SYSTEMICALLY IMPORTANT BANK BOND FUNDING: IMPLICATIONS FOR FINANCIAL STABILITY

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Agency costs, asymmetric information, bond markets, bond issue spreads, financial stability, financial innovation, flotation costs, foreign banks, major banks, market discipline, private debt, public debt, regulation, reputation, structured notes, systemically important bank, too big to fail.

Abstract

The Global Financial Crisis (GFC) of 2007 and 2008 led to financial instability and unfavourable economic and social outcomes. Following the GFC, large banks were identified as Systemically Important Banks by regulators. If one of these large banks fail it would pose a systemic risk to the stability of the economy. An important function of banks is to issue risky bonds in the capital markets to fund balance sheets. Depending on whether banks issue bonds onshore or offshore, or a traditional bond versus non-traditional bonds, these activities can impact financial stability. Increases in financial instability can occur if banks have large cost of funds advantages over competitors because investors believe these large banks are Too Big to Fail.

This research draws on seminal and empirical research into the choice of debt and changes in regulation since the GFC. Academic literature discusses how agency costs, asymmetric information, market depth, reputation, and costs of issuance motivate firms to issue private or public debt. Literature focuses on private and public debt either issuing in the onshore market or non-financial firms issuing in alternative markets. An overarching problem is that existing literature does not address how bond funding from Systemically Important Banks can contribute to financial instability. This research, using cross-sectional data, analyses bond funding in primary markets across three studies with the objective of answering the following research questions.

1) What role does agency cost, reputation, and flotation cost play in Systemically Important Banks' market choice selection of either Onshore Bond, Eurobond, Foreign Bond, Global Bond, or Yankee Bond, and what are the impacts on financial stability?

2) What influence does agency cost, reputation, flotation cost, and Global Financial Crisis regulatory reforms have on Systemically Important Banks' issuance of unsecured and secured structured notes, and what are the impacts on financial stability?

3) Is there adequate market discipline of the Major Banks in the Australian bond market compared to Foreign Banks, indicating the Major Banks are not Too Big to Fail?

The results of Studies 1 and 2 suggest agency costs, reputation, and costs of issuance have significant relationships with bond market choice and traditional versus non-traditional

bond choices. These can have both positive and negative impacts on financial stability. Interestingly, jurisdictions including Australia can have different economic outcomes. The introduction of regulation after the GFC decreases the likelihood of issuing non-traditional bonds, a positive to financial stability. However banks may be losing the flexibility to issue non-traditional bonds that provide funding diversity and increase profitability, and is counterintuitive to financial stability. The results of Study 3 indicate that the Australian Major Banks experience a subsidy benefit over Foreign Banks. As local regulation is introduced following the GFC, the funding subsidy of the Major Banks did not necessarily decrease, as expected. This may indicate weak market discipline from bond investors and indicate that the Major Banks are Too Big to Fail. This can have a negative impact on financial stability.

Financial stability remains a relevant topic today with the recent bank failures in the United States and Europe. The findings from all three studies make original contributions to the existing literature and provide insights to Australian and developed country regulators setting local and global financial stability policy.

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List of Abbreviations

ADI	Authorised Deposit-Taking Institution
APRA	Australian Prudential Regulation Authority
BASEL III	Third Basel Accord
BCBS	The Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CDS	Credit Default Swap
CRA	Credit Rating Agency
D-SIB	Domestic Systemically Important Bank
FSB	Financial Stability Board
GFC	Global Financial Crisis
G-SIB	Global Systemically Important Bank
IS	Issue Spread
MC	Market Choice
OFFCB	Offshore Covered Bond
OTC	Over the Counter
RBA	Reserve Bank of Australia
SIB	Systemically Important Bank
USN	Unsecured Structured Note

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To the memory of my father, Assoc. Prof. Thomas Kevin Bell (June 1936 to December 2018)

Chapter 1: Introduction

1.1 CHAPTER OVERVIEW

This chapter describes financial stability and banks (Section 1.2) and research questions (Section 1.3). This is followed by a discussion of the research significance and contributions (Section 1.4) and research design (Section 1.5). Section 1.6 concludes with a thesis outline.

