2005, there had been significant progress in the use of uniform accounting standards in the form of International Financial Reporting Standards (IFRS) across the globe. The key accounting standard for determining the inventory of such assets and liabilities for a bank is IFRS 9 *Financial Instruments* which provides guidance on both when a bank's assets and liabilities need to be recognised on the balance sheet including derivatives, and also on how such exposures are to be measured (IFRS Foundation: IFRS 9 - https://www.ifrs.org/issued-standards/list-of-standards/ifrs-9-financial-instruments/#about). As of the date, approximately 144 countries around the world apply IFRS (IFRS Foundation: Use of IFRS Standards by jurisdiction - https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/#analysis) thereby providing a degree of uniformity and comparability regarding the asset and liability positions of banks use for the measurement of these ratios. In addition, IAS 37 *Provisions, Contingent Liabilities and Contingent Assets*, although not as exhaustive as IFRS 9, provides the much-needed guidance concerning off-balance-sheet exposures.

The analysis demonstrates that although it can be conjectured that the degree of information asymmetry in the liquidity ratios is lower as compared to the capital adequacy ratios, they are however present for the stipulated liquidity ratios. Consequently, as with the capital adequacy ratios for credit and market risk the

liquidity ratios also meet the conditions stipulated in the heuristic framework to be considered as the key performance variable.

3.11 Additional Information Requirements

The aim of this section is to highlight the additional information requirements in key areas that provide evidence towards the veracity of the heuristic framework under consideration. The aim is not to provide a summary or listing of all the requirements in the Basel pronouncements, which are exhaustive.

Basel 1 and all the subsequent BCBS pronouncements address this inherent information asymmetry through the requirement of additional information in different ways. As the analysis will demonstrate although the ways in which this information is captured differs, they all have the same objective – to provide additional information to the regulator to assess whether the computations have been conducted in line with regulatory objectives. The approaches taken by BCBS can be generally grouped into three categories. First by stipulating, the methodology to be used for such computations including key input parameters. Second, where the computation methodology is unspecified by specifying either the inputs or by prescribing limits on the values of the inputs that can be used for such computations. And finally, by requiring quality controls over such computations that need to be implemented to ensure the accuracy and compliance of such computations with regulatory requirements. The common feature in all the above approaches is that they require regular mandatory reporting to the regulator of the information generated.

3.11.1 Basel 1

Section 3.8 analytically analyses the information asymmetry present in the capital adequacy ratio and demonstrates that it arises both from the measurement of RWAs and from what is eligible capital. Consequently, the areas where additional information would be required by Basel 1 would be in the measurement of RWAs and the determination of eligible capital.

The approach taken by Basel 1 is to specify the methodology for computing the RWAs to be used in the capital adequacy computation along with the regular reporting of such computations to regulators. Table 3.1 below sets out the standardised risk weights for assets and off-balance sheet exposures to be used in determining RWAs under Basel 1. Similarly, credit conversion factors were defined for off-balance sheet items.

Table 3.1: Risk Weight Categories (Basel 1)

Risk-weight Categories in Basel 1
0 Percent • Cash • Claims on central government and central banks denominated in national currency and funded in that currency • Other claims on OECD countries, central governments and central banks • Claims collateralised by cash of OECD central government securities or guaranteed by OECD central governments
0, 10, 20 or 50 percent • Claims on domestic public sector entities, excluding central governments, and loans guaranteed by securities issued by such entities
20 Percent • Claims on multilateral development banks and claims guaranteed or collateralised by securities issued by such banks • Claims on, or guaranteed by, banks incorporated in the OECD • Claims on, or guaranteed by, banks incorporated in countries outside the OECD with residual maturity of up to one year • Claims on non-domestic OECD public-sector entities, excluding central government and claims on guaranteed securities issues by such entities • Cash items in process of collection
50 Percent • Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented.
100 Percent • Claims on private sector • Claims on banks incorporated outside the OECD with a residual maturity of over one year • Claims on central governments outside the OECD (unless denominated and funded in national currency) • Claims on commercial companies owned by the public sector • Premises, plant and equipment and other fixed assets • Real estate and other investments • Capital instruments issued by other banks (unless deducted from capital) • All other assets

(BCBS: *International Convergence Of Capital Measurement And Capital Standards*, July 1988, Annex 2)

In case of RWAs the specification of the risk weights reduces information asymmetry by providing additional information on how they have been computed. The standardisation of risk weights ensures consistency and transparency of application that can be reviewed by the regulator - for example all mortgage exposures have to be assigned a 50% risk weight. In addition, it also provides additional information on the bank's actions concerning credit risk management. The additional information requirement requires banks to report the breakup of the banks' lending activities by sector thereby informing the regulator as to whether the bank has actually lent to sectors that are considered to be high or low risk a judgement that the regulator can make because of this information requirement.

What could be considered as eligible capital in Basel 1 is outlined in Table 3.2 below. The core or tier 1 capital consisted of the universally recognised elements of shareholders equity and retained earnings. Other elements such as revaluation reserves, subordinated debt, general loan loss reserves and other hybrid instruments (instruments exhibiting characteristics of both equity and debt such as convertible bonds) were designated as Tier 2 capital.

Table 3.2: Definition of Capital (Basel 1)

Definition of Capital in Basel 1
Capital Elements
Tier 1 • Paid up share capital / common stock • Disclosed reserves
Tier 2 • Undisclosed reserves • Asset revaluation reserves • General provisions / general loan loss reserves • Hybrid (debt / equity) capital instruments • Subordinated debt
Limits and Restrictions • Total of tier 2 elements limited to a maximum of 100 percent of tier 1 elements • Subordinated term debt limited to a maximum of 50 percent of tier 1 elements • Loan-loss reserves limited to a maximum of 1.25 percentage points • Asset revaluation reserves that take the form of latent gains on unrealised securities subject to a discount of 55 percent

(BCBS: *International Convergence Of Capital Measurement And Capital Standards*, July 1988 – Annex 1)

The definition of capital elements, reduce information asymmetry by providing additional information about what has been considered as eligible capital in the computation of the capital adequacy ratio. The regulatory objective in stipulating a capital requirement is to ensure that banks maintain a level of loss absorbing capacity through the availability of funds that share in such losses. The information requirement about capital elements as required by Basel 1 provides this information to the regulator. It provides information about the bank's actions in the way it has financed its operations and the composition of such financing i.e., whether or not it has actually financed itself through instruments that have a loss absorbing capacity

such as equity or through other means that don't for example deposits that are prone to withdrawal in times of losses.

Information on RWAs and eligible capital needed to be disclosed by banks complying with the Basel 1 capital adequacy requirements on an ongoing basis, the frequency of which was determined based on jurisdictional specifications and represent the mandatory disclosure requirements arising from Basel 1.

3.11.2 Market Risk Amendment

Section 3.9 analytically analyses the information asymmetry present in the capital adequacy ratio for market risk. The heuristic framework, posits that additional information would be required by the MRA in the following areas:

- the measurement of market risk exposure; and
- determination of tier 3 capital as information regarding tier 1 and tier 2 capital was already being provided by the additional information requirements in Basel 1.

The MRA introduces Tier 3 capital, which consists of short-term subordinated debt. Given the challenges in ensuring that banks only consider instruments that are loss absorbing and as with Basel 1 the MRA provides specific definitions for what can be considered as Tier 3 capital. The MRA stipulates that a bank can consider short-term subordinated debt as eligible Tier 3 capital only if such instruments were, if circumstances demanded, be capable of becoming part of a bank's permanent capital and thus be available to absorb losses in the event of insolvency (BCBS: *Amendment To The Capital Accord To Incorporate Market Risks*, January 1996). These requirements ensure that a bank only consider instruments with loss absorbing

capacity as Tier 3 capital. In addition, it also provided information about the bank's actions in the manner in which it has financed its operations i.e. whether or not it has actually financed its market risk operations using instruments that can and will absorb losses in the event such losses crystallise.

Regarding the computation of market risk exposure, the MRA requires information about the specific methodologies to be provided. For example, for standardised approaches for interest rate risk, along lines similar to Basel 1, the MRA specified the risk weights to be used (see Appendix 3). Again, for the computation of general market risk, under the standardised approach it specified the methodology and the parameters to be used in the computations. For example, for the maturity method the MRA provided the specifics around bucketing debt securities into maturity buckets and the risk weights to be used for each bucket to arrive at the capital requirement (see Appendix 4). These specifications, as with Basel 1, provide additional information about the measure of market risk exposure. It reduces information asymmetry by ensuring banks assign the same degree of risk to its market positions and use consistent methodology for measuring market risk for such positions. In addition, the breakup by type of exposure and type of risk provides additional information on the bank’s actions concerning its trading positions.

The approach taken for internal model-based approaches was different as under these approaches the methodology used was the banks own internal models for market risk. Consequently, the approach taken was to specify both qualitative controls on the use of such models along with the specification of certain quantitative limits on inputs, which were outlined sections B.1 to B.6 of the MRA.

Firstly, all internal models used had to obtain regulatory approval which required the banks to submit to regulators all details of such models for their evaluation thereby alleviating the information advantage of the banks in this regard. To ensure continued working of such models along regulatory requirements the MRA in section B.2 stipulated qualitative criteria like the presence of internal controls and internal audit requirements, whilst B5 set out stress test requirements and B6 external validation requirements. The MRA required the results of such qualitative controls to be reported to regulators on an ongoing basis.

B.3 and B.4 provide the quantitative risk specifications for the models. B.3 stipulated the minimum market risk factors that a bank needed to incorporate in their models by risk category. For example, for interest rate risk it requires the modelling of yield curves by estimating zero coupon yields based on different maturity segments whilst for exchange rates it requires the incorporation of risk factors corresponding to the individual foreign currencies in which the bank's positions are denominated. Similarly risk factors were specified for equity price and commodity price risks. B.4 on the other hand provides the quantitative standards for use in internal models. It specifies for example, that VaR needs to be computed daily using a 99th percentile one-tailed confidence interval. It also stipulated that the historical observation period would be constrained to a minimum length of one year.

As can be seen from the above, as with the standardised approaches the MRA also requires substantial additional information for internal model-based approaches to address information asymmetry. The stipulation of qualitative requirements for the first time introduces information requirements on the quality of implementation

thereby providing information on the Agent's actions in managing their market risk exposures.

As with Basel 1, the above information needed to be disclosed by banks complying with the Basel MRA requirements on an ongoing basis, the frequency of which was determined based on jurisdictional specifications and are the mandatory disclosure requirements arising from the MRA.

3.11.3 Basel 2

For the same reasons as Basel 1, in case of Basel 2 the heuristic framework would posit that additional information would be required concerning the measurement of RWAs and eligible capital. Since Basel 2 did not make any major changes to the definition of eligible capital, the information requirements specified in Basel 1 continued to apply. However, with the change in measurement methodology for the computation of RWAs incorporating CRM and non-traditional credit instruments, Basel 2 imposed significant additional information requirements in these areas.

The key change brought in by Basel 2 in the standardised approach was the use of external credit ratings for determining the level of credit risk. Basel 2 requires that all external ratings used for the purposes of computing RWAs meet the following six criteria:

- Objectivity: The methodology for assigning credit assessments must be rigorous, systematic, and subject to some form of validation based on historical experience. Moreover, assessments must be subject to ongoing review and responsive to changes in financial condition. Before being recognised by supervisors, an assessment methodology for each market

segment, including rigorous backtesting, must have been established for at least one year and preferably three years.

- Independence: All credit rating agencies should be independent and should not be subject to political or economic pressures that may influence the rating. The assessment process should be as free as possible from any constraints that could arise in situations where the composition of the board of directors or the shareholder structure of the assessment institution may be seen as creating a conflict of interest.
- International access/Transparency: The assessments should be available to both domestic and foreign institutions with legitimate interests and at equivalent terms. In addition, the general methodology used should be publicly available.
- Disclosure: The credit rating agency should disclose the following information: its assessment methodologies, including the definition of default, the time horizon, and the meaning of each rating; the actual default rates experienced in each assessment category; and the transitions of the assessments, e.g. the likelihood of AA ratings becoming A over time.
- Resources: The credit rating agency should have sufficient resources to carry out high quality credit assessments. These resources should allow for substantial ongoing contact with senior and operational levels within the entities assessed in order to add value to the credit assessments. Such assessments should be based on methodologies combining qualitative and quantitative approaches.
- Credibility: To some extent, credibility is derived from the criteria above. In addition, the reliance on a credit rating agency's external credit assessments by

> independent parties (investors, insurers, trading partners) is evidence of the credibility of the assessments.

(BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework*, June 2004, paragraph 91)

The above criterions provide the necessary information to regulators about the quality of the ratings provided to ensure that they adequately reflect credit risk. The interesting point to note is that the above requirements do not impose any additional disclosure requirements on banks, but instead do so on rating agencies providing the ratings. For banks using the standardised approach the statement of compliance provides the necessary information to regulators as to the quality of the ratings used for the computation of RWAs.

The inclusion of a wide range of CRM activities to reduce credit risk in Basel 2 also resulted in several additional information requirements for such activities. For example, for specific CRM strategies, such as the use of collateral, it specified a number of additional factors that needed to be complied with and disclosed by banks. It required banks to have clear policies to ensure segregation of collateral and on procedures regarding disposal of collateral that needed to be disclosed to regulators before any capital reduction could be obtained for credit risk purposes. Finally, it provided a list of collateral that were eligible for inclusion in the computation of RWA's (see Appendix 5 for details). The above information enables regulators to ensure that only collateral that is capable of being realised and provide an economic hedge against losses are included in the computation of capital adequacy.

As with the MRA, the IRB approaches rely on sophisticated modelling for determining the PD, LDG, EAD and M - the key risk parameters for determining

RWAs. Given the inherent information advantage of banks in determining these parameters Basel 2 requires additional information for each of the parameters depending on their use. It does this by first requiring all exposures to be classified into one of the following five categories:

- Corporate which is further divided into five sub-classes;
- Sovereign;
- Bank;
- Retail which is further divided into three sub-classes;
- Equity.

For each of the categories it provided specific methodology guidance for determining each of the parameters. As an example, Appendix 6 provides the requirements for determining LGD under the Advanced Approach.

Basel 2 also prescribed stringent model validation procedures that need to be complied with to ensure that regulators had the necessary information regarding whether the models used to determine RWA's were providing a reliable and accurate estimate of credit losses. Details of the validation procedures are outlined in Appendix 7.

As mentioned at the outset the aim of this section is not to list all the requirements in Basel 2, which are indeed exhaustive, but to focus on outlining the key additional information requirements as posited by the proposition under consideration. The above analysis shows that Basel 2 does require additional information on key performance variables as with Basel 1 and the MRA. The above information needs to

be to maintained and disclosed by banks to regulators in their filings on an ongoing basis and represent the mandatory disclosure requirements.

3.11.4 Basel 3

Basel 3, for the first-time, introduced global liquidity requirements for banks whilst strengthening the requirements for credit risk, further adding to the requirements in Basel 2. As these have already been extensively evaluated this section only focusses on the additional information requirements on liquidity risk.

The key challenge in determining whether the LCR meets regulatory objectives is ensuring that the assets considered in determining the ratio are indeed high-quality liquid assets and which do not lose value during times of stress. To ensure the above Basel 3 stipulates several qualifying requirements for such assets:

"(i) Fundamental characteristics

- Low risk: assets that are less risky tend to have higher liquidity. High credit standing of the issuer and a low degree of subordination increase an asset's liquidity. Low duration, low legal risk, low inflation risk and denomination in a convertible currency with low foreign exchange risk all enhance an asset's liquidity.
- Ease and certainty of valuation: an asset's liquidity increases if market participants are more likely to agree on its valuation. Assets with more standardised, homogenous and simple structures tend to be more fungible, promoting liquidity. The pricing formula of a high-quality liquid asset must be easy to calculate and not depend on strong assumptions. The inputs into the pricing formula must also be publicly

available. In practice, this should rule out the inclusion of most structured or exotic products.

- Low correlation with risky assets: the stock of HQLA should not be subject to wrong-way (highly correlated) risk. For example, assets issued by financial institutions are more likely to be illiquid in times of liquidity stress in the banking sector.
- Listed on a developed and recognised exchange: being listed increases an asset's transparency.

(ii) Market-related characteristics

- Active and sizable market: the asset should have active outright sale or repo markets at all times.
    - There should be historical evidence of market breadth and market depth. This could be demonstrated by low bid-ask spreads, high trading volumes, and a large and diverse number of market participants. Diversity of market participants reduces market concentration and increases the reliability of the liquidity in the market.
    - There should be robust market infrastructure in place. The presence of multiple committed market makers increases liquidity as quotes will most likely be available for buying or selling HQLA.
- Low volatility: Assets whose prices remain relatively stable and are less prone to sharp price declines over time will have a lower probability of triggering forced sales to meet liquidity requirements. Volatility of traded prices and spreads are simple proxy measures of

market volatility. There should be historical evidence of relative stability of market terms (e.g., prices and haircuts) and volumes during stressed periods.

- Flight to quality: historically, the market has shown tendencies to move into these types of assets in a systemic crisis. The correlation between proxies of market liquidity and banking system stress is one simple measure that could be used."

(BCBS: *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools,* January 2013, paragraph 24)

To obtain additional information about the valuations of such assets under stressed conditions, Basel 3 further divide such assets into two categories – Level 1 and Level 2 assets. Level 1 assets are the most liquid and can be included without any reduction in value or haircuts as compared to their market value. Basel 3 subsequently specifies the types of assets that can be considered in the different levels. Level 1 assets for example include central bank reserves, government securities to mention a few. Level 2 assets are those assets that can be considered as HQLA but only with a haircut of 15%, as they are expected to lose a certain portion of their value during stress periods. In addition, for the purposes of LCR, the total amount of Level 2 assets can be no more than 40% of the total stock of such assets after all haircuts. As with Level 1 assets, Basel 3 goes on to specify the assets that can be considered as Level 2 assets. In addition, to ensure the portfolio of assets indeed consists of liquid assets that can be used to provide funds under stress conditions, Basel 3 also stipulates certain operational information requirements. It requires banks to monetise a proportion of the HQLA through either sale or repo transactions on a regular basis. This

information demonstrates to the regulator that the selection of assets used for the purposes of computing LCR indeed represent liquid assets thereby providing further information on the portfolio of assets used for the purposes of determining LCR.

In determining the cash outflows for LCR, Basel 3 requires information based on various classes of financial assets and liabilities that determine these cash flows and specifically provides run-off rates for each class. For example, for retail deposits or demand deposits, a key source of funding, it specifies the run-off rates for 'stable' and 'less stable' demand deposits that can be considered in the computation of LCR. In this manner Basel 3 goes on to specify the cash flow expectations for various classes of assets and liabilities. An illustration showing a summary LCR computation providing the details of the classes and the run-off rates as provided in Basel 3 is reproduced in Appendix 8.

As with the LCR, for the NSFR information asymmetry again arises from the determination of the cash flows used to measure a) available amount of stable funding (ASF) and b) required amount of stable funding (RSF). ASF is measured based on the broad characteristics of the relative stability of an institution's funding sources: the contractual maturity of its liabilities and the differences in the propensity of different types of funding providers to withdraw their funding. The amount of ASF is calculated by first assigning the carrying value of an institution's capital and liabilities to one of five categories. The amount assigned to each category is then multiplied by an ASF factor, and the total ASF is the sum of the weighted amounts. Carrying value represents the amount at which a liability or equity instrument is recorded before the application of any regulatory deductions, filters or other adjustments.

RSF is also measured based on the broad characteristics of the liquidity risk profile of an institution's assets and OBS exposures. The amount of RSF is calculated by first assigning the carrying value of an institution's assets to the categories listed in Basel 3. The amount assigned to each category is then multiplied by its associated required stable funding (RSF) factor, and the total RSF is the sum of the weighted amounts added to the amount of OBS activity again multiplied by its associated RSF factor. Appendix 9 provides a summary of the RSF factors by class (BCBS: *Basel III: the net stable funding ratio*, October 2014). The factors assigned to various types of assets are intended to approximate the amount of a particular asset that would have to be funded either because it will be rolled over or because it could not be monetised through sale or used as collateral in a secured borrowing transaction over the course of one year without significant expense. Similarly, the factors used for ASF are based on the approximate amounts at which liabilities will provide the necessary funding for the bank's operations i.e. amounts required to ensure that the bank has stable funding. Basel 3 also stipulates banks are expected to meet the LCR and NSFR requirements on an ongoing basis and these ratios should be reported at least quarterly and represent mandatory disclosure requirements for banks.

As previously stated, the aim of this section is not to list all the additional information requirements in BCBS pronouncements which are indeed exhaustive, but to focus on determining whether such pronouncements require the provision of additional information on the key performance variable as posited by the heuristic framework. The above analysis shows that Basel 1 to 3 require additional information on the key performance variables that go towards reducing the inherent information asymmetry in such measures thereby providing support for the heuristic framework.

3.12 Choice of Key Performance Variable

Analysis of Basel requirements show that the key performance variable of choice for credit and market risks is the capital adequacy ratio. It is a measure that combines information from both the asset and capital elements to arrive at the ratio. In recent years, in Basel 3, the other measure used as the key performance variable is the liquidity ratio for liquidity risk. The liquidity ratio again uses information from the asset and liability/capital positions of banks to arrive at the ratio.

There exists a significant body of literature analyzing the information provided by the capital adequacy ratio. Literature has considered extensively the information provided by the capital adequacy ratio in the context of its ability to predict bank failure, one of the key regulatory objectives. Literature has also evaluated alternative measures that could be used for the purposes of bank regulation from the perspective whether such alternative measures are better able to predict bank failure as compared to the capital adequacy ratio.

Estrella, Park & Persistiani, (2000) find that the leverage ratio and the gross revenue ratio, as defined by them, predict bank failure as well as the more complex risk-weighted ratios over a time horizon of one to two years. They define leverage ratio as Tier 1 capital divided by the total tangible assets; gross revenue ratio as Tier 1 capital divided by total interest and non-interest income before deduction of any expense and risk weighted capital ratio as the ratio of Tier 1 capital to risk weighted assets. However, they find that risk weighted capital ratios tend to perform better over longer time horizons and that all the three ratios are strongly informative about subsequent failures.

Acharya, Engel & Richardson, (2012) develop an alternative measure of capital requirements based on the systemic risk of a financial institution – the measure of expected capital shortfall of a firm in a crisis. This in a single measure, in their view, captures many of the characteristics considered important for systemic risk. In their view a firm's expected capital shortfall considers most notably the co-movement of a financial firm's assets with the aggregate financial sector asset movement in a crisis and therefore represents a better measure for regulatory purposes. Chernykh & Cole, (2015) test the predictive power of several alternative measures of capital adequacy in identifying US bank failures during the financial crisis. They identify an unconventional ratio – the non-performing asset coverage ratio which significantly outperforms Basle-based ratios including Tier 1 ratio, the total capital ratio and the leverage ratio.

Borio & Lowe, (2002) argue that it is feasible to predict with reasonable levels of confidence the likelihood of banking crises developing by analyzing the development of certain key vulnerabilities associated with the onset of a banking crisis. Based on stylised descriptions of the origins of banking crises they explore combinations of composite indicators where a signal of pending distress is selectively on, if and only if, the thresholds of the corresponding composite indicators are simultaneously exceeded. Their analysis suggests that it is possible to construct simple composite indicators of banking crises that can be used to assess the risk of future crises instead of relying on a capital adequacy ratio framework for the same. Hong, Huang & Wu, (2014) examine the potential links between the Basel 3 liquidity risk measures and bank failures. The find that both the LCR and the NSFR have limited effects on bank failures.

The analysis of literature show that studies to date have considered the adequacy of the capital adequacy ratio as a metric in its ability to predict bank failures. The analysis in this section addresses a different question regarding the use of the capital adequacy ratio. Instead of evaluating whether such a ratio is a good leading indicator of bank failure, it considers whether its selection by regulators as the key performance variable represents an optimal choice from an information asymmetry perspective thereby adding to literature in the area. The heuristic framework argues that regulators will aim to reduce information cost in any regulatory contract. Consequently, one way of reducing information cost is by selecting a key performance variable that represents the lowest level of information cost by contract design. The aim of this section is to analytically evaluate the choice of the capital adequacy ratio by regulators from this perspective. It does so by comparing from an information cost perspective the choice of capital adequacy ratio as the key performance variable with other forms of contract design that use a key performance variable/variables with lower information asymmetry and therefore information cost, an aspect not considered in literature to date.

As established previously information cost arises, amongst other sources, from information asymmetry in the key performance variable. This information asymmetry arises from both elements of the capital adequacy ratio computation – the measure of risk (e.g., RWAs for credit risk) and the capital element. Consequently, a key performance variable that is based only on a single element i.e., either a measure of asset risk or a measure of capital will by design reduce information cost and should be the variable that is chosen by regulators for the purposes of bank regulation instead of the capital adequacy ratio. As the subsequent analysis will demonstrate such measures, although having lower information costs, fail either to provide the right incentive

effects or create incentive effects that are contrary to regulatory objectives. In addition, regulatory contract design based only on either a risk-based or capital-based measure can challenge the reason for the existence of financial intermediation in an economy.

3.12.1 Asset Based Regulatory Contract Design

It is certainly possible to achieve regulatory objectives by using a regulatory contract design that uses a measure of asset risk as the key performance variable. Such a contract, instead of stipulating minimum capital adequacy ratio could instead stipulate a maximum threshold for the risk in banking assets. Such a threshold could be stipulated exactly in the same manner as risk weighted assets in the Basel framework or in some other manner. As previously noted, the capital adequacy ratio is composed of two components: a measure of RWA and a measure of eligible capital with each measure contributing to the total information asymmetry. A key performance variable that is based on only one of the components will therefore invariably entail a lower degree of information asymmetry as compared to the capital adequacy ratio. Consequently, for example any regulatory contract design using a measure of asset risk as the key performance variable, will by contract design entail a lower level of information asymmetry and consequently a lower information cost as compared to a contract that uses the capital adequacy ratio as the key performance variable. Such forms of regulatory contracts are seen in practice in other industries for example insurance and pensions, where regulatory contracts control the investment or the asset side of the entity's balance sheet.

Regulation only encompassing a measure of risk arising from a bank’s assets or asset-based regulation tend to create incentive effects on both a bank’s investment and funding decisions. One of the objectives of any regulatory contract design is to

provide the firm with the right incentives i.e. incentives that are compatible with regulatory objectives. This is stylistically captured in the heuristic framework by using the incentive constraint. Regulation that is based only on a measure of the riskiness of a bank's assets removes this incentive mechanism by contract design. By removing the benefits associated with risk reduction through lower capital costs, asset-based regulation removes the incentive for banks to actively manage and reduce risks. On the contrary it creates incentives for banks to operate at the maximum possible risk level as allowed under regulation to maximise shareholder returns.

Asset based regulation also implies that banks don't have to maintain a required capital level and consequently would be free to finance themselves in a manner that again optimizes shareholder value. This causes a unique problem in banking due to the presence of deposit insurance schemes – schemes that are not priced based on the riskiness of a bank's assets. In most jurisdictions there exist such schemes that protect depositors from bank losses. In the presence of information asymmetry Chan, Greenbaum & Thakor, (1992) show that it is generally impossible to implement an incentive compatible, fairly priced deposit insurance scheme. Merton, (1977) and Pyle, (1984) studied the adverse incentive effects of flat rate deposit insurance schemes. Using option-pricing techniques, they show that banks to maximise the value to equity holders will attempt to maximise the option value of the deposit insurance by increasing leverage and/or asset risk thereby increasing probability of failure – an incentive that is contrary to that of banking regulation. Giammarino, Lewis, & Sappington, (1993) show that in the presence of information asymmetries between bank and regulator, a deposit insurance scheme that is socially optimal in conjunction with an optimal risk based capital requirement can only be achieved by imposing restrictions on lending to address the adverse incentive effects. This adverse

incentive effect is also confirmed by empirical literature. Thies & Gerlowski, (1989) and Wheelock, (1992) find that for the US banking sector risk-taking and probability of failure are increasing in deposit insurance. Demirgüç-Kunt & Detragiache, (2000) find in a sample of 61 countries over a period from 1980 to 1997, deposit insurance significantly increased the risk of a banking crisis. Consequently, an asset based regulatory contract design will exacerbate the incentive to take on leverage and risk thereby increasing the probability of bank failure - an incentive mechanism that goes contrary to regulatory objectives.

Another form of asset-based regulation that has been considered is to create what are called narrow banks, banks that are only allowed to invest in low-risk or riskless assets. This achieves the regulatory objective of avoiding bank failures but has other implications. Restricting bank activities to allow investment in only low-risk assets mitigates against bank failure and also the need for deposit insurance arising again from low risk of bank failures. However, it prevents banks from performing one of its key services - that of monitoring investments and creating liquidity in credit markets (Diamond, 1984). The other drawback of narrow banking is that it prevents financial intermediaries from exploiting gains that arise from combined deposit taking and lending activities extended through credit lines and commitments (Kashyap, Rajan & Stein, 2002). Also, as shown by Diamond & Dybvig, (1986) and Wallace, (1996) it is possible that new firms will move in to fill the vacuum left by banks thereby creating the same challenges to financial stability but arising from another group of institutions in the economy.

It is also worth noting that the sectors for which such a form of regulation exists do not have access to subsidized funding in the form of deposits and access to deposit insurance schemes, such as insurance and pensions.

3.12.2 Capital/Liability Based Regulatory Contract Design

Regulatory contract design using only capital and/or liability restrictions is also possible. From an information cost perspective this is more efficient as it removes the information asymmetry arising from the measurement of risk in a bank's assets.

One alternative is to consider banks that are funded only by equity. By regulatory design such banks are prevented from raising deposits and this ensures that bank runs are prevented. Also, banks funded entirely by equity would by design have loss absorbing capacity in a crisis. As noted by, amongst others, Benink & Whilborg, (2002), shareholder capital provides a buffer against unexpected losses causing bankruptcy - one of the reasons for the focus on capital in Basel regulations. Benink & Whilborg, (2002) show that equity creates incentives for management to manage risk appropriately and equity capital of sufficient magnitude signals to lenders that the bank will not be taken advantage of. Berger, Herring & Szego, (1995) show that even in the absence of regulatory capital requirements, markets will require banks to hold capital to provide protection against asymmetric information and financial distress. Therefore, the narrow bank approach creates the necessary incentives, albeit through market mechanisms, for the bank to manage its risks.

However, such restrictions on funding will prevent banks from providing liquidity insurance to depositors – one of the key activities of financial intermediation (Bryant, 1980; Diamond & Dybvig, 1983). In addition, such a proposal would also be expensive from an efficiency perspective. Jacklin, (1987) show that under certain

conditions deposits dominate equity contracts in insuring consumers against random shocks to their intertemporal preferences for consumption, thereby making the notion of equity funded banks inefficient as compared to one's funded through both deposits and equity[24]. In addition, such a form or regulatory contract design will impose additional costs on banks as equity funding is more expensive as compared to deposit funding. From a Principal – Agent perspective, one of the key incentives for participating in regulation is the ability to access low-cost funding in the form of deposits (captured in a stylised manner in the heuristic framework using a participation constraint). Consequently, banks funded only through equity will be denied this benefit and therefore will bring into question whether the contract that only allows for equity funding would be possible given a binding participation constraint.

Continuing with liability focused regulatory contract designs, it is also possible to contemplate regulation based on borrowing limits where the key performance variable is a form of gearing ratio that limits the amount of bank borrowing or leverage. From an information cost perspective, any key performance variable based on this form of regulatory contract design, such as the gearing ratio, will have lower information costs as compared to the capital adequacy ratio as it again eliminates the need for a measure of riskiness of bank assets.

Firstly, it is debatable whether such a measure provides firstly, any information concerning bank failures and in case of the liquidity ratio (a form of gearing ratio)

[24] Calomiris & Kahn, (1991) and Diamond & Rajan, (2001) instead consider the importance of demand deposit funding for banks as depositors can monitor banks by withdrawing their deposits if they observe unacceptable policies and procedures by banks. With this focus they contend that the threat of a bank run is beneficial and deposit insurance a hindrance. However, if such depositor monitoring is noisy, then deposit insurance may be valuable. See Carletti (1999) for the problems with depositors' monitoring when they do not have perfect information about the bank's future prospects.

Hong, Huang & Wu, (2014) find that liquidity ratios have little effect on bank failures. In addition, by ignoring the risk arising from bank assets it can create ambiguous incentive effects for the bank. As banks are free to take on any type of risk any such uniform gearing requirement would be too high for safe assets but low for risky assets. Consequently, it makes economic sense for banks to deploy in high-risk assets to maximise returns. By breaking the link between risk and cost of regulation, banks could be tempted to substitute lower risk assets that are costly in terms of regulatory capital with high-risk assets that are relatively cheaper.

The overall impact of such a regulatory approach on a banks likelihood of failure will depend on two effects and is possible that such a measure will distort incentives and thereby increase the chances of banks failure although the effect is ambiguous. The incentive effect depends on the relative magnitude of the limited liability effect (risk reduction) and the assets substitution effect (risk increase) (Bichsel & Bloom, 2005). As the regulatory contract design removes any incentive for banks to manage their risks arising from investments it can bring about a risk increase. Given that regulators are generally risk averse (see section 2.8), it is not surprising that such a measure has always been frowned on by regulatory parties and has only been used in conjunction with other measures. Therefore, it is unlikely that such an approach or contract design would achieve regulatory objectives irrespective of its lower information cost.

The above analysis shows that alternative forms of regulatory contract design can indeed reduce information costs borne by the regulator. Consequently, mandatory disclosures as argued in the previous section is *a* solution and not *the* solution for reducing information costs.

In the context of banking, the analysis provides an information cost based economic rationale for the choice of the capital adequacy ratio as the key performance variable even though such a choice may not be optimal from an information cost perspective. The analysis shows that whilst other forms of contract design can be favourable to those using the capital adequacy ratio as the key performance variable, such alternative contract designs have other limitations that prevent their use in banking. Such designs either create incentives that are contrary to regulatory objectives and thereby violate the incentive constraint in the Principal Agent framework or violate the participation constraint by making participation in regulation expensive for entities by constraining the benefits of regulation. Consequently, the optimal regulatory contract needs to encompass both assets and liabilities which is achieved by the capital adequacy ratio. The capital adequacy ratio encompasses the riskiness of a bank's asset in conjunction with the amount of capital available to a bank to absorb losses arising from such assets and makes more capital or less risky assets substitutes and thereby achieving the necessary focus on both aspects of a bank's activity. In addition, the use of the ratio creates the necessary incentive mechanism by ascribing a capital cost on banks linked to the riskiness of their assets, which is again an objective of any contract design as posited by the heuristic framework.