1.2 FINANCIAL STABILITY AND BANKS

The Reserve Bank of Australia (RBA) defines a stable financial system as "one in which financial institutions, markets and market infrastructures facilitate the smooth flow of funds between savers and investors. This helps to promote growth in economic activity" (RBA, 2023b). Financial instability can result in asset price volatility, investor loss of confidence, and fragility in financial institutions. This impedes or even stops the "flow of funds" within the economy. The Global Financial Crisis (GFC) of 2007 to 2008 was an example of financial instability at its extremity, with the collapse of investment bank Lehman Brothers Holding Inc. (Lehman) and an ensuing global recession.

A bank classified as a Systemically Important Bank (SIB) is an institution that is Too Big to Fail. SIBs are required to hold more capital and are more stringently supervised than other banks because any future failure in these institutions could harm financial stability (FSB, 2019). To understand the impact of bond funding choices on financial stability, this research focuses on SIBs from developed countries that have the largest impact on global financial markets and the global economy. This is opposed to non-financial corporates, non-bank financial corporates or SIBs from developing or emerging markets.

Banks are financial institutions, and crucially act as intermediaries converting short-term deposits from customers into longer-term loans. Any deficit in funds from savers to provide credit to customers can be overcome by issuing bonds in capital markets. Banks, and the bonds issued by banks, have a role to play in financial stability. The entire system relies on confidence that banks will repay their obligations and borrowers will repay their loans. Bonds are fixed income securities whereby the investor (lender) provides funding to the issuer (borrower), typically in exchange for regular coupon payments and the repayment of the principal at maturity date. Traditional bond[1] bank funding is a long-term liability for an issuer, and from an investor perspective, bonds can provide income certainty through coupon payments more so than discretionary dividends from shares (PIMCO[2], 2022).

Banks, through bond funding, influence the degree of financial stability, either positively or negatively. Excessive offshore bond funding creates refinance risks if offshore investors do not reinvest upon maturity in times of markets stress, increasing the potential for instability (Bellrose & Norman, 2019). On the other hand, increased onshore funding (where the brand is stronger relative to offshore funding) is positively related to financial stability. In Australia, the shortfall in onshore savings results in higher offshore funding relative to other countries (RBA, 2002). The motivation to choose offshore funding for issuers is aided by the globalisation of financial markets and technological advances in real time information and settlement systems. Turner and Nugent (2015) raise concerns regarding the financial stability of the four largest Australian banks, known as the "Major Banks"[3], due to their large use of offshore bond markets compared to onshore. A motivation for this research is to better understand Australian bank bond funding behaviours relative to other countries.

There are alternative types of funding compared to traditional bonds. Hybrid securities are tailored and complex securities that offer exposure to markets unavailable through traditional bonds (Henderson & Pearson, 2011; Telpner, 2004). The issuance of hybrid securities by banks can improve funding diversity and reduce the cost of funds, which improves financial stability (Crabbe & Argilagos, 1994). These hybrid securities, as a form of non-traditional finance, embrace the positives of financial innovation. However, in times of market stress, they have more market risk than traditional bonds due to volatility in the underlying linked assets and illiquidity of the securities (Crabbe & Argilagos, 1994). This can decrease financial stability. The RBA (2018) notes that subprime mortgage lending and complex securities referencing subprime mortgages were a main cause of the GFC, and yet do not

[1] In this thesis, the term "bond" is generic and can mean either long-term bonds or notes issued by the borrower. Bond characteristics such as principal, maturity, and price are agreed at the transaction date and do not vary. The risk that an issuer may fail to pay an investor is termed credit risk, and the investor demands a default premium to compensate for this risk.

[2] The world's largest fixed income fund manager.