3.13 Conclusion

This section tests the validity of the heuristic framework outlined in section 2.0 for the existence of mandatory disclosure requirements in an economy. Using BCBS regulatory pronouncements it finds support for the heuristic framework that regulatory contracts will stipulate a key performance variable that is a noisy signal of Agent's actions. The analysis also provides evidence to support the stipulation that

regulators will include requirements in the regulatory contract to provide additional information on the key performance variable that shed light on the Agent's actions. The research evaluates banking regulations over three decades and finds support for the propositions in the heuristic framework in all key BCBS pronouncements to date (Basel 1, MRA, Basel 2 and Basel 3) thereby demonstrating that the propositions in the heuristic framework apply irrespective of the drivers and circumstances behind such regulations.

In addition, the analysis of the evolution of Basel 2 provides analytical support for the applicability of the constraints used in the heuristic framework. The heuristic framework argues that although the aim of the optimal incentive contract is to optimise regulatory objectives, this can only be done in the presence of two constraints - the participation constraint and the incentive constraint (see section 2.8). Analysis of the drivers behind Basel 2 show that one of the key drivers behind Basle 2 was the persistent criticism of the methodology used in Basel 1 for measuring risk weighted assets. The key driver behind the change was not a change in the objectives or the information needs of regulators, which remained the same, but the constraints discussed in the heuristic framework. One possible explanation for this pressure from banks to change the methodology for computing risk weighted assets was to reduce the level of capital required and thereby the cost of compliance. The blunt approach used in Basel 1, whereby little distinction was made between different credit qualities, resulted in banks holding more capital than would be required under a mechanism that made such distinction possible. Consequently, from the point of view of the heuristic framework it can be argued that the cost of compliance led banks to evaluate both their participation in the regulatory environment (captured by the participation constraint in the heuristic framework) and the cost they had to bear in modifying their

actions to comply with regulatory objectives (captured by the incentive constraint in the heuristic framework). In other words, the optimal incentive contract was no longer optimal as it was failing to satisfy the constraints; more specifically the participation and the incentive constraints, leading to a revision in the optimal incentive contract as seen with Basel 2. In addition, the section also provides an explanation for the use of the capital adequacy ratio in banking regulation from an information cost perspective thereby adding to literature in the area.

CHAPTER FOUR: INFORMATION CONTENT AND PILLAR 3 DISCLOSURES

4.1 Introduction

Section 2.0, using a Principal Agent framework, posits a heuristic framework for the existence of mandatory disclosures in an economy. The heuristic framework establishes that the Principal or the regulator bears a cost, and this cost can be considered as an information cost. This information cost depends on the degree of informativeness of the contract regarding the Agent's actions and increasing the informativeness of Agent's actions through the contract can reduce this cost. Mandatory disclosures are a method of reducing this information cost borne by regulators. Section 3.0 tests the validity of the explanation provided in Section 2.0 using Basel regulatory requirements and finds support for the framework. Continuing with the theme of mandatory disclosures this Section empirically evaluates, in the context of banking, the information content of mandatory disclosures.

The heuristic framework presented in Section 2.0 is premised upon mandatory disclosures providing information to regulators or such disclosures having information content. Mandatory disclosures required by banking regulation will be said to have information content if such disclosures lead to a change in the regulator's assessment of the future distribution of survival probabilities of banks such that there is a change in the equilibrium value of the key performance variable for a bank – in case of Basel regulatory requirements the capital adequacy ratio. For obvious reasons, it is difficult to empirically evaluate the information content of such regulatory disclosures as firstly such disclosures are usually confidential and secondly there is no observable market or data on changes in capital adequacy ratio requirements for

individual banks. Consequently, an empirical evaluation of the information content of such disclosures will need to be addressed using alternatives that can provide an indication of the information content of such disclosures and one that can be subject to empirical methods of evaluation. One such alternative is to evaluate the information content of Pillar 3 disclosures from the perspective of market participants which forms the basis of the 'market discipline' principle in BCBS regulatory requirements.

The BCBS (Basel Committee on Banking Supervision) uses a 'three pillars' concept in banking regulation – Pillar 1 minimum capital requirements, Pillar 2 supervisory review process, and Pillar 3 market discipline, which was introduced by Basel II in 2004. Pillar 3 complements Pillar 1 and Pillar 2 and aims "*to promote market discipline through regulatory disclosure requirements. These requirements enable market participants to access key information relating to a bank's regulatory capital and risk exposures to increase transparency and confidence about a bank's exposure to risk and the overall adequacy of its regulatory capital*" (BCBS: *Standards Revised Pillar 3 disclosure requirements*, January 2015, pp - 1.).

In broad terms market discipline is the mechanism by which market participant's monitor and discipline, through price and quantity responses, excessive risk-taking by banks. More specifically, given the importance to firms' of being able to access capital and the cost of such capital, market discipline refers to the role external stakeholders play in shaping a firm's risk-taking behaviour by demanding higher risk premiums on the funds they provide or by reducing the amount of funding they provide to the firms outright. The operation of the principle of market discipline is premised on two factors: a) that markets incorporate bank risk in their pricing

decisions and b) the risk disclosures provide this information to markets ie such disclosures have information content.

Pillar 3 disclosures provide a comprehensive dataset of information on the bank's capital and risk positions to markets which are based on the information banks are required to provide to regulators confidentially under regulatory requirements[25]. Given that Pillar 3 disclosures are based on regulatory disclosure requirements, provide similar if not the same information and are public disclosures for the market, evaluation of the information content of such disclosures using a market perspective can provide an indication of the information content from a regulatory perspective. In addition, considering Pillar 3 disclosures also has the advantage that the study can shed light on the efficacy of the principle of market discipline, one of the Pillars of banking supervision today.

However, any inference about the information content from a regulatory perspective will based on a proxy and therefore needs to be approached with caution. A deeper analysis of the Pillar 3 requirements reveals that the commonality of information between regulatory disclosure or reporting requirements and those of Pillar 3 is not always present. For example, for banks in the European Union regulatory reporting is done through FINREP and COREP reporting templates, the former being for financial information and the latter used for information concerning a bank's risk and capital positions. Pillar 3 disclosures represent the regulatory information the banks must make public and include information on capital and risk positions. A comparison of

[25] Meyer clearly mentions this objective in his comments on market discipline where he states 'For example, a policy improving disclosures of bank risk exposures and internal capital assessments could potentially improve the market's ability to assess risks.'(See Speech by Mr Laurence H Meyer, a member of the Board of Governors of the US Federal Reserve System, at the conference on Reforming Bank Capital Standards in New York on 14 June 1999).

FINREP returns with annual reports and COREP returns when Pillar 3 disclosures reveal that whilst for FINREP returns around two thirds of the data provided have significant overlap with the data provided in annual reports, albeit with a higher degree of granularity in FINREP returns, the same cannot be said for COREP returns. Substantial amounts of information included in COREP returns are not disclosed under the Pillar 3 requirements and for many areas COREP contains a far greater breadth of metrics than Pillar 3 reports. In other cases, such as market risk there is an overlap in scope at the summary level between COREP and Pillar 3, but there is far greater level of granularity available in COREP (Calver & Owladi, 2017).

This limitation of Pillar 3 disclosures naturally restricts the efficacy of the proxy, but it also raises a question about the information content of such disclosures from a market's perspective. In view of the complexity of the information provided in such disclosures and their limitations (often justifiable) the question that necessarily arises is that do Pillar 3 disclosures have the necessary information content for them to achieve their goal of market discipline[26]. However, by considering the proxy the research will address the critical question – do Pillar 3 disclosures, that form the cornerstone of market discipline regulatory requirements, provide information from a market perspective? - an area that has not been evaluated in literature to date to a great extent.

4.2 Market Discipline

Disclosures promote transparency which allows financial investors to more accurately perceive and react to bank risk. If a bank has especially high risk and this risk is

[26] The other question to also consider is whether there is a trade-off between simplicity and understandability of disclosures and adding to the complexity of the same through the addition of granular details.

observable, market participants are likely to demand higher risk premiums and vice versa. As previously noted, the underlying assumption is that for disclosures to be effective in achieving market discipline, they should have information content for investors.

Literature reflects evidence that investor can assess financial firm's true condition quite well (see reviews by Berger, 1991; Flannery, 1998; Gilbert, 1990). Work by Barth, Caprio & Levine, (2004), Beck, Demirgüç-Kunt, & Levine, (2006), and Fonseca & González, (2010) show that information disclosure is regarded as one of the most effective incentives for market discipline to take place.

The search for market discipline in debt prices focussed on the contemporaneous relationship between bank risk indicators and subordinated debt yields or large deposit rates. These studies showed that the issuance and secondary market risk premiums on traded subordinated notes and debentures are correlated with accounting measures of risk, asset portfolio composition, credit-agency or regulatory ratings, and probability of undercapitalization or of failure (Krishnan, Ritchken, & Thomson, 2003; Sironi, 2003; Jagtiani, Kaufman, & Lemieux, 2002; Evanoff & Wall, 2001; Jagtiani & Lemieux, 2001; Morgan & Stiroh, 2001). The analysis of the rates on large uninsured Certificates of Deposit (CD) yields mixed results. Hall et al. (2002) focus on banks that have a satisfactory regulatory rating and document a positive relation between CD yields and measures of bank risk. On the other hand, Jagtiani & Lemieux, (2001) find no evidence of market discipline in the uninsured CD market for a small sample of bank holding companies (BHCs) with failing subsidiaries. Furfine, (2001) searches for evidence of market discipline in the overnight federal funds market. He argues that the overnight federal funds market would provide the

strongest evidence of market discipline given sophisticated counterparties and the expectation of significant losses arising from large uncollateralised transactions in this market. Consistent with this expectation, the author documents that interest rates paid on federal funds transactions reflect differences in credit risk across borrowers. The above studies show that investors take cognizance of risk information, and that there is a link between risk information and debt prices.

Nier & Bauman, (2006) point out that as emphasised by Berger, (1991) and Bliss & Flannery, (2002), the "previous literature has concentrated primarily on whether the market prices [of bank liabilities] react adversely to information about risk" (Berger, 1991). However, this does not reveal the degree to which market discipline is effective as an incentive scheme, i.e., to what degree does the existence of market discipline influence bank behaviour? They address this question and examine empirically the hypothesis that market discipline is effective in providing incentives for banks to limit their risk of default by holding capital buffers against adverse outcomes in portfolio risk. Using a sample of banks from 32 countries they document a positive association between capital and risk after controlling for government guarantees.

Nier & Bauman, (2006) argue that the conditions needed for market discipline to be effective involve three factors. First, the effectiveness of market discipline will depend on the extent of the government safety net (support). Explicit or implicit government guarantees may limit the responsiveness of the yield on bank liabilities to changes in the bank's risk of default and hence limit the incentive effects of market discipline. Second, effectiveness will depend on the degree to which the bank is financed by uninsured liabilities (funding). A larger proportion of uninsured liabilities

will make it more costly for the bank to increase its risk of default. And third, it will depend on the extent of observability of the bank's risk choices (disclosure). Banks that disclose more information will be subject to more market discipline and have a greater incentive to limit their risk of default. The hypothesis they test is whether the factors that are meant to increase the strength of market discipline are also associated banks limiting their default risk.

Neir & Baumann, (2006) for the purposes of measuring the strength of disclosures construct three different measures of disclosure, two of which are simple binary measures and the third is an index of disclosure which is constructed by measuring the amount of information available in the bank's published accounts as represented in the Fitch IBCA BankScope database. They find that the presence of government safety nets reduces capital buffers held by banks. On the other hand, uninsured liabilities and disclosures create incentives for banks to limit their risks of insolvency by choosing a larger capital buffer for a given risk. Whilst their results point to the effectiveness of market discipline mechanisms in general, they also find that when banks enjoy a high degree of government support the effect of disclosure and uninsured funding on market discipline is hampered.

Whilst the above studies reviewed the effectiveness of market discipline and the conditions for their operation in a holistic manner, they did not consider the role of specific information included in such disclosures in the process. Araujo & Leyshon, (2017) point out that the indices used in the above studies do not have specific weights for different disclosure requirements or safety net components. Each component is measured as a dummy variable with a value of 1if disclosure occurs and 0 if it does not. The greater the value of the index, the more market discipline

incentives. They contend that it is likely that some components have more weight than others in enhancing market discipline. For example, it is unlikely that the disclosure of a bank's governance and risk management framework has the same impact on market discipline as does the public disclosure of off-balance sheet items. Instead of combining all the variables into one index, they analyse each disclosure component individually to explore the possibility that the disclosure requirements may have varying impacts on market discipline. They aim to answer the question 'which specific information disclosure requirements influence financial investors to discipline banks, and which do not?' In the analysis of each individual information disclosure requirement, they find that nearly all the disclosure requirements in the study reduce or do not influence market discipline practices. For example, they find that information disclosure requirements which require the disclosure of a bank's governance and risk management framework appear to significantly mitigate market discipline.

Akpomiemie & Ojah, (2021) find that the European Union's *Banking Recovery and Resolution Directive* (BRRD) has improved market discipline in the European bank market for unsecured debt. They conclude that their results are consistent with the principle of market discipline ie debt holders actively monitor banks. They find that bank bonds subject to BRRD bail-in carry a 13-basis points bail-in premium in terms of the yield spread, driven by low capitalization. Banks that respond to market pressure by de-risking their portfolios are able to secure cheaper funding for instruments that are subject to bail-in.

The review of literature in the area demonstrates that studies evaluating the benefits of information disclosure have done so by considering a disclosure or private monitoring

index. These indices serve as a proxy for the incentives for financial investors to enact market discipline (Barth, Caprio, & Levine, 2004; Beck, Demirgüç-Kunt, & Levine, 2006; Nier & Baumann, 2006). The components of the indices typically include the specific country level disclosure requirements, bank-level financial data, and bank safety net features, most commonly deposit insurance schemes. For example, Furfine, (2001) uses a bank's profitability, measured by its return on assets, a bank's loan quality measured by loans past due more than 90 days and its non-accruing loans as a proportion of total loans as proxies for credit risk, whilst Neir & Baumann, (2006) use three different indices to measure the strength of the disclosures. Second, whilst the studies have shown the presence of information content in aggregate Araujo & Leyshon, (2017) question the information content of each component when considered individually.

The existing literature extensively evaluates the relationship between disclosure of bank risk parameters and market reaction to the same empirically. As outlined in section 4.3, Pillar 3 disclosures comprehensively changed the nature, content, and complexity of risk disclosures. The above studies do not address the specific enhanced and improved disclosures in Pillar 3 and are based on disclosure indices composed of the disparate risk information as provided by banks prior to the introduction of Pillar 3 disclosure requirements. Section 4.3 also documents that the literature specifically focussing on Pillar 3 is limited.

4.3 Pillar 3 Disclosures

Pillar 3 disclosure requirements were initially introduced in 2004 with the aim of increasing observability around a bank's risk positions for investors by significantly increasing both the quality and quantity of risk disclosure and by bringing the

disparate measures of risk in one single report. Pillar 3 disclosure requirements provide a comprehensive dataset of information on the bank's capital position to markets which are based on the information banks are required to provide to regulators confidentially under regulatory requirements. It should be noted that such an increase in the disclosure burden is not costless and has significantly added to amount and complexity of information that is currently available to investors and at a substantial cost to the banks. For example, the Pillar 3 report of HSBC for December 2020 runs into 105 pages (*HSBC Holdings plc Pillar 3 Disclosures at 31 December 2020*).

Whilst the requirement to provide detailed risk information in a comprehensive and cogent manner was introduced by the Pillar 3 disclosure requirements, elements of a bank’s risk position had been available to investors previously albeit on a fragmented and piecemeal basis. Risk disclosures were either required or recommended by various jurisdictions. The Institute of Chartered Accountants in England and Wales (ICAEW) published in 1998 a discussion paper 'Financial Reporting of Risk Proposals for a Statement of Business Risk'. The discussion paper explored risk reporting and concluded that UK companies should voluntarily disclose risk information but in a separate segment within their annual reports. Canadian Institute of Chartered Accountants (CICA) in their guidance on Management's Discussion and Analysis also addressed risk disclosures. Risk disclosure discussions also took place in the USA. For example, the American Accounting Association/ Financial Accounting Standards Board (AAA/FASB) 1997 conference incorporated a risk disclosure session for participants. Concurrent to the above the BCBS also issued a number of papers on the disclosure of risk information in the banking sector. The BCBS 1998 paper 'Enhancing Bank Transparency' recommended banks disclose six

categories of information within their annual reports. Significantly two of these information categories are risk exposures, and risk management strategies and practices (Linsley, Shrives & Crumpton, 2006). As the analysis above shows such disclosures were not uniform across jurisdictions, neither did they provide the level of detail as is done under Pillar 3 disclosures and last, they were not mandatory and were recommendatory in nature.

In a nutshell, Pillar 3 disclosures require banks to provide information both from a qualitative and a quantitative standpoint on the following areas: i) Scope of application of the capital adequacy framework; ii) Capital structure and capital adequacy; iii) Credit risk; iv) Securitisation; v) Market risk; vi) Equities; vii) Interest rate risk in the banking book; and viii) Operational risk. The disclosures require an overview of the bank's risk management, its prudential metrics, and its risk-weighted assets (RWAs) that allows users to assess a bank's position "at a glance" for each risk type (credit risk, market risk, interest rate risk in the banking book, operational risk, leverage risk and liquidity risk) and its components (BCBS: *Standards Revised Pillar 3 disclosure requirements*, January 2015).

Using credit risk as an example Pillar 3 requires banks to disclose:

- The main characteristics and elements of credit risk management (business model and credit risk profile, organisation and functions involved in credit risk management, risk management reporting) focusing in particular on for example criteria and approach used for defining credit risk management policy and for setting credit risk limits;
- Provide a comprehensive picture of the credit quality of a bank’s (on- and off-balance sheet) assets;

- Identify the changes in a bank's stock of defaulted exposures, the flows between non-defaulted and defaulted exposure categories and reductions in the stock of defaulted exposures due to write-offs.
- Supplement the quantitative templates with information on the credit quality of a bank's assets which include quantitative disclosures on:
    - Breakdown of exposures by geographical areas, industry and residual maturity;
    - Amounts of impaired exposures (according to the definition used by the bank for accounting purposes) and related allowances and write-offs, broken down by geographical areas and industry;
    - Ageing analysis of accounting past-due exposures;
    - Breakdown of restructured exposures between impaired and not impaired exposures.
    - Provide qualitative information on the mitigation of credit risk and disclose the extent of use of credit risk mitigation techniques.
- In case of use of IRB models provide main parameters used for the calculation of capital requirements for IRB models including:
    - definitions, methods and data for estimation and validation of PD (e.g., how PDs are estimated for low default portfolios; if there are regulatory floors; the drivers for differences observed between PD and actual default rates at least for the last three periods); and where applicable:
    - LGD (e.g., methods to calculate downturn LGD; how LGDs are estimated for low default portfolios; the time lapse between the default event and the closure of the exposure);

    - credit conversion factors, including assumptions employed in the derivation of these variables;
- Illustrate the effect of credit derivatives on the IRB approach capital requirements' calculations.
- Present a flow statement explaining variations in the credit risk-weighted assets (RWA) determined under an IRB approach.
- Provide backtesting data to validate the reliability of PD calculations.

(BCBS: *Standards Revised Pillar 3 disclosure requirements*, January 2015).

Similar disclosure is required for both market risk and operational risk, albeit to a lesser degree for operational risk.

Although market discipline was included in the regulatory framework under Basel II from 2004, the financial crisis showed the deficiencies of such disclosures. The Basel Committee on Banking Supervision concluded that the existing disclosure framework had '*failed to promote the identification of a bank's material risks and did not provide sufficient, and sufficiently comparable, information to enable market participants to assess a bank's overall capital adequacy and to compare it with its peers….*' (BCBS: *Standards Revised Pillar 3 disclosure requirements*, January 2015, pp - 1). In response to this a revised Basel Pillar 3 framework was published in 2015 increasing the disclosure requirements for banks concerning various risks and only fully implemented across jurisdictions through 2017 (Calver & Owladi, 2017).

Pillar 3 reporting differs from banks' financial reporting along several dimensions. First, unlike financial reporting, prepared by banks according to the adopted accounting standards, Pillar 3 reporting is regulated by the Basel Committee and

follows the Basel Rules. Second, unlike the financial reporting that covers a bank's financial information of accounting measurement and disclosure, the information disclosed in Pillar 3 is related to a bank's risk exposure and risk management, referred to as "risk reporting." Third, banks may publish their Pillar 3 report in a standalone document or in a discrete section of banks' financial reporting, with a frequency varying between quarterly, semi-annual, or annual frequency, which is specified by jurisdictional requirements. Pillar 3 information is not mandatorily audited in all jurisdictions but must be subject to internal review and control.

Literature on the impact of Pillar 3 disclosures is limited and have been primarily focussed on equity markets. Sabiwalsky, (2012) analyse the marginal contribution of Pillar 3 data to the quality of equity volatility forecasts for individual banks and find that Pillar 3 information allows for a better-than-random ranking of banks according to their risk, but Pillar 3 data does not help reduce volatility forecast error magnitude. Niessen-Ruenzi, Parwada, & Ruenzi, (2015) study the effect of Pillar 3 disclosures on equity analyst research and find that such disclosures alter the informational advantages of equity analysts in Australia. They find that in Australia equity analysts seem to have gained value relevant information that was hitherto only preserve of banks and regulators. Parwada, Ruenzi, & Sahgal, (2013) in their study find that the higher frequency of Pillar 3 reporting in Australia as compared to other countries to be useful to investors and as they react positively to reports of an increase in capital and negatively to a decrease in credit quality. They also find that investors ignore changes in the risk-weighted assets of a bank but pay attention to total credit exposure. In another study Parwada, Lau, & Ruenzi, (2015) using a sample of the 54 largest banks in Australia, Canada, India, Singapore, South Africa and UK, find that,

with the exception of South Africa and Singapore, there is a reduction in time-waited bid-ask spreads post the implementation of Pillar 3 reporting.

The review of literature in the area shows that there is limited evidence of the impact of Pillar 3 disclosures on equity markets. However, literature to date has not evaluated the impact of such disclosures on bond markets which form the backbone of the principle of market discipline (see section 4.4).

4.4 Objectives

Pillar 3 disclosures not only standardise the previously fragmented and disparate disclosures on a bank's risk position but also significantly enhance, expand, and amplify the same. Given the stated aims of BCBS and the support in literature on the information content of risk disclosures of banks and its importance for market discipline, it is the expectation that Pillar 3 disclosures have information content. However, as the analysis of literature shows there is paucity of evidence for the same. Previous studies have evaluated the information content of risk disclosures that were significantly different from Pillar 3 disclosures in both detail and complexity. In addition, the studies demonstrating the contemporaneous relationship between an index of bank risk indicators and debt yields or large deposit rates inherently suffer from the limitation that they do not necessarily demonstrate causality. Also, literature has not addressed the question of information content of Pillar 3 disclosures in the context of bond markets.

Pillar 3 disclosures are focussed on a bank's risk and capital positions and therefore are more relevant for bond investors given their focus on evaluating the risks associated with a fixed or predetermined stream of bond cash flows and not on the growth of free cash flows, as is the focus of equity investors. In addition there is

support in literature for bond markets being the target for such disclosures and policy proposals in the area to date have focused on debt market information as the information content of equity prices is often considered unrelated to a regulator's conservative goals since equity, as a call option, gains value when asset risk rises (Flannery, 2001)[27]. Most market discipline proposals[28] consider bond spreads as the lynchpin given that they reflect the bank's risk and the governance controls provided by debt covenants. Consequently, when evaluating the information content of Pillar 3 disclosures, bond markets provide more relevant information as compared to equity markets given the commonality of objectives between bond investors and regulators – an area not addressed in literature to date.

This research aims to fill this gap in literature by evaluating the information content of Pillar 3 disclosures using bond market data employing event study methodology. Given the principle of market discipline such a study will shed light on the efficacy of market discipline which is the aim of Pillar 3 disclosure requirements. Based on the analysis it can reasonably be argued that the evaluation of information content of Pillar 3 disclosures based on changes in bond prices using event study methodology is the more appropriate method for studying the information content of such disclosures. It focusses on the market segment for which these disclosures are intended and by using an event study methodology alleviates to an extent the challenges of causality that previous studies suffer from.

[27] Saunders, (2001) emphasizes both bond and equity prices reflect similar information about a firm's condition. In addition, it has also been argued that since equity and bond investors value risk differently, regulators may learn more from a combination of equity and bond returns than they can learn from either price change alone.

[28] For example, mandatory issue of unsubordinated debt by banks which are most susceptible to investor action given lack of any protection against default in the form of subordination (Meyer, 1999).

The research aims to provide evidence on a question that will inform regulators and market participants on the efficacy of Pillar 3 disclosures and has the following policy implication: whether Pillar 3 disclosures that are provided at a significant cost by banks meet their objective of providing information to markets to enable markets to perform the function of market discipline as envisaged by regulators. The research will also provide indications as to whether or not the information provided in Pillar 3 disclosures have information content from a regulatory perspective. However, as indicated in section 4.1, any such inference has to approached with caution given the inherent limitations of using Pillar 3 disclosures as a proxy.

4.5 Event Study

The rationale behind the Pillar 3 requirements of Basel II/III is that the provision of additional information to markets will enable investors to make the necessary investment decisions based on the risk position of a bank. It can therefore be argued that given that markets are informationally semi-efficient the provision of this new information by banks will have an impact on asset prices if such disclosures provide new information to markets or have information content. The empirical evaluation of whether new information has an impact on asset prices is well established in literature and such studies use what can be loosely termed as ‘event study methodologies’. The event study methodology has, in fact, become the standard method of measuring security price reaction to some announcement or event (Binder, 1998; Maul & Schiereck, 2016). Event studies evaluate whether a particular announcement or disclosure has an impact on asset prices. If such announcements or disclosures have an impact on asset prices, bond holding returns for the purposes of this research, it is

inferred that the disclosure or event provides new information to markets as evidenced by the change in asset prices.

Beaver, (1968) in his seminal paper on the topic establishes the methodology and definitions that have subsequently become standard for such studies in the area of accounting and finance. He notes that the issue under consideration is of a positive rather than of a normative nature – that is, the question of concern in such studies is not whether investors and/or other participants should react to the information being disclosed but rather whether investors and/or other participants do react to the information. Consequently, this obviates the need for an expectations model for investors and/or other participants. Henri Theil, (1967) in *Economics and Information Theory* defines information as a change in expectations about the outcome of an event. In the context of earnings reports, they are said to have information content information content information content if it leads to a change in the investors' assessment of the probability distribution of future returns (or prices) such that there is a change in the equilibrium value of the current market price.

Landsman, Maydew & Thornock, (2011) using the above methodology study the information content of the IFRS earnings announcements following mandatory adoption of IFRSs. Their findings suggest that information content increased in 16 countries that mandated adoption of IFRSs relative to 11 that maintained domestic accounting standards, providing empirical evidence on the information content of mandatory disclosures required by accounting standards.

While equity market event studies are legion, the bond market event studies represent a much smaller set. Historically this has partially been due to lack of quality data and also due to the need to use numerous databases simultaneously to capture the

information necessary for such event studies (Ederington, Guan & Yang, (2015) hereafter EGY). However, the availability of TRACE (Trade Reporting and Compliance Engine) data makes bond market event studies more feasible. Literature on bond market event studies to date predominantly deal with the information content of rating announcements by studying the behaviour of bond prices in the period surrounding such announcements. The review of literature below is focussed on the technical aspects of such studies given their relevance for the topic under consideration.

Weinstein, (1977) study the effect of rating announcements on bond prices and find that ratings announcements, especially rating downgrades, have information content from a market perspective. The study uses monthly holding period returns and excess return calculation is done by subtracting the return on a matched rating class bond portfolio from the return of the bond. Whilst the study arrives at its conclusion using t-statistics it acknowledges the limitations of using a such measure due to heteroscedasticity of bond returns. Hand, Holthausen & Leftwich, (1992) study the information content of rating announcements on stock and bond prices and arrive at similar conclusions. For the purposes of their study, they use daily price data from bond markets with excess return being measured as the difference between the bond return and the return on a long term treasury bond. The t-statistic is again used the measure for arriving at its conclusions. Whilst the use of daily price data is an improvement as compared to Weinstein, (1977) the excess return computation fails to control for variations in term of default premiums since only a long-term riskless bond is used as the benchmark for all bonds, regardless of maturity. Also, the study fails to address the limitations of using the t-statistic as in the case on Weinstein, (1977).

Steiner & Heinke, (2001) conduct event studies to determine the impact of credit rating announcements of Eurobond prices. The study uses daily price data and uses both parametric and non-parametric tests statistics in arriving at conclusions similar to those arrived at by Weinstein, (1977) and Hand, Holthausen & Leftwich, (1992). Excess bond returns are computed using a maturity matched benchmark bond. The study in addition to using the normal t-test also uses the Wilcoxon's sign rank test, the t-test developed by Brown & Warner, (1985) and the Corrado, (1989) rank sum test. The use of test statistics other than the t-test critically corrects for the heteroscedasticity of bond returns. However, the study does not use standardised bond returns to correct for misspecification of bond return distributions. As noted by EGY standardisation of returns leads a substantial increase in the power of the t-test and the signed-rank test. EGY also note that as at the date of their study of bond event studies, no such study had implemented the standardisation of bond returns.

The investigation of information content of ratings announcements has also been extended to credit default swap markets by Hull, Predescu & White, (2004), again using even study methodology. They extend the literature in the area by studying the relationship between credit default swap spreads, bond yields and ratings announcements. The key advantage of using credit default swap spreads is that no adjustment is required for computing excess bond returns as they are already credit spreads. They find evidence that the Credit Default Swap market anticipates negative credit events.

Shi et al. (2020) using the event study method, empirically examine the explanatory power of the signalling, free cash flow, and wealth transfer hypotheses based on the reaction of the stock market, bond market, and firm abnormal returns to the private

placement announcement. Their results show that the stock market has a negative reaction toward private placement, whereas the bond market has a positive reaction. Their results also show that the scale of private placement is correlated with the severity of the market reaction. Rebucci, Hartley & Jiménez, (2021) use event study methodology to study the impact of quantitative easing announcements to mitigate the economic impacts of the COVID-19 outbreak on bond yields. They conduct an event study of 30 quantitative easing (QE) announcements made by 21 central banks on daily government bond yields and bilateral US dollar exchange rates in March and April 2020, in the midst of the global financial turmoil triggered by the COVID-19 outbreak. They find that in emerging markets, the QE impact on bond yields is much stronger and its transmission to exchange rates is qualitatively different than in advanced economies.

The review of literature in the area demonstrates that event study methodology is a well-established tool in literature for determining the information content of disclosures from a market perspective. In addition, the review of literature also demonstrates the evolution and refinement of the techniques used in such studies especially concerning the determination of excess returns, the need for standardisation of such returns and the appropriateness of the statistical methods used. Also, a point of note is that as of date none of the bond market event studies reviewed implement standardisation of returns as recommended by EGY.

This study adopts an event study methodology to evaluate the information content of Pillar 3 disclosures using bond market data. The focus, once again, is on abnormal returns following disclosure of new information. As a first step the event under investigation is determined and the reaction of asset prices around that event is

studied (the event window). The aim of an event study is to determine whether asset prices exhibit abnormal returns as a result or the announcement or disclosure. Abnormal returns are determined by subtracting the return on a benchmark bond from the return on the bond under investigation. The objective is to ensure that the return on the benchmark bond captures normal market activity, and the excess or abnormal return represents the return arising from the presence of additional information on the firm that is not applicable for the market as a whole. The process attempts to isolate the return on the bond arising solely from the presence of new information. A similar approach is followed by bond event studies in literature.

Existing studies have used numerous ways to calculate bond returns and abnormal bond returns. In their seminal paper on bond event studies Bessembinder et al. (2009) (hereafter BKMX) establish that given the idiosyncrasies of bond markets care must be taken in determining the appropriate price and model used in the calculation of returns and outline various methods to address such idiosyncrasies. EGY refine the recommendations in BKMX to further enhance the power of the statistical tests used in such studies. The review of bond event study methodologies by Maul & Schiereck, (2016) establish that efficacy of the recommendations outlined in BKMX and EGY. This research follows the recommendations in BKMX and EGY in designing the methodology for the study and is outlined hereafter.

In any event study the following parameters play a critical role:

- The choice of the Event date which represents the date when the information under consideration is first made available to the markets. For the purposes of this study this is the date banks publish their Pillar 3 reports and is denoted as the *t date* (the event date);

- Event Horizon – the number of days prior to and after the event date that is considered for computing abnormal returns;
- Computation of bond and benchmark bond returns;
- Standardisation of such returns; and finally
- Computation of abnormal bond returns by deducting the standardised return on benchmark bonds from the standardised return on bonds;

The sections below outline in detail the implementation of the above steps for this study.

4.5.1 Data

Whilst bond event studies have used either monthly or daily data on bond prices from different sources, BKMX demonstrate that using daily bond price data instead of monthly data significantly increases the power of the test. They also conclude that among the bond databases examined, TRACE data yield the most powerful event test statistics. Accordingly, for the purposes of this study all daily bond price data is obtained from TRACE. Bond attributes, such as coupon, maturity and ratings, are obtained from the Eikon Refinitive database. Following BKMX and EGY the sample is restricted to non-convertible, non-puttable bonds as the return on such bonds are not impacted by the optionality present in convertible and puttable bonds that impact their price and consequently the computed returns. For similar reasons, all perpetual bonds and bonds with complex interest rate structures such step-up or step-down clauses are also eliminated, and it is ensured that the selected bonds are not in default. The last condition did not result in any bonds being eliminated from the sample.

The TRACE data following the suggestions of BKMX is cleaned by dropping canceled, corrected, and reversed trades as they do not represent actual market transactions. The following trades are eliminated (1) ‘‘when issued’’ or ‘‘special price’’ trades, (2) trades with special sale conditions attached and (3) irregular trades as indicated by TRACE’s ‘‘as of’’ flag.

4.5.2 Choice of Banks and Event Date

Given the relative illiquidity of bond markets as compared to equity markets, to ensure that there is an adequate sample of bonds available for the purposes of study it is essential to pick a sample of banks that would have an amount of bonds outstanding and trading in markets. In addition, to ensure that such disclosures are followed by investors in bond markets it is also essential that the selected banks had the necessary market presence to entail such a following. Consequently, for the purposes of the study the top 100 global banks by size, as per the Standard & Poors listing of top banks for 2018, were selected as they are expected to meet the above conditions. From the above list of 100 banks the following were removed:

- Banks in a jurisdiction that did not require compliance with Basel norms as such banks would not be reporting Pillar 3 information; or
- Banks that were not listed as of 1st January 2018 as they are not required to disclose information to the markets.