[3] Australia and New Zealand Banking Group Limited (ANZ), Commonwealth Bank of Australia (CBA), National Australia Bank Limited (NAB), and Westpac Banking Corporation (WBC) regulated by APRA as Authorised Deposit-Taking Institutions in accordance with the Banking Act.

specifically mention unsecured structured notes such as hybrid securities and secured covered bonds, which are captured under capital market non-traditional finance (Jobst, 2007).

A priority following the GFC was to end the moral hazard of taxpayer bailouts of banks considered to be Too Big to Fail (FSB, 2022; USC, 2010). Institutions labelled Too Big to Fail decrease financial stability as these institutions can take excessive risks knowing they will be bailed out by regulators if they fail. Regulators, and bond investors through bond pricing, can employ market discipline. The goal of market discipline is to ensure financial firms do not take excessive risk (Flannery & Bliss, 2018). Banks that are Too Big to Fail can lead to weak market discipline from bond pricing and lax regulatory supervision of banks, decreasing financial stability.

1.3 RESEARCH QUESTIONS

The existing corporate finance literature focuses on funding choices between issuing private and public debt. Onshore and offshore bond markets present different options for bank issuers, and these include funding diversification through access to new investors, increased maturity tenor, and greater sophistication of bond products (Black & Munro, 2010). These markets offer choices between non-public[4] debt and public debt. Cost considerations, including cost of funds at issuance impacted by credit rating, market conditions, and flotation costs (Blackwell & Kidwell, 1988) impact the selection of these markets. Seminal work from Myers (1977) outlines the conflict between shareholders and bondholders, and how this conflict can be reduced by the selection of private debt. Incentive problems can impact funding decisions; however, Diamond (1989) demonstrates that these can be overcome with enhanced reputation. Myers and Majluf (1984) find that several types of debt funding are impacted by imbalances in information between borrowers and lenders, known as asymmetric information. To reduce these problems, empirical research (Black & Munro, 2010; Denis & Mihov, 2003; Esho et al., 2001; Fuertes & Serena, 2018; Johnson, 1997; Krishnaswami et al., 1999; Tawatnuntachai & Yaman, 2008) reveals that private debt is preferred to public debt. However, the literature is yet to examine bond market choices of banks in Australia and other developed countries. To address this gap in the literature, Study 1 analyses the relationship between agency costs,

[4] Not strictly private debt like a bank loan and not strictly public debt like a Global Bond.

reputation, and flotation costs on decisions to issue in onshore and offshore bond markets for Australian, Canadian, European, and United States banks. The aim is to answer **Research Question 1:**

What role does agency cost, reputation, and flotation cost play in Systemically Important Banks' market choice selection of either Onshore Bond, Eurobond, Foreign Bond, Global Bond, or Yankee Bond, and what are the impacts on financial stability?

Financial innovation in the derivative and bond markets over the last few decades has enabled banks to manufacture and structure securities that include a risk transfer using derivatives or a synthetic version of an underlying asset (Jobst, 2007). Financial innovation has benefits due to the efficiency in risk transfer; however, it increases the fragility of the system (Carter, 1989). The regulatory response following the GFC prioritised financial stability, resulting in the United States Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act). The Dodd-Frank Act reforms increased transparency in derivative markets and abolished the Too Big to Fail notion following the government bailouts of financial institutions during the GFC. The Basel Committee on Banking Supervision (BCBS) released the Third Basel Accord for Capital and Liquidity (Basel III) to build resilience into the banking system. To date, literature on unsecured structured notes has tended to focus on pricing of primary unsecured structured notes (Baaquie et al., 2014; Chiarella et al., 2014; Liao & Hsu, 2009; Lin et al., 2017; Li et al., 2020). Study 2 examines the relationship of agency cost, reputation, and flotation cost from Study 1 and global regulation following the GFC to the selection of issuance of unsecured structured notes versus traditional bonds, and offshore versus onshore covered bonds. The aim of Study 2 is to answer **Research Question 2:**

What influence does agency cost, reputation, flotation cost, and Global Financial Crisis regulatory reforms have on Systemically Important Banks' issuance of unsecured and secured structured notes, and what are the impacts on financial stability?

The Major Banks dominate the Australian banking market share and hold more than 80 percent of the total of Authorised Deposit-Taking Institution (ADI) housing loans (APRA, 2022). The Major Banks have a subsidy over Foreign Banks[5] in the Australian bond markets, which can lead to a Too Big to Fail expectation. Major Banks issue bonds in the Australian

[5] Foreign subsidiary banks and branches of foreign banks regulated by APRA as Authorised Deposit-Taking Institutions in accordance with the Banking Act.

marketplace to fund balance sheet growth and benefit from a competitive advantage over rivals, as issue spreads are at a discount. Bond investors employ market discipline in bond pricing. Flannery (2001) states that market discipline should follow regulatory efforts and specifies market discipline as an investor's ability to monitor bank conditions. Flannery and Bliss (2018) indicate that the purpose of market discipline is to moderate disproportionate risk-taking by financial institutions. Empirical studies (Balasubramnian & Cyree, 2014; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Sironi, 2003) reveal that the subsidy did in fact decrease after regulatory changes. However, other studies do not find a reduction, which indicates weak market discipline (Acharya et al., 2013; Avery et al., 1988; Morgan & Stiroh, 2005). Santos (2014) suggests that larger banks support the Too Big to Fail theory. Empirical studies that examine bond market discipline in Australia are scarce, except for Cummings and Guo (2020), who find that the impacts of Basel III capital changes reduced the Major Banks Too Big to Fail bond funding subsidy by half compared to other Australian-owned banks. Study 3 analyses the market discipline of bond investors, as captured in the issue spread of Major Banks and Foreign banks, as banking conditions change. The results of Study 3 will indicate if the Major Banks subsidy over Foreign Banks implies that the Major Banks are Too Big to Fail. The aim is to answer **Research Question 3:**

Is there adequate market discipline of the Major Banks in the Australian bond market compared to Foreign Banks, indicating the Major Banks are not Too Big to Fail?

The Research Questions 1 to 3 are answered respectively in Chapter 2, Chapter 3, and Chapter 4.

1.4 SIGNIFICANCE AND CONTRIBUTIONS

This year, financial stability risks have increased with the United States bank failures and privately negotiated takeovers of United States and European banks. The selection of SIBs in developed countries in all three studies will advance current literature and ensure market participants and regulators are aware of how bond funding for these important banks influences financial stability policy settings. The contributions Study 1, Study 2, and Study 3 make to the existing literature are discussed in the following paragraphs.

Study 1 selects a sample of the most active SIBs in onshore and offshore bond markets. The results conclude that there is no statistical difference between a Global SIB (G-SIB) and a

Domestic SIB (D-SIB) in terms of market choices. The results suggest increases in asymmetric information and bond issue size are positively related to financial stability as the likelihood of onshore bonds increases. Conversely, increases to bond maturity tenor and incentive problems are negatively related to financial stability as the likelihood of offshore bonds increases. Advancing the research into the motivating factors for onshore and offshore bond market choices is important because policy regulators and banks as issuers can influence these factors, and in turn their impact on financial stability.