This left a sample of 94 banks across multiple jurisdictions that report Pillar 3 information. A further 44 banks were eliminated primarily due to the lack of any trading data for the period under consideration. This arose due to the following reasons:

- The banks had very few US listed bonds which were not traded; or
- The banks either did not have any listed bonds or any bonds listed on the US exchanges; or
- No Pillar 3 data was published by these banks for the year under consideration due to mergers or acquisitions or some other regulatory action.

This left a sample of 50 banks, and these are listed in Appendix 10.

As noted in section 4.3 the revised Pillar 3 disclosure requirements were only fully implemented across jurisdictions through 2017. Consequently, the study considers the impact of the revised Pillar 3 disclosure requirements on bond prices for the year 2018, the first full year of implementation of the revised requirements. For the selected banks, the quarterly/bi-annual reporting dates for the year 2018 were obtained from Eikon. The date selected as the announcement date of Pillar 3 results by banks was the earlier of the two dates: i) date of the press/analyst conference by the Bank's management announcing the results and ii) publication of the results. In most instances these two dates match but on occasion they were different. In the event they are different the earlier date is taken as the event date to ensure that the measurement of abnormal returns is based on the period when the information is first made available to the market. This is designated as the *t date*. Most banks in the sample report Pillar 3 information quarterly, whilst some provide this information bi-annually. Each reporting is considered as an event for the purposes of the study and consequently for banks reporting quarterly there are four events included in the study for 2018 and for those reporting bi-annually there are two events included in the study. For the purposes of categorisation, all reporting's in the first quarter of 2018 is

considered as Event Horizon 1 or EH 1 and subsequent reporting's as EH 2, EH 3 and EH 4 accordingly.

In the final sample there are 180 events[29] covering 50 banks for all event horizons.

4.5.3 Event Horizon

The event horizon is the number of day's prior and after the *t date* (the event date) that are considered for the purposes of evaluating bond returns. The choice of the event horizon has several consequences on the results as expanding the event horizon usually implies a higher number of eligible prices or trades of bonds that can be considered. Given the paucity of bond trade data this can significantly increase the test power. Increasing the event horizon beyond the minimum of 1 day either side of *t date* i.e., from (t-1) to (t+1) also has the advantage of bringing in trade observations on other days even if the bond trades on both (t-1) and (t+1) days (EGY).

However, expanding the event horizon also increases the risk of contamination i.e., the chances of bond prices in the wider event horizon being affected by news other than the event under consideration, in this case Pillar 3 disclosures. One of the key challenges of any event study is to ensure that the prices under study, in this case bond returns, are not impacted by information other than that that is the subject of the study or suffer from 'contamination'. Such 'contamination' can arise when information different from the one that is the subject of the study and has the potential

[29] Theoretically there should be 200 events for 50 banks assuming all banks report quarterly. However, only 180 events were observed due to the following reasons: i) some banks report results only half yearly as per jurisdictional requirements; ii) certain banks due to corporate action only provided annual data and iii) in certain instances there was no trading data for the reporting event. The breakdown of events by event horizon is as follows:

EH1	EH2	EH3	EH4	Total
46	45	45	44	180

to impact market expectations is made available in the same event window. For this study, the selected event is contemporaneous with banks releasing their financial results to markets along with Pillar 3 information. As previously argued in section 4.3 the information presented in Pillar 3 is different from that presented in the financial statements. Pillar 3 disclosures provide information on a bank's risk position and is tailored for bond investors, and this is one of reasons for selecting the bond market for the purposes of this study. In addition, Pillar 3 also provides information that is included in the financial statements but 'repackaged' to better suit bond investors for example risk positions are reconciled with amounts reported in the financial statements (see also discussion on FINREP and COREP in section 4.1). Consequently, given the design and focus of Pillar 3 on bond investors and the inclusion of the relevant financial statement information in such disclosures, it can be argued that the risk of contamination arising from the reporting of financial results is low when considering bond market data as the relevant information for such investors is contained in Pillar 3 reports.

EGY consider the alternative of basing return calculations on average trade prices over several trading days before and after the event. If a bond trades on both days $(t-1)$ and $(t-2)$, the aim would be to include both but with the observed trades on day $(t-1)$ with greater weight since they are closer to the event and thus have less non-event noise. For instance, for a $(t-2, t+2)$ event window, the bond returns are computed as follows: average of $(t-1, t+1)$, $(t-1, t+2)$, $(t-2, t+1)$, and $(t-2, t+2)$ or as many of the four as are calculable. Suppose for instance that the bond trades on three of the four days: $(t-2)$, $(t-1)$, and $(t+1)$, but not $(t+2)$. In this case, the composite return, $(t-2, t+2)$ is an average of $(t-1, t+1)$ and $(t-2, t+1)$. In summary, they find that as compared with tests based on trades on

just days $(t-1)$ and $(t+1)$, expanding the sample to utilize trades on days $(t-2)$ and $(t+2)$ leads to an increase in test power even when there are trades on days $(t-1)$ and $(t+1)$. While trades further from the event have more noise than those close to the event, they tend to average out some of the noise in individual trade observations. They also find that the increase in power of the test as the window is expanded beyond three days before and after is slight. The methodology used in this study follows the methodology applied by EGY and considers an event horizon of 2 days[30] before and after the *t date* i.e., from $(t-2)$ to $(t+2)$.

The same event horizon is used for benchmark bonds (see section 4.5.6).

4.5.4 Calculating Raw Bond Returns

The raw bond returns from day $(t-2)$ to day $(t+2)$ are calculated as follows:

$$R(t-2,t+2)_n = \frac{P_{n,t+2} - P_{n,t-2}}{P_{n,t-2}}$$

where $P_{n,t}$ is the trade-size-weighted average ‘‘clean’’ price of bond n on day t. Based on EGY the returns are calculated from the average price on day $(t-2)$ to the average price on day $(t+2)$ since announcements may occur before, during, or after trading on day (t). Accordingly, the following returns are calculated:

a) from $(t-2)$ to $(t+2)$ or a 4-day period;

b) from $(t-2)$ to $(t+1)$ and from $(t-1)$ to $(t+2)$or a 3-day period; and

c) from $(t-1)$ to $(t+1)$ or a 2-day holding period.

[30] Only trading days were considered for the purposes of the study thereby eliminating all weekends and non-trading days in the year.

The above method ignores accrued interest on the bonds as it uses 'clean' prices and both BKMX and EGY demonstrate that ignoring accrued interest or using clean prices makes little difference to the power of the tests used to test the null hypothesis of zero abnormal returns.

Since a bond can trade numerous times in a day, the average daily price of the bond or $P_{n,t}$ is the weighted average price of all trades for that bond on that day. BKMX show that calculating bond returns from average daily trade prices where each transaction price is weighted by trade size yields the best test results when using TRACE data. EGY explore two methodologies for weighting the bond prices: i) based on quantity traded i.e. trade size and ii) based on square root of the quantity traded i.e. square root of trade size. Weighting by quantity traded gives large trades more weight. Since large trades have lower bid-ask spreads and may represent trades by better-informed investors, it would seem desirable to give such trades a higher weight. However, given that such a weighting scheme gives a trade of 10,000 bonds a weight 100 times that of a trade of 100 bonds, the second weighting scheme, which compensates for this bias, is also implemented by EGY. This study uses both weighting schemes and the results considered separately in the tests[31].

For the purposes of the study a total of 162,612 returns were computed covering 180 events. It should be noted that the above is the number of returns which involves trades of the same bond over two dates[32]. Consequently, at a minimum the study

[31] The same process is followed for determining the returns on benchmark bonds.

[32] As an example, the total number of trades considered in the study for HSBC across all event horizons was 4,259 and their break-up by event horizon was as follows:

EH1	EH2	EH3	EH4	Total
1,286	935	1,142	896	4,259

considers data from over 325,000 bond trades covering all the event horizons. This does not include the trades considered over the non-event period which were used for the purposes of standardisation as outlined below or the trades used to determine benchmark returns.

4.5.5 Standardisation of Returns

One of the key challenges faced by all bond market event studies is ensuring the correct specification of tests used to evaluate the impact of the event under consideration. As the review of literature shows, initially the only test used was the t-test and this suffered from certain drawbacks. BKMX report that the abnormal return variance is higher for speculative grade bonds than for investment grade bonds and the prices of long-term bonds are more variable than those of short-term notes. In addition, return volatility rises as the time-to-maturity lengthens and the rating falls and varies over time. Since the t-test assumes bond returns are identically distributed, failure to control for the heteroscedasticity results in mis-specified t-tests. The solution proposed by EGY to control for this heteroskedasticity is to standardise each bond's return by an estimated standard deviation for that bond's returns and base the event study test statistics on standardised returns – a procedure that is reasonably common in equity market event studies. They report that the low t-test power documented in BKMX is primarily due to this violation of the homoscedasticity assumption. Critically they find that standardisation each bond's event window return by its return volatility reduces heteroscedasticity which leads to a substantial increase in the power of not only the t-test but also the non-parametric signed-rank test.

The standard deviation of raw returns, following EGY, is estimated using observed prices from $(t-45)$to $(t-3)$ and from (t + 3) to (t + 45), a period that does not

overlap the event horizon (non-event horizon). The Standardised Returns (SRR) are calculated by dividing the raw return ($R(t-1,t+1)_n$) by the standard deviation of raw returns over $(t-45, t-3)$ and $(t+3, t+45)$ periods. The SRR is computed using both weighting schemes outlined in section 4.5.4 i.e., based on quantity and the square root of quantity.

As noted in section 4.5.3 the study considers an event horizon of 2 days before and after the *t date* i.e., from $(t-2)$ to $(t+2)$. In calculating standardised returns over $(t-1, t+1)$, the raw return over the $(t-1, t+1)$ window is divided by the standard deviation of 2-day returns. In calculating standardised returns over the $(t-2, t+1)$, the raw return over the $(t-2, t+1)$ window is divided by the standard deviation of 3-day returns. Since the standard deviation of 3-day returns exceed that of 2-day returns, this effectively means that the trades on day $(t-2)$receive a lower weight than those on day $(t-1)$in calculating this composite return. This ensures that trades that are closer to the event and thus have less non-event noise get greater weight.

EGY winsorize SRR to reduce the impact of outliers at 5 percent. For the purposes of this study standard deviations are calculated with and without winsorization and the results considered separately.

The same process is followed for determining the standard deviations of benchmark returns (see section 4.5.6).

4.5.6 Calculation of Benchmark Returns

BKMX recommend calculating abnormal bond returns using value-weighted rating/maturity benchmarks. Following BKMX, EGY for the purposes of calculating

the returns on benchmark portfolio utilize 24 benchmark portfolios: six rating classes (Aaa and Aa, A, Baa, Ba, B, and below B) and four maturity groupings (1 to 3 years, 3+ to 5 years, 5+ to 10 years, and over 10 years). EGY uses Moody's rating to assign bonds to portfolios if available. If Standard & Poor's (S&P) rates the bond and Moody's does not, S&P's rating is used.

A similar methodology is followed for the purposes of this study for creating the benchmark portfolio i.e., based on matching rating and maturity. However, this is done with a higher degree of granularity to improve the accuracy of reported results. Literature uses long term issuer credit ratings for the purposes of creating the benchmark portfolios and they represent the overall credit risk of the issuing institution rather than the credit risk of the specific instrument i.e., the bond in this case.

For an estimate of the credit risk of a specific bond issued by a bank the alternative is to consider the 'issue' rating for that specific bond instead of the 'issuer' rating that applies to all bonds issued by that bank. Such ratings take cognizance of the bond specific features such as subordination and collateralization of the bond and therefore represents a more accurate representation of the bond specific credit risk. Issue ratings are also the ratings considered by bond analysts, in general, given its higher degree of specificity. This study therefore uses *issue* ratings instead of *issuer* ratings. In addition, given that the study only considers banks such ratings are more easily available as compared to other industries. Consequently, for every bond in the sample a benchmark portfolio of benchmark bonds is created based on matching maturity and issue rating. Therefore, instead of utilizing a fixed number of benchmark portfolios

for all the bonds in the study a benchmark portfolio is created for every bond in the study, and this is implemented as follows:

- For every bond in the study the issue rating is obtained from Eikon along with the bond's maturity.
- A matching portfolio of benchmark bonds (benchmark portfolio) is created by matching rating and maturity.
- The maturity bucket used for each bond is a one-year bucket to effectively minimise the impact of 'duration'[33] on bond returns. For example, if a bond in the sample has a maturity of 31st September 2020, then only bonds with maturity between 1st January 2020 and 31st December 2020 are included in the benchmark portfolio.
- Given the nature of the sample issuer rating was often available from multiple sources. In case multiple issuer ratings were available, all the ratings available are used to select benchmark bonds. In the event it was not possible to create a benchmark portfolio, due to lack of issuer rating or often due to lack of available benchmark bonds, the bond for which the benchmark portfolio could not be created was omitted from the study.
- Only TRACE eligible bonds were selected as the study is based on daily bond prices from TRACE.
- In addition, all bonds with complex interest structurers, convertibles, puttables were eliminated along with bonds issued by banks as they are also potentially impacted by Pillar 3 disclosures.

[33] A measure of the sensitivity of the price of a bond or other debt instrument to a change in interest rates.

To improve the accuracy of the results the maturity bucket considered was one year for every bond in the study and not 1 to 3 years, 3+ to 5 years, 5+ to 10 years, and over 10 years as done in literature. This leads a more accurate matching of durations between the bank bond and the benchmark bond. This further increases the number of benchmark portfolios used in the study as there were bonds in the study with the same 'issuer rating' but different maturities for which separate benchmark portfolios needed to be created.

For every rating / maturity combination a portfolio of benchmark bonds (benchmark portfolio) was created and the prices of these benchmark bonds over the event period and the non-event period were obtained. The $SRR(t-1,t+1)_n$ is calculated by dividing the $R(t-1,t+1)_n$ (raw return) by the standard deviation of returns over the non-event period. For each rating/maturity group a standardised benchmark return $SBM(t-1,t+1)_n$ is computed as an average of the $SRR(t-1,t+1)_n$. The average is a weighted average of the SRR with trade count used as weights thereby giving more weight to those benchmark bonds that are more liquid and consequently more representative of the market return as at that date (see section 4.5.7 for details on weighting scheme).

In total 1,459,831 benchmark returns were computed representing over 2.9 million benchmark bond trades for the sample used in the study[34].

4.5.7 Computation of Abnormal Returns

Finally, the abnormal standardised bond return ($ABSR$) is calculated as follows:

$$ABSR(t-1,t+1)_n = SRR(t-1,t+1)_n - SBM(t-1,t+1)_n$$

[34] As an example, for HSBC 32 benchmark portfolios were created and computations undertaken for both the event period and the non-event period for the purposes of the study.

Unlike the estimation of abnormal stock returns, the estimation of abnormal bond returns of a firm presents several unique issues when a firm / bank has more than one bond outstanding. Unlike equity a firm can have several bonds outstanding at a particular point in time for which abnormal returns would have been calculated. For example, HSBC had 46 bonds[35] outstanding for EH1 and abnormal returns are calculated for each of these bonds. A few studies, such as Jayaraman & Shastri, (1988), Hand, Holthausen & Leftwich, (1992), Warga & Welch, (1993) and Cook & Easterwood, (1994), treat each bond as a separate observation. However, as BKMX observe, this biases the sample toward larger firms. Moreover, returns for bonds of the same firm will be correlated leading to biased test statistics. Hence, BKMX combine a firm's various bond returns into a single firm-bond return weighing each bond return by its volume of bonds outstanding relative to the firm total. EGY consider other possible weightings including weights based on the size and number of trades and a simple average. They find the different weighting schemes make little difference in terms of the bias and power of the tests. For the purposes of this study the weighting is based on trade count for the same reasons as those for using trade count for weighting benchmark returns.

Abnormal returns in the study are based on 162,612 returns comprised of over 325,000 trades over all the event horizons and 1,459,831 benchmark returns

[35] Break up of bonds outstanding for HSBC by event horizon:

EH1	EH2	EH3	EH4
46	33	40	40

comprised of over 2.9 million trades of benchmark bonds again covering all the event horizons[36].

4.6 Descriptive Statistics

Table 4.1: Descriptive Statistics Unstandardised Bond Returns

Unstandardised Bond Returns					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	-0.000728	-0.000391	0.003183	- 0.675	9.963
Bond Return Weighted by Square Root of Trade Quantity	-0.000739	-0.000384	0.003171	-0.712	10.021
Number of Events	180				

Table 4.1presents the descriptive statistics of Unstandardised bond returns for the two weighting schemes implemented. The Unstandardised bond returns represent the average raw return calculated over a 4-day, 3-day and 2-day holding period (see section 4.5.4). Given the short holding periods the computed Unstandardised bond returns are expectedly low. The negative Unstandardised bond returns reflect the fact during the period under consideration 2018, there was a steady increase in the Federal Funds rate with a consequent drop in bond prices over the period.

[36] This does not include the trades used to compute the standard deviations over the non-event horizon periods for standardizing returns.

The measure of kurtosis shows the challenge of using Unstandardised bond returns for the purposes of applying the statistical tests.