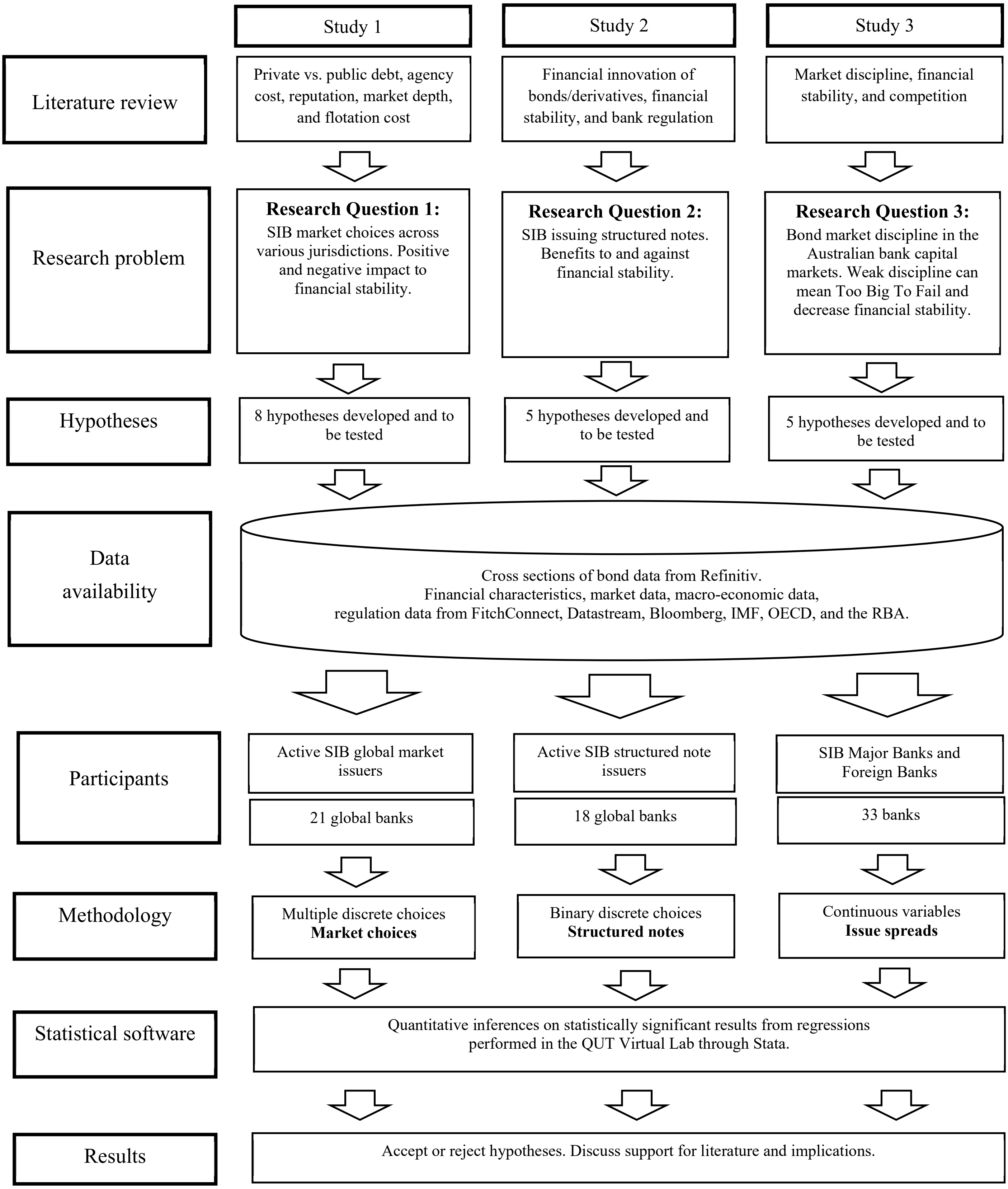
Study 2 outlines the diverse types of over the counter (OTC) unsecured structured notes and standardised secured covered bonds. These securities provide funding diversity and lower the cost of funds for SIBs issuing them. The findings indicate increases in reputation proxies can increase the likelihood of issuing unsecured structured notes compared to traditional bonds, although issuer credit rating has no significant relationship. Increases in agency problems can decrease the likelihood of issuing unsecured structured notes. Increases in agency problems can decrease the likelihood of an issue of offshore covered bond compared to an onshore covered bond in Australia; however, in Canada they can increase the likelihood of offshore covered bonds. As expected, derivative regulation decreases the likelihood of issuing unsecured structured notes; however, interestingly the results are not necessarily uniform for different payoff structures. Liquidity regulation both increases and decreases the likelihood depending on what type of unsecured structured note was issued. The motives of the Basel III and the Dodd-Frank Act were to increase financial stability and protect SIBs against future shocks. However, a possible unintended consequence is the reduction in likelihood of unsecured structured notes that provide funding diversity and increase profitability.