Table 4.2: Descriptive Statistics Standardised Bond Returns

Standardised Bond Returns (SRR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	-0.145391	-0.093790	0.577461	-0.919	4.466
Bond Return Weighted by Trade Quantity_Winsorized	-0.171343	-0.105306	0.642957	-0.862	3.384
Bond Return Weighted by Square Root of Trade Quantity	-0.143553	-0.071877	0.576406	-0.884	4.304
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.169098	-0.083290	0.642090	-0.854	3.252
Number of Events	180				

Table 4.2 presents the descriptive statistics of Standardised bond returns with standardisation implemented with and without winsorization. The measure of kurtosis show improvement thereby improving the power of the tests employed as demonstrated by EGY.

Table 4.3: Descriptive Statistics Abnormal Standardised Bond Returns

Abnormal Standardised Bond Returns (ABSR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	-0.006249	0.037691	0.426155	-0.648	3.290
Bond Return Weighted by Trade Quantity_Winsorized	-0.011352	0.038770	0.464189	-0.605	2.589
Bond Return Weighted by Square Root of Trade Quantity	0.002014	0.038906	0.425025	-0.744	3.681
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.003214	0.037617	0.464385	-0.725	3.046
Number of Events	180				

Table 4.3 presents the descriptive statistics for abnormal standardised bond returns $(ABSR)$ (computed by deducting standardised benchmark returns (SBM) from standardised raw returns (SRR)) using both weighting schemes and standardisation with and without winsorization.

The impact of the different weighting schemes and winsorization become evident from the above data. As the data shows the mean of Abnormal returns using a square root of trade price weighting scheme is impacted by outliers as it is positive. Removing the outliers through winsorization leads to the mean becoming negative as is the case in all other instances.

The above descriptive statistics represents all event observations over 2018 or 180 event observations. The descriptive statistics for abnormal standardised bond returns $(ABSR)$ for each event horizon is given in Appendices 11A to 11D.

4.7 Statistical Tests

EGY in their paper extensively test the power of the statistical tests employed - the t-test, the sign test, and the Wilcoxon sign-rank test and find that not only are the above tests well specified but that the power of the statistical tests to detect any abnormal events are significantly enhanced by standardisation of returns. Following EGY the same three tests are used for the purposes of this research.

None of the statistical measures used adjust for possible cross-correlation between bond returns. Kolari & Pynnönen, (2010) show that the presence of cross-correlations between bond returns can significantly bias the results of the tests when event dates overlap and propose a correction to the t-test. This has not been considered for this study as the event dates used in the study generally do not overlap given banks disclose results at different times. In addition, as established by EGY, since a bond's abnormal returns are calculated by subtracting the average return of benchmark bonds of the same rating and maturity, this eliminates rating and maturity as correlation sources. EGY also demonstrate that in the absence of overlapping event dates the results are unbiased without the adjustment proposed by Kolari & Pynnönen, (2010). Consequently, not correcting for any possible cross-correlations does not bias the results of this study.

4.8 Results

Table 4.4: Results of Statistical Tests

Results	*Mean*	*t – test*	*Sign test*	*Sign rank test*
Bond Return Weighted by Trade Quantity	-0.006249	-0.197	1.118	0.750
Bond Return Weighted by Trade Quantity_Winsorized	-0.011352	-0.328	0.671	0.404
Bond Return Weighted by Square Root of Trade Quantity	0.002014	0.064	0.969	1.010
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.003214	-0.093	0.373	0.653
Number of Events	180			

I test the null hypothesis of zero abnormal returns, signifying that the provision of Pillar 3 information does not lead to abnormal returns, in all the tests. The test results in Table 4.4 indicate that the null hypothesis be retained when all the events are considered together. The tests are also carried out for each event horizon separately to determine if the null hypothesis could be rejected for any event horizon when each event horizon is considered separately. The same result is obtained when the tests are performed for each event horizon separately and the results of the same are included in Appendices 12A to 12D.

Literature evidences the contemporaneous relationship between bank risk indicators and debt yields or large deposit rates demonstrating that investors do consider and act on the information about a bank's risk positions – thereby providing support for the principle of market discipline. However, the above results call into question the efficacy of the amended, expanded, and standardised information on risk in the form of Pillar 3 disclosures.

4.9 Absence of Expected Results – Possible Explanations

Given the importance to firms' of being able to access capital and the cost of such capital, market discipline relies on external stakeholders to shape a firm's risk-taking behaviour by demanding higher risk premiums on the funds they provide or by reducing the amount of funding they provide to the firms outright. The reason for the existence of Pillar 3 disclosures is to enable markets to perform this function and the above results call into question their effectiveness in the context of bond market investors.

Whilst the results are indeed surprising at first glance, the financial crisis does provide evidence of their failure. As outlined in section 4.3, the financial crisis provided the first indications that the Pillar 3 risk disclosures were not effective in achieving their stated objective, a fact acknowledged by the BCBS. This led to their revision with the current requirements being published in 2015. The regulatory solution to the problem was to provide new and more comprehensive information to investors – a solution that is often considered as the panacea for such problems. However, the result of this research indicates that the improvements made are not eliciting the expected response from bond market investors, the market participants for whom such disclosures were designed. The provision of this information imposes significant costs on banks and

the economy as a whole and the research indicates that the expected regulatory benefits are not present.

Whilst it is difficult to provide a single reason for the results in the study, it possible to posit certain explanations for markets ignoring the information contained in Pillar 3 disclosures.

As outlined in the heuristic framework the Principal or regulator can improve the information content about the Agent's actions through the introduction of additional variables in the contract. The Principal has the option to choose from several variables that can provide additional signals of the Agent's efforts. However, not all variables when included in the optimal incentive contract lead to an increase in the information content of the Agent's efforts. The *Minimum Statistic Theorem* (Holmstrom, (1979), states that this will only be the case if the additional information variables are not a sufficient statistic when evaluated with the other variables in the contract. Consequently, the Principal or regulator can only improve the information content about the Agent's actions by incorporating additional variables in the contract that are not sufficient statistic for each with respect to the Agent's actions. It is possible that in the case of Pillar 3 disclosures, this condition is not being met and the overall noise arising from the sheer volume and complexity of disclosures is preventing their use by market participants.

In addition, as outlined in section 4.1, Pillar 3 disclosures do not provide the same information as that contained in regulatory reporting. For example, in Europe substantial amounts of information included in regulatory returns are not disclosed under the Pillar 3 requirements (Calver & Owladi, 2017). Consequently, it is also possible that the completeness of the information is Pillar 3 disclosure requirements is

in question. Market participants are unable to form a view on the risk positions of banks based on the incomplete information provided in Pillar 3 disclosures, resulting in them ignoring such disclosures in their investment decisions.

The design of Pillar 3 disclosures is based on a fundamental premise – markets need and use the same information that is used by regulators. Pillar 3 disclosures provide a comprehensive dataset of information on the bank's capital and risk positions to markets which are based on the information banks are required to provide to regulators confidentially under regulatory requirements. The results of the study raise doubts regarding the above premise. The heuristic framework argues that the regulatory contract is designed to achieve regulatory objectives (captured stylistically in the regulatory objective function) and the regulatory contract prescribes additional information requirements that address such objectives, which manifest themselves as mandatory disclosure requirements in an economy. Consequently, regulatory disclosures are designed to provide information that address the information needs of regulators based on their objectives. As previously argued, the regulatory objectives are often multi-dimensional and multi-faceted. It is not necessary that under all circumstances such regulatory goals will be congruent with those of market participants. In the absence of such goal congruence the regulatory information needs, which form the basis of Pillar 3 disclosures, could well be different from the information needs of market participants causing market participants to ignore such disclosures, leading to the results observed by this study.

Neir & Baumann, (2006) show that the effectiveness of market discipline will depend on the extent of the government safety net (support). Given the sample of banks in the study, which are primarily from jurisdictions that have such government support

schemes and clearly manifest the phenomena of ‘too big to fail’, it is also possible that the disclosures are not eliciting the expected response due to the presence of such guarantees that protect investors from future losses thereby removing any incentive for them to discipline banks. This poses a unique conundrum from a regulatory perspective as these are the very banks that pose the greatest systemic risk.

Instances of similar occurrences of lack of investor response subsequent to the provision of additional information are also being evidenced in literature in other regulatory areas. In response to criticisms that audit reports were standardised, providing little useful information, standard setters introduced the Extended Auditor’s Reports (EAR) that disclose audit-specific information, including issues that involve significant auditor judgment during the audit. In certain jurisdictions, the EAR is mandatory for audits of listed entity financial statements. The EAR aims to provide significant additional information pertinent to financial statement users’ understanding of the audit process. Regulators and Standard setters expected that the implementation of the EAR would improve the informativeness and communicative value of financial statement audits. Gutierrez et al. (2018) consider whether the introduction of the EAR in the U.K. enhances the decision usefulness of the auditor’s report and find it does not. Lennox, Schmidt, & Thompson, (2021) using short-window and long-window tests show that investors do not find EAR disclosure to be incrementally informative. Bradbury and Almulla, (2018) find similar results for New Zealand.

Recent research on investor attention limitations is also providing additional strands of evidence that more directly cast doubt on the assumption underlying most existing models of disclosure that require observers be fully attentive to publicly available

information. Hirshleifer, Lim & Teoh, (2004) show that limited attention sometimes causes observers to fail to consider the implications of an absence of a signal and also sometimes causes a failure to process disclosed signals. In their model the assumption of limited attention captures two stylized facts. First is that human information processing power is limited and the second is that people in certain contexts seem to be less skeptical about the incentives for strategic behavior of interested parties than rationality would seem to require. The authors argue that limited attention has important effects on exchange between informed and uninformed parties in a range of settings, such as securities markets, consumer product markets, and non-market social interactions. It is consequently possible that the volume and complexity of information being provided by Pillar 3 as compared to the summarized information that was provided pre-Pillar 3 could be a reason for the lack of investor focus on such disclosures.

The results also raise questions about the information content of disclosures required for regulatory purposes under the Basel norms given the similarity of the information between such reporting requirements and the Pillar 3 requirements. However, as outlined in section 4.1, whilst there are significant similarities between regulatory reporting requirements and financial information the same cannot be said about capital and risk information. Consequently, any inferences about the information content of regulatory reporting based on the above research has to be addressed with caution.

4.10 Conclusion

The aim of this research was to fill a gap in literature by specifically evaluating the information content of Pillar 3 disclosures using an event study methodology based

on bond market data. The results call into question the efficacy of Pillar 3 disclosures in achieving their objective of market discipline. This could be due to the the challenges arising from information noise or complexity and/or the limited attention of investors. These areas can be addressed through the design of such disclosure requirements going forward and are areas within the purview of banking regulators. The presence of government guarantees on the other hand raises policy implications that go beyond banking regulation and lie in the wider realm financial stability policy. Given that market discipline is one of the three pillars of banking supervision globally and the cost implications of providing such information, answers to the questions raised by this research, will enhance banking supervision and its efficacy and warrants further research.

CHAPTER FIVE: CONCLUSION

The aim of this thesis was to arrive at an alternative explanation for the existence of mandatory disclosures in an economy and to test the veracity of the aforementioned explanation. In addition, the thesis having taken an alternative view based on information asymmetries empirically evaluates the information content of a critical set of mandatory disclosures that support one of the key pillars of banking supervision today – that of market discipline. The following sub-sections summarise the conclusion of each of the aforementioned elements of this thesis: -

5.1 The Heuristic Framework

In chapter 2.0 the thesis arrives at an alternative explanation for the existence of mandatory disclosures by considering the regulatory process by which mandatory disclosure requirements are set in an economy in combination with the economic incentives for firms to participate in such regulation. Following literature on regulations, the thesis uses a PA framework that captures the interaction between regulator and firm in a stylised manner using a constrained optimisation. The thesis demonstrates that in the presence of moral hazard the regulator will require additional information in the form of mandatory disclosures.

The thesis by using a constrained optimisation process also posits that there will be limits to such disclosure requirements that can be imposed. The thesis arrives at the above conclusions by considering the Principal to be risk averse and the Agent to be Risk Neutral which is a variation from the norm in regulatory literature. As argued in the thesis, in addition to being a more realistic stylisation of the risk preferences, such risk preferences enable the heuristic framework to accommodate circumstances where there is goal congruence between regulator and firm along with the usual occurrence

of conflict of interest. The usual stylised assumptions in literature about risk preferences would preclude instances of possible goal congruence, circumstances that do indeed occur in regulatory environments, albeit rarely, as corroborated by personal experience.

The thesis contributes to literature on mandatory disclosures by providing an alternative explanation that puts information at its heart and also conforms with the stylised view of regulation as a PA relationship. By adopting an alternative approach to explaining mandatory disclosure requirements, the thesis also explores the possible limits of such disclosures and posits characteristics of such disclosures that also widens existing literature.

5.2 BCBS Regulations

Chapter 3.0 analyses the regulatory pronouncements of the BCBS with the aim of evaluating whether or not such regulatory pronouncements contain requirements that meet the conditions proposed by the heuristic framework developed in chapter 2.0. In the process it also documents the evolution of such regulations from the inception of the BCBS. The research finds support for the framework developed in Chapter 2.0 by demonstrating that BCBS regulations stipulate a key performance variable/variables that is noisy signal of Agent's actions and that they contain requirements to provide additional information on such key performance variable that shed light on the Agent's actions. The research evaluates banking regulations over three decades and finds support for the propositions in the heuristic framework in all key BCBS pronouncements to date (Basel 1, MRA, Basel 2 and Basel 3) thereby demonstrating that the propositions in the heuristic framework apply irrespective of the drivers and circumstances behind such regulations.

The thesis also finds support in favour of the application of the constraints used in the constrained optimisation process in the analysis of the evolution of the Basel 2 requirements. The analysis argues that with Basel 1 the cost of compliance led banks to evaluate both their participation in the regulatory environment (captured by the participation constraint) and the cost they had to bear in modifying their actions to comply with regulatory objectives (captured by the incentive constraint), leading to a revision in the regulatory contract as seen with Basel 2.

Using the information lens, the analysis in Chapter 3.0 also provides an information cost based rationale for the choice of the capital adequacy ratio as the key performance variable. The analysis shows that whilst other forms of contract design can be favourable from an information cost perspective ie using key performance variable/variables other than the capital adequacy ratio, such alternative contract designs have other limitations that prevent their use.

The analysis of BCBS regulatory pronouncements provides evidence in support of the heuristic framework thereby providing credence to the same and consequently broadening existing literature on the topic. Also, by evaluating the regulatory requirements using an information lens, which is different from existing literature, the research also widens the literature on banking regulation.

5.3 Pillar 3 Disclosures

Pillar 3 disclosures are focussed on a bank's risk and capital positions are designed for bond investors and play a critical role in implementing the principle of market discipline in the BCBS regulatory framework. Chapter 3 using event study methodology explores the impact of Pillar 3 disclosures using a portfolio of systemically important banks. The research carries out statistical tests for Pillar 3

reporting in 2018 and finds no evidence of abnormal bond returns around Pillar 3 disclosure announcements by the selected banks, thereby raising questions about the efficacy of such disclosures. Whilst the research deals only with Pillar 3 disclosures and consequently cannot not be generalised for all mandatory disclosure requirements, the results do however raise questions about the information content of such disclosures – questions that have significant policy implications as explored in section 5.4 below.

Existing literature on the information content of Pillar 3 disclosures is sparse and only evaluates its impact on equity markets. This research by evaluating their information content for bond markets, the target of such disclosures, extends the existing literature on the information content of Pillar 3 disclosures. In addition, the research also implements the latest methodological advances in bond market event studies thereby contributing to the literature on bond market event studies.

5.4 Policy Implications

By taking an information theoretic viewpoint regarding mandatory disclosure requirements the research raises questions regarding the efficacy of Pillar 3 disclosures, the key element of market discipline, one of the three pillars of banking supervision globally. The research evaluates the information content of Pillar 3 disclosures from a bond market perspective to determine whether such disclosures, that are provided at a significant cost by banks, meet their objective of providing information to markets to enable markets to perform the function of market discipline as envisaged by regulators and finds them wanting. It should be noted that the findings do not necessarily question the principle of market discipline. Literature evidences the contemporaneous relationship between bank risk indicators and debt

yields or large deposit rates demonstrating that investors do consider and act on the information about a bank's risk positions – providing support for the principle of market discipline. The research therefore raises questions regarding the vehicle used to achieve market discipline i.e. Pillar 3 disclosures. This result has significant policy implications. The research provides evidence that supports the revision of Pillar 3 disclosures such that they provide markets with the necessary and relevant information to enforce market discipline.

In the generalised context of mandatory disclosures, the research results questions the automatic assumption made by regulators that all mandatory disclosures have information content. The research results posit a closer look at this assumption and challenges the same.

The research posits a few reasons for the observed results. One of the arguments posited by the research is that the challenge arising from information noise or complexity could be a possible explanation. Using the heuristic framework, the research posits that it is possible that the information provided by the Pillar 3 disclosures do not meet the sufficient statistic requirements. As argued in Chapter 2.0 the Principal has the option to choose from several variables that can provide additional signals of the Agent's efforts. However, not all variables when included in the optimal incentive contract lead to an increase in the information content in this instance the bank's risk management activities as embodied by the *Minimum statistic theorem* (Holmstrom, (1979). Accordingly, it is possible that the information being provided by Pillar 3 disclosures are not a sufficient statistic when evaluated with the other information also presented in such disclosures i.e., they do not convey value relevant information to bond investors. The above argument is equally relevant for all

mandatory disclosures as the volume of such disclosures increase leading to what is termed as ‘disclosure overload’ in the industry.