Study 3 examines the subsidy Australian SIB Major Banks have over Foreign Banks in the Australian bond markets. Large subsidies can indicate a Too Big to Fail expectation, and banks that benefit from this expectation can issue bonds at a lower issue spread relative to competitors. Whilst empirical evidence identifies a reduction in the implicit subsidy that banks benefit from following the introduction of regulation, no study to the author's knowledge focuses on the spread subsidy between Australian Major Banks and Foreign Banks as banking regulatory conditions change following the GFC. The results indicate that the Major Bank subsidy to Foreign Banks did reduce following some regulatory initiatives; however, not for others including enforcement initiatives following the Royal Commission and regulatory inquiries following the GFC. This can indicate weak market discipline from bond investors and the notion that Major Banks are Too Big to Fail, and therefore negatively impacts financial stability. It also provides the Major Banks with a competitive advantage in bond funding markets if they are Too Big to Fail.

1.5 RESEARCH DESIGN

Figure 1.1 provides an overview of the three studies and the frameworks that govern them. Each study includes a seminal and empirical examination of the literature, resulting in the identification of the research problems. This is followed by the development and testing of hypotheses relating to the research questions. Data is collected from relevant sources. The computation of discrete dependent variables for Study 1 and Study 2 uses the same data from Refinitiv Eikon (Refinitiv) and active SIB issuers in bond markets and structured notes are selected. Study 3 uses continuous bond issue spreads of Major and Foreign Banks and studies the relationship to changing bank regulatory conditions in Australia. Independent variables for all the studies are sourced from a variety of financial data repositories and government agencies. Regressions were performed in the QUT virtual lab using Stata.

Figure 1.1: Research Design



1.6 THESIS OUTLINE

This thesis comprises three distinct studies that respectively aim to answer the three research questions. The first study is presented in Chapter 2, titled *Global Issuance: Market Choices*. The second study is presented in Chapter 3, titled *The Complex World of Structured Notes: Global Banks and Financial Stability*. The third study is presented in Chapter 4, titled *Market Discipline of Bond Issuance: An Australian Banking Experience*. Chapter 5 concludes the thesis.

Chapter 2: Global Issuance: Market Choices (Study 1)

2.1 INTRODUCTION

This chapter leverages existing theoretical (Blackwell & Kidwell, 1988; Diamond, 1984, 1989, 1991; Myers, 1977; Myers & Majluf, 1984) and empirical research in corporate finance to examine what impacts the bond market choice of global and domestic SIBs in developed countries. SIBs in developed countries intermediate enormous amounts of credit in the global financial system. SIBs use bond funding to support intermediation including credit growth; however, bond funding can contribute to financial instability. This study aims to answer Research Question 1: What role does agency cost, reputation, and flotation cost play in Systemically Important Banks' market choice selection of either Onshore Bond, Eurobond, Foreign Bond, Global Bond, or Yankee Bond, and what are the impacts on financial stability? A motivation is to understand how Australia compares to other countries with regard to onshore versus offshore bond market choices. To the best of the author's knowledge, there are no specific studies on the funding choices of SIBs from different jurisdictions before and following the GFC. This study adopts commonly used proxies to test agency cost, reputation, and flotation cost theories on a sample of SIBs. The dependent variable is a cross-section of bond data sourced from Refinitiv. Financial bank characteristics are sourced from Fitch Connect (Fitch) with local macro-economic and market conditions as control variables. Hypotheses are developed for the bond market choices by banks and tested against each of the proxied variables. The findings indicate what costs are statistically and economically significant in the selection of market choices for global banks, and the impacts on financial stability.

In Australia there are financial stability concerns over the Major Banks' reliance on offshore bond markets (Turner & Nugent, 2015). In times of crisis, offshore investors tend to reinvest in local names rather than with offshore bond issuers. Bellrose and Norman (2019) advise that rollover risk increases for two reasons, firstly due to the "home bias" effect as investors are less likely to reinvest in offshore debt and revert to their onshore