Next the research notes that the design of mandatory disclosures is based on the fundamental premise that markets need and use the same information that is used by regulators and questions this premise. Whilst such disclosures often provide exhaustive information about aspects of a business, such disclosures are primarily designed to achieve regulatory objectives. However, this does not automatically imply that there is congruence of objectives between markets and regulators. Consequently, it is possible that even the best designed mandatory disclosures designed to achieve regulatory objectives might fall short of market information needs, as demonstrated by the results of the research using Pillar 3 disclosures.

Pillar 3 disclosures provide a comprehensive dataset of information on the bank's capital and risk positions to markets that are based on the information banks are required to provide to regulators. The heuristic framework argues that the regulatory contract is designed to achieve regulatory objectives and the contract also prescribes additional information requirements that address such objectives. Consequently, regulatory disclosures are designed to provide information based on regulatory objectives and goals and the research posits that such goals may not, under all circumstances, be congruent with those of market participants. Consequently, regulatory information needs, which form the basis of Pillar 3 disclosures, could very well be different from the information needs of market participants causing market participants to ignore such disclosures. Lastly, by focussing on information content the research also develops possible explanations based on investor attention span as evidenced in other areas of regulatory literature.

The deficiencies in the previous version of Pillar 3 disclosures, which became evident during the financial crisis, led to such disclosures being expanded and standardised. The result of this research not only raise questions about the effectiveness of such revisions but also regarding the approach followed by BCBS towards addressing the problem. All of the reasons presented above for investors ignoring such disclosures present a strong argument in favour of a policy of complete redesign of Pillar 3 disclosures rather than their augmentation through the provision even more information, as previously done by BCBS.

The heuristic framework by putting information at the centre of the explanation for the existence of mandatory disclosures enables the discussion to focus on the information content of mandatory disclosures or their value relevance. The aim of such disclosures, as hypothesized by the heuristic framework, is to address the information asymmetry between regulators and firms about the firm's actions instead of being a solution for market failures. This shift in focus to information content will enable better design and implementation of mandatory disclosure requirements, which impose a significant cost to the economy as a whole, by all regulatory authorities, as demonstrated in the case of Pillar 3 disclosures.

5.5 Limitations of the Study

As with any research, this research also has its limitations. In developing the alternative framework, the research arrives at its conclusions by optimising the interaction between Regulator and Firm as it is currently stands. Whilst this captures the economic reality of such interactions in a stylised manner, it does not however question whether the process for the setting of such disclosures or for that matter all regulation in an economy represents the most efficient solution from an economic

perspective. Consequently, the research given its focus on mandatory disclosures does not ask the broader theoretical question as to whether or not the process by which such disclosures are set in an economy represent an optimum solution – a question in the area of Mechanism Design.

Mandatory disclosures encompass both ones that are required for markets and those that are required by regulators. Existing literature on the information content of mandatory disclosures focus on disclosures that are meant for markets, as does this research. Chapter 3 evaluates using Pillar 3 disclosures and bond market data as a proxy for evaluating the information content of regulatory risk disclosures that are required to be provided by banks. However, as pointed out in the Chapter given the inherent limitations of the proxy it is difficult to generalise and extend the results of the research to draw inferences about regulatory disclosures, which is a limitation of the research.

The results of the empirical evaluation have significant policy implications as explored earlier. However, given the current scope of the research it can only posit possible explanations for the same. It is unable, however, to comment on the exact reasons for the result, which is its obvious limitation.

5.6 Future Research

The results of the empirical evaluation of Pillar 3 disclosures question the efficacy of such risk disclosures. The reason why such disclosures lack information content or value relevance for bond market investors is an area of future research. Given the evidence in literature on the information content of pre-Pillar 3 risk disclosures, it is possible that investors prefer summarised information as is being indicated through research in other areas such as Extended Audit Reports and also through research on

investor attention spans. Following methods similar to those implemented by Araujo & Leyshon, (2017) such research can evaluate the value relevance of components of Pillar 3 risk disclosures rather than considering their information content overall, as done in this research and also previous research. Such research can provide valuable insights to regulators regarding not only the design of mandatory risk disclosures but mandatory disclosures in general.

The heuristic framework posits that there are limits to the amount of disclosures/information that can demanded of firms by regulations. If indeed that is the case with risk disclosures and regulators don't have the ability to either expand or improve on them any further, then the question of relying on Pillar 3 disclosures to achieve market discipline becomes paramount as such disclosures will fail to achieve this objective. Research into this question can have significant policy implications that go beyond banking regulation. Government guarantees and deposit insurance schemes play a critical role in ensuring financial stability. Given the inherent conflicts between market discipline and government guarantees and deposit insurance schemes, research in the area can provide insights into which of these elements or tools of financial stability should be the policy focus and priority going forward.

The heuristic framework argues that the risk preference of the regulator is one of risk aversion and that of the firm is of risk neutrality. Research using comment letters on regulatory proposals can shed light on the risk preferences of firms and whilst the regulatory response to such letters can shed light on the risk preferences of regulators. This can present an interesting area of future research to evaluate whether the assumed risk preferences are corroborated in practice and if such risk preferences are universally applicable to all regulators or whether they vary.

The evaluation of the broader theoretical question as to whether or not the process by which mandatory disclosures are set in an economy represent an optimum solution provides avenues for further research along with consideration of wider application of the framework developed in Chapter 2.0 to regulations other than banking.

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Appendix 1: First-Best Contracts (for CHAPTER 2)

Observable Effort

Risk Neutral Principal and Agent

If the Principal could observe effort directly, a forcing contract could be selected to ensure that the Agent selects the appropriate action without the incentive constraint. Consequently, when effort is observable, we can ignore the incentive constraint.

Assuming a risk neutral Principal the Principal's maximisation problem can be written as:

$$Max\int \big(z - c(z)\big)f(z \mid e)dz = Max\int \big(zf(z \mid e) - c(z)f(z \mid e)\big)dz$$

Therefore, the maximisation problem is the same as minimising the compensation cost for the Principal. We can write the objective function as

$$Min \int c(z)f(z \mid e)dz$$

subject to the participation constraint of the Agent which is

$$\int v\big(c(z)\big)f(z/e)dz - g(e) \geq \overline{U}.$$

It can shown that the optimal incentive contract is given by

$$\gamma = \frac{1}{v\ '\big(c(z)\big)}$$

where γ is the Lagrangian multiplier for the participation constraint (see Appendix 2 for workings on the optimisation method).

If the Agent is strictly risk averse (so that $v\ '(c)$ is strictly decreasing in c) the

implication of the above is that the optimal compensation scheme $c(z)$ is a constant; that is the Principal should provide the Agent with a fixed compensation payment. Hence given the contract's specification of e, the Principal fixes a fixed compensation payment c_e^*such that the Agent exactly receives the reservation utility level or satisfies the participation constraint:

$v(c_e^*) - g(e) = \overline{U}$.

Since $g(e_H) > g(e_L)$, the Agent's compensation will be higher if the contract calls for higher effort.

On the other hand, if the Agent is risk neutral and $v\big(c(z)\big) = c$, the optimal incentive contract condition is satisfied for any incentive function. Any incentive function that meets the Agent's reservation utility level ie gives the Agent an expected wage payment equal to $\overline{U} + g(e)$ is optimal. Therefore, with observable effort and a risk neutral Principal the risk attitudes of the Agent do not lead any additional costs being borne by the Principal. The surplus for the Principal under both circumstances is given by $Max \int zf(z \mid e)dz - v^{-1}\left(\overline{U} + g(e)\right)$.

Unobservable Effort

Risk Neutral Principal and Agent

In the instance that both Principal and Agent are risk neutral and in the absence of a limited liability constraint, the same result as above can be achieved even if effort is unobservable and non-observability does not impose any additional cost on the Principal.

In case of a risk neutral Agent, we can write $v\big(c(z)\big) = c$, where c is a constant.

Assume that the compensation schedule offered by the Principal to the Agent is of the form $c(z) = z - \alpha$ where α is a constant. This form of compensation schedule implies that the Principal receives a fixed amount α with the Agent receiving the difference.

In the case of observable effort, the optimal effort e^* leads to the optimal payoff $Max \int zf(z \mid e)dz - v^{-1}\left(\overline{U} + g(e)\right)$. As the Agent is risk neutral, we can write the optimal payoff as $Max \int zf(z \mid e)dz - g(e) - \overline{U}$.

If the Agent accepts this contract, the Agent chooses e to maximise his/hers utility given by $\int v\big(c(z)\big)f(z/e)dz - g(e)$. Given the assumption of risk neutrality we can write the above as $\int cf(z \mid e)dz - g(e)$ and using the stipulated incentive function this becomes $\int zf(z \mid e)dz - \alpha - g(e)$ which is the same as the optimal payoff when effort is observable. Thus this contract induces the first-best effort level e^*.

The Agent is willing to accept this contract as long as it meets his/her participation constraint ie as long as $\int zf(z \mid e^*)dz - \alpha - g(e^*) \geqslant \overline{U}$. Let α^* be the level of α for which the constraint holds with equality and the optimal incentive function is $c(z) = z - \alpha^*$.

Re-arranging we can write $\alpha^* = \int zf(z \mid e)dz - g(e) - \overline{U}$ which is the same as the optimal payoff for the Principal when effort is observable.

Consequently, as demonstrated above even if effort is unobservable, if both Principal and Agent are risk neutral the first-best effort level can be implemented at no additional cost to the Principal ie the optimal incentive contract is Pareto optimal. (Mas-Colell, Whinston and Green, 1995).

Appendix 2: Standard PA Formulation (for CHAPTER 2)

Risk Neutral Principal and Risk Averse Agent

As before given the fact that the Principal is risk neutral the objective function can be considered as $Min \int c(z)f(z \mid e)dz$. This is optimised subject to the participation constraint $\int v\big(c(z)\big)f(z/e)dz - g(e) \geq \overline{U}$ and assuming the Principal wants to implement e_H, the incentive constraint $\int v\big(c(z)\big)f(z \mid e_H)dz - g(e_H) \geq \int v\big(c(z)\big)f(z \mid e_L)dz - g(e_L)$.

Let $\gamma > 0$ be the multiplier for the participation constraint and $\mu > 0$ be the multiplier for the incentive constraint. $c(z)$ must satisfy the following Kuhn-Tucker conditions for all $z \in \left[\overline{z}, \underline{z}\right]$:

$$-f(z/e_H) + \gamma v'\big(c(z)\big)f(z/e_H) + \mu v'\big(c(z)\big)\big[f(z/e_H) - f\big(z(/e_L)\big)\big] = 0$$

or

$$\frac{1}{v'(c(z))} = \gamma + \mu\left[1 - \frac{f(z|e_L)}{f(z|e_H)}\right].$$

With $= e_H$, both γ and μ are positive.

In the event effort is observable we have previously demonstrated that $c^*_{e_H} = v^{-1}\left(\overline{U} + g(e_H)\right)$ or $v\big(c^*_{e_H}\big) = \overline{U} + g(e_H)$. The Agent's risk aversion implies that $v\big(c(z)\big)$is concave and consequently following Jensen's inequality we can state that $v\big[E\big(c(z)\big) \mid e_H\big] > \overline{U} + g(e_H)$ ie the Utility of the expected value of compensation is greater than value of expectations.

This is equivalent to $v\left[E\left(c(z)\right) \mid e_H\right] > v\left(c^*_{e_H}\right)$which implies $\left[E\left(c(z)\right) \mid e_H\right] > c^*_{e_H}$ or the expected value of compensation is greater than compensation under full observability. Consequently, the compensation under the optimal incentive contract is second best and therefore includes an information cost that is borne by the Principal.

(Mas-Colell, Whinston and Green, 1995).

Appendix 3: Specified Risk Weights for Interest Rate Risk as specified in the Market Risk Amendment (MRA) (CHAPTER 3)

Security	**Risk Weight**
Government	0%
Qualifying (residual term to maturity 6 months or less)	0.25%
Qualifying (residual term to maturity between 6 months and 24 months or less)	1%
Qualifying (residual term to maturity exceeding 24 months)	1.60%
Other	8%

(BCBS: *Amendment To The Capital Accord To Incorporate Market Risks*, January 1996, paragraph 4)

Appendix 4: Specified Risk Weights for General Market Risk under the Maturity Method as specified in the Market Risk Amendment (MRA) (CHAPTER 3)

Coupon 3% or more	**Coupon less than 3%**	**Risk weight**
1 month or less	1 month or less	0.00%
1 to 3 months	1 to 3 months	0.20%
3 to 6 months	3 to 6 months	0.40%
6 to 12 months	6 to 12 months	0.70%
1 to 2 years	1.0 to 1.9 years	1.25%
2 to 3 years	1.9 to 2.8 years	1.75%
3 to 4 years	2.8 to 3.6 years	2.25%
4 to 5 years	3.6 to 4.3 years	2.75%
5 to 7 years	4.3 to 5.7 years	3.25%
7 to 10 years	5.7 to 7.3 years	3.75%
10 to 15 years	7.3 to 9.3 years	4.50%
15 to 20 years	9.3 to 10.6 years	5.25%
Over 20 years	10.6 to 12 years	6.00%
	12 to 20 years	8.00%
	Over 20 years	12.50%

(BCBS: *Amendment To The Capital Accord To Incorporate Market Risks*, January 1996, Table 1)

Appendix 5: List of Eligible collateral for inclusion in the computation of RWA's as specified in Basel 2 (CHAPTER 3)

The following collateral instruments are eligible for recognition in the simple approach: (a) Cash (as well as certificates of deposit or comparable instruments issued by the lending bank) on deposit with the bank which is incurring the counterparty exposure.
(b) Gold.
(c) Debt securities rated by a recognised external credit assessment institution where these are either: • at least BB- when issued by sovereigns or PSEs that are treated as sovereigns by the national supervisor; or • at least BBB- when issued by other entities (including banks and securities firms); or • at least A-3/P-3 for short-term debt instruments.
(d) Debt securities not rated by a recognised external credit assessment institution where these are: • issued by a bank; and • listed on a recognised exchange; and • classified as senior debt; and • all rated issues of the same seniority by the issuing bank that are rated at least BBB- or A-3/P-3 by a recognised external credit assessment institution; and • the bank holding the securities as collateral has no information to suggest that the issue justifies a rating below BBB- or A-3/P-3 (as applicable) and; • the supervisor is sufficiently confident about the market liquidity of the security.
(e) Equities (including convertible bonds) that are included in a main index.
(f) Undertakings for Collective Investments in Transferable Securities (UCITS) and mutual funds where: • a price for the units is publicly quoted daily; and • the UCITS/mutual fund is limited to investing in the instruments listed in this paragraph.

(BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework*, June 2004, paragraph 3 (i))

Appendix 6: Guidance on Determination of LGD parameter for use in the Advanced Approach as specified in Basel 2 (CHAPTER 3)

Standards for all asset classes

- A bank must estimate an LGD for each facility that aims to reflect economic downturn conditions where necessary to capture the relevant risks. This LGD cannot be less than the long-run default-weighted average loss rate given default calculated based on the average economic loss of all observed defaults within the data source for that type of facility. In addition, a bank must take into account the potential for the LGD of the facility to be higher than the default-weighted average during a period when credit losses are substantially higher than average. For certain types of exposures, loss severities may not exhibit such cyclical variability and LGD estimates may not differ materially (or possibly at all) from the long-run default-weighted average. However, for other exposures, this cyclical variability in loss severities may be important and banks will need to incorporate it into their LGD estimates. For this purpose, banks may use averages of loss severities observed during periods of high credit losses, forecasts based on appropriately conservative assumptions, or other similar methods. Appropriate estimates of LGD during periods of high credit losses might be formed using either internal and/or external data. Supervisors will continue to monitor and encourage the development of appropriate approaches to this issue.

- In its analysis, the bank must consider the extent of any dependence between the risk of the borrower and that of the collateral or collateral provider. Cases where there is a significant degree of dependence must be addressed in a conservative manner. Any currency mismatch between the underlying obligation and the collateral must also be considered and treated conservatively in the bank's assessment of LGD.

- LGD estimates must be grounded in historical recovery rates and, when applicable, must not solely be based on the collateral's estimated market value. This requirement recognises the potential inability of banks to gain both control of their collateral and liquidate it expeditiously. To the extent, that LGD estimates take into account the existence of collateral, banks must establish internal requirements for collateral management, operational procedures, legal certainty and risk management process that are generally consistent with those required for the standardised approach.

- Recognising the principle that realised losses can at times systematically exceed expected levels, the LGD assigned to a defaulted asset should reflect the possibility that the bank would have to recognise additional, unexpected losses during the recovery period. For each defaulted asset, the bank must also construct its best estimate of the expected loss on that

asset based on current economic circumstances and facility status. The amount, if any, by which the LGD on a defaulted asset exceeds the bank's best estimate of expected loss on the asset represents the capital requirement for that asset, and should be set by the bank on a risk-sensitive basis in accordance with paragraphs 272 and 328 to 330. Instances where the best estimate of expected loss on a defaulted asset is less than the sum of specific provisions and partial charge-offs on that asset will attract supervisory scrutiny and must be justified by the bank.

Additional standards for corporate, sovereign, and bank exposures

- Estimates of LGD must be based on a minimum data observation period that should ideally cover at least one complete economic cycle but must in any case be no shorter than a period of seven years for at least one source. If the available observation period spans a longer period for any source, and the data are relevant, this longer period must be used.

Additional standards for retail exposures

- The minimum data observation period for LGD estimates for retail exposures is five years. The less data a bank has, the more conservative it must be in its estimation. A bank need not give equal importance to historic data if it can demonstrate to its supervisor that more recent data are a better predictor of loss rates.

(BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework*, June 2004, paragraphs 468 - 473)

Appendix 7: Details of Validation Procedures for Internal Models for use in the Advanced Approach as specified in Basel 2 (CHAPTER 3)

Validation of internal estimates

- Banks must have a robust system in place to validate the accuracy and consistency of rating systems, processes, and the estimation of all relevant risk components. A bank must demonstrate to its supervisor that the internal validation process enables it to assess the performance of internal rating and risk estimation systems consistently and meaningfully.

- Banks must regularly compare realised default rates with estimated PDs for each grade and be able to demonstrate that the realised default rates are within the expected range for that grade. Banks using the advanced IRB approach must complete such analysis for their estimates of LGDs and EADs. Such comparisons must make use of historical data that are over as long a period as possible. The methods and data used in such comparisons by the bank must be clearly documented by the bank. This analysis and documentation must be updated at least annually.

- Banks must also use other quantitative validation tools and comparisons with relevant external data sources. The analysis must be based on data that are appropriate to the portfolio, are updated regularly, and cover a relevant observation period. Banks' internal assessments of the performance of their own rating systems must be based on long data histories, covering a range of economic conditions, and ideally one or more complete business cycles.

- Banks must demonstrate that quantitative testing methods and other validation methods do not vary systematically with the economic cycle. Changes in methods and data (both data sources and periods covered) must be clearly and thoroughly documented.

- Banks must have well-articulated internal standards for situations where deviations in realised PDs, LGDs and EADs from expectations become significant enough to call the validity of the estimates into question. These standards must take account of business cycles and similar systematic variability in default experiences. Where realised values continue to be higher than expected values, banks must revise estimates upward to reflect their default and loss experience.

- Where banks rely on supervisory, rather than internal, estimates of risk parameters, they are encouraged to compare realised LGDs and EADs to those set by the supervisors. The information on realised LGDs and EADs should form part of the bank's assessment of economic capital.

(BCBS: *International Convergence of Capital Measurement and Capital Standards A Revised Framework*, June 2004, paragraphs 500 - 505)

Appendix 8: An illustration showing a summary LCR computation providing details of the classes and the run-off rates as provided in Basel 3 (CHAPTER 3)

Illustrative Summary of the LCR
(percentages are factors to be multiplied by the total amount of each item)

Item	Factor
Stock of HQLA	
A. Level 1 assets:	
• Coins and bank notes • Qualifying marketable securities from sovereigns, central banks, PSEs, and multilateral development banks • Qualifying central bank reserves • Domestic sovereign or central bank debt for non-0% risk-weighted sovereigns	100%
B. Level 2 assets (maximum of 40% of HQLA):	
Level 2A assets	
• Sovereign, central bank, multilateral development banks, and PSE assets qualifying for 20% risk weighting • Qualifying corporate debt securities rated AA- or higher • Qualifying covered bonds rated AA- or higher	85%
Level 2B assets (maximum of 15% of HQLA)	
• Qualifying RMBS • Qualifying corporate debt securities rated between A+ and BBB- • Qualifying common equity shares	75% 50% 50%
Total value of stock of HQLA	

Cash Outflows	
A. Retail deposits:	
Demand deposits and term deposits (less than 30 days maturity) • Stable deposits (deposit insurance scheme meets additional criteria) • Stable deposits • Less stable retail deposits	3% 5% 10%
Term deposits with residual maturity greater than 30 days	0%
B. Unsecured wholesale funding:	
Demand and term deposits (less than 30 days maturity) provided by small business customers: • Stable deposits • Less stable deposits	5% 10%
Operational deposits generated by clearing, custody and cash management activities • Portion covered by deposit insurance	25% 5%
Cooperative banks in an institutional network (qualifying deposits with the centralised institution)	25%
Non-financial corporates, sovereigns, central banks, multilateral development banks, and PSEs • If the entire amount fully covered by deposit insurance scheme	40% 20%
Other legal entity customers	100%
C. Secured funding:	
• Secured funding transactions with a central bank counterparty or backed by Level 1 assets with any counterparty. • Secured funding transactions backed by Level 2A assets, with any counterparty • Secured funding transactions backed by non-Level 1 or non-Level 2A assets, with domestic sovereigns, multilateral development banks, or domestic PSEs as a counterparty • Backed by RMBS eligible for inclusion in Level 2B • Backed by other Level 2B assets • All other secured funding transactions	0% 15% 25% 25% 50% 100%
D. Additional requirements:	
Liquidity needs (eg collateral calls) related to financing transactions, derivatives and other contracts	3 notch downgrade
Market valuation changes on derivatives transactions (largest absolute net 30-day collateral flows realised during the preceding 24 months)	Look back approach
Valuation changes on non-Level 1 posted collateral securing derivatives	20%
Excess collateral held by a bank related to derivative transactions that could contractually be called at any time by its counterparty	100%
Liquidity needs related to collateral contractually due from the reporting bank on derivatives transactions	100%

Increased liquidity needs related to derivative transactions that allow collateral substitution to non-HQLA assets	100%
ABCP, SIVs, conduits, SPVs, etc:	
• Liabilities from maturing ABCP, SIVs, SPVs, etc (applied to maturing amounts and returnable assets)	100%
• Asset Backed Securities (including covered bonds) applied to maturing amounts.	100%
Currently undrawn committed credit and liquidity facilities provided to:	
• retail and small business clients	5%
• non-financial corporates, sovereigns and central banks, multilateral development banks, and PSEs	10% for credit 30% for liquidity
• banks subject to prudential supervision	40%
• other financial institutions (include securities firms, insurance companies)	40% for credit 100% for liquidity
• other legal entity customers, credit and liquidity facilities	100%
Other contingent funding liabilities (such as guarantees, letters of credit, revocable credit and liquidity facilities, etc)	National discretion
• Trade finance • Customer short positions covered by other customers' collateral	0-5% 50%
Any additional contractual outflows	100%
Net derivative cash outflows	100%
Any other contractual cash outflows	100%
Total cash outflows	

Cash Inflows	
Maturing secured lending transactions backed by the following collateral:	
Level 1 assets	0%
Level 2A assets	15%
Level 2B assets • Eligible RMBS • Other assets	25% 50%
Margin lending backed by all other collateral	50%
All other assets	100%
Credit or liquidity facilities provided to the reporting bank	0%
Operational deposits held at other financial institutions (include deposits held at centralised institution of network of co-operative banks)	0%
Other inflows by counterparty: • Amounts to be received from retail counterparties • Amounts to be received from non-financial wholesale counterparties, from transactions other than those listed in above inflow categories • Amounts to be received from financial institutions and central banks, from transactions other than those listed in above inflow categories.	50% 50% 100%
Net derivative cash inflows	100%
Other contractual cash inflows	National discretion
Total cash inflows	
Total net cash outflows = Total cash outflows minus min [total cash inflows, 75% of gross outflows]	
LCR = Stock of HQLA / Total net cash outflows	

(BCBS: *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, January 2013, Annex 4)

Appendix 9: Summary of the RSF factors by class for computation of NSFR as provided in Basel 3 (CHAPTER 3)

Summary of asset categories and associated RSF factors

RSF factor	Components of RSF category
0%	• Coins and banknotes • All central bank reserves • All claims on central banks with residual maturities of less than six months • "Trade date" receivables arising from sales of financial instruments, foreign currencies and commodities.
5%	• Unencumbered Level 1 assets, excluding coins, banknotes and central bank reserves
10%	• Unencumbered loans to financial institutions with residual maturities of less than six months, where the loan is secured against Level 1 assets as defined in LCR paragraph 50, and where the bank has the ability to freely rehypothecate the received collateral for the life of the loan
15%	• All other unencumbered loans to financial institutions with residual maturities of less than six months not included in the above categories • Unencumbered Level 2A assets
50%	• Unencumbered Level 2B assets • HQLA encumbered for a period of six months or more and less than one year • Loans to financial institutions and central banks with residual maturities between six months and less than one year • Deposits held at other financial institutions for operational purposes • All other assets not included in the above categories with residual maturity of less than one year, including loans to non-financial corporate clients, loans to retail and small business customers, and loans to sovereigns and PSEs
65%	• Unencumbered residential mortgages with a residual maturity of one year or more and with a risk weight of less than or equal to 35% under the Standardised Approach • Other unencumbered loans not included in the above categories, excluding loans to financial institutions, with a residual maturity of one year or more and with a risk weight of less than or equal to 35% under the standardised approach
85%	• Cash, securities or other assets posted as initial margin for derivative contracts and cash or other assets provided to contribute to the default fund of a CCP • Other unencumbered performing loans with risk weights greater than 35% under the standardised approach and residual maturities of one year or more, excluding loans to financial institutions • Unencumbered securities that are not in default and do not qualify as HQLA with a remaining maturity of one year or more and exchange-traded equities • Physical traded commodities, including gold
100%	• All assets that are encumbered for a period of one year or more • NSFR derivative assets net of NSFR derivative liabilities if NSFR derivative assets are greater than NSFR derivative liabilities • 20% of derivative liabilities as calculated according to paragraph 19 • All other assets not included in the above categories, including non-performing loans, loans to financial institutions with a residual maturity of one year or more, non-exchange-traded equities, fixed assets, items deducted from regulatory capital, retained interest, insurance assets, subsidiary interests and defaulted securities

(BCBS: *Basel III: the net stable funding ratio*, October 2014, Table 2)

Appendix 10: List of Banks (for CHAPTER 4)

Name	Headquarters	Total Assets US $, Billions
ABN AMRO GROUP	Netherlands	436.56
AUSTRALIA AND NEWZEALAND BANKING GROUP LIMITED	Australia	681.30
BANCO BRADESCO SA	Brazil	337.24
BANK OF AMERICA CORP.	U.S.	2,354.51
BANK OF CHINA LTD.	China	3,092.21
BANK OF MONTREAL	Canada	613.56
BANK OF NEW YORK MELLON CORP.	U.S.	362.87
BANK OF NOVA SCOTIA	Canada	785.44
MITSUBISHI UFJ FINANCIAL GROUP INC.	Japan	2,812.88
BARCLAYS PLC.	U.K.	1,444.39
BANCO BILBAO VIZCAYA ARGENTARIA SA	Spain	774.78
BNP PARIBA SA	France	2,336.66
CANADIAN IMPERIAL BANK OF COMMERCE	Canada	467.55
CAPITAL ONE FINANCIAL CORP.	U.S.	372.54
CITIGROUP INC.	U.S.	1,917.38
COMMERZ BANK AG	Germany	528.84
COMMONWEALTH BANK OF AUSTRALIA	Australia	691.03
CREDIT AGRICOLE GROUP	France	2,123.61
CREDIT SUISSE GROUP AG	Switzerland	781.45
DEUTSCHE BANK AG	Germany	1,543.55
GOLDMAN SACHS GROUP INC.	U.S.	931.80
GROUPE BPCE	France	

		1,462.70
HSBC HOLDINGS PLC	U.K.	2,588.12
INDUSTRIAL & COMMERCIAL BANK OF CHINA LTD.	China	4,027.44
ING GROEP NV	Netherlands	1,015.61
INTESA SANPAOLO SpA	Italy	901.90
ITAU UNIBANCO HOLDINGS SA	Brazil	401.10
JP MORGAN CHASE & CO.	U.S.	2,622.53
LLOYDS BANK GROUP PLC	U.K.	1,016.55
MIZUHO FINANCIAL GROUP INC.	Japan	1,837.80
MORGAN STANLEY	U.S.	853.53
NATIONAL AUSTRALIA BANK LTD.	Australia	583.79
NOMURA HOLDINGS INC.	Japan	411.18
PNC FINANCIAL SERVICES GROUP INC.	U.S.	382.32
RABO BANK	Netherlands	676.02
ROYAL BANK OF CANADA	Canada	1,039.24
BANCO SANTANDER SA	Spain	1,670.79
SKANDINAVISKA ENSKILDA BANKEN AG	Sweden	288.91
SOCIETE GENERALE SA	France	1,485.31
STANDARD CHARTERED BANK PLC	U.K.	688.76
STATE BANK OF INDIA	India	538.35
STATE STREET BANK	U.S.	244.60
SUMITOMO MITSUI FINANCIAL GROUP INC.	Japan	1,848.20
SVENSKA HANDELSBANKEN AB	Sweden	335.12
TORONTO-DOMINION BANK	Canada	1,006.00
UBS GROUP AG	Switzerland	958.49

UNICREDIT SpA	Italy	951.99
US BANCORP	U.S.	467.37
WELLS FARGO & CO.	U.S.	1,895.88
WESTPAC BANKING CORP.	Australia	636.69

(S & P GLOBAL MARKET INTELLIGENCE: The world's 100 largest banks, total assets as at 31st December 2018)

Appendix 11A – Descriptive Statistics of Abnormal Standardised Bond Returns

EH1 (for CHAPTER 4)

EH1 - Abnormal Standardised Bond Returns (ABSR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	-0.035661	0.041640	0.482919	-1.355	3.146
Bond Return Weighted by Trade Quantity_Winsorized	-0.046433	0.033676	0.492999	-1.052	2.521
Bond Return Weighted by Square Root of Trade Quantity	-0.009480	0.055743	0.474403	-1.227	2.571
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.022443	0.054219	0.489946	-0.865	1.602
Number of Events	46				

Appendix 11B – Descriptive Statistics of Abnormal Standardised Bond Returns EH2 (for CHAPTER 4)

EH2 - Abnormal Standardised Bond Returns (ABSR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	-0.086221	-0.001542	0.412291	-0.943	1.760
Bond Return Weighted by Trade Quantity_Winsorized	-0.112204	-0.018087	0.471962	-0.723	1.356
Bond Return Weighted by Square Root of Trade Quantity	-0.097503	0.005149	0.429943	-1.449	3.555
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.120771	-0.043156	0.490484	-1.237	2.890
Number of Events	45				

Appendix 11C – Descriptive Statistics of Abnormal Standardised Bond Returns

EH3 (for CHAPTER 4)

EH3 - Abnormal Standardised Bond Returns (ABSR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	0.071682	0.084016	0.465184	0.308	4.115
Bond Return Weighted by Trade Quantity_Winsorized	0.075044	0.103172	0.510242	-0.165	3.985
Bond Return Weighted by Square Root of Trade Quantity	0.083955	0.078245	0.463471	0.227	4.382
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	0.087725	0.094901	0.507685	-0.229	4.314
Number of Events	45				

Appendix 11D – Descriptive Statistics of Abnormal Standardised Bond Returns

EH4 (for CHAPTER 4)

EH4 - Abnormal Standardised Bond Returns (ABSR)					
	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Bond Return Weighted by Trade Quantity	0.026586	0.054005	0.318585	-0.580	-0.107
Bond Return Weighted by Trade Quantity_Winsorized	0.040108	0.077035	0.354680	-0.461	-0.348
Bond Return Weighted by Square Root of Trade Quantity	0.032005	0.051900	0.298435	-0.409	-0.496
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	0.044114	0.061874	0.332863	-0.303	-0.666
Number of Events	44				

Appendix 12A: Test Results by Event Horizon – EH1 (for CHAPTER 4)

Results – EH1 (published in the first quarter of 2018)	*Mean*	*t – test*	*Sign test*	*Sign rank test*
Bond Return Weighted by Trade Quantity	-0.035661	-0.501	0.147	0.158
Bond Return Weighted by Trade Quantity_Winsorized	-0.046433	-0.639	0.147	-0.180
Bond Return Weighted by Square Root of Trade Quantity	-0.009480	-0.136	0.442	0.574
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.022443	-0.311	0.147	0.115
Number of Events	46			

Appendix 12B: Test Results by Event Horizon – EH2 (for CHAPTER 4)

Results – EH2 (published in the second quarter of 2018)	*Mean*	*t – test*	*Sign test*	*Sign rank test*
Bond Return Weighted by Trade Quantity	-0.086221	-1.403	0	-0.660
Bond Return Weighted by Trade Quantity_Winsorized	-0.112204	-1.595	-0.894	-1.180
Bond Return Weighted by Square Root of Trade Quantity	-0.097503	-1.521	0	-0.818
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	-0.120771	-1.652	-0.596	-1.315
Number of Events	45			

Appendix 12C: Test Results by Event Horizon – EH3 (for CHAPTER 4)

Results – EH3 (published in the third quarter of 2018)	*Mean*	*t – test*	*Sign test*	*Sign rank test*
Bond Return Weighted by Trade Quantity	0.071682	1.034	0.596	1.236
Bond Return Weighted by Trade Quantity_Winsorized	0.075044	0.987	0.596	1.247
Bond Return Weighted by Square Root of Trade Quantity	0.083955	1.215	0.298	1.473
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	0.087725	1.159	0.298	1.462
Number of Events	45			

Appendix 12D: Test Results by Event Horizon – EH4 (for CHAPTER 4)

Results – EH4 (published in the final quarter of 2018)	*Mean*	*t – test*	*Sign test*	*Sign rank test*
Bond Return Weighted by Trade Quantity	0.026586	0.554	1.357	0.969
Bond Return Weighted by Trade Quantity_Winsorized	0.040108	0.75	1.357	1.097
Bond Return Weighted by Square Root of Trade Quantity	0.032005	0.711	0.754	0.899
Bond Return Weighted by Square Root of Trade Quantity_Winsorized	0.044114	0.879	0.754	0.969
Number of Events	44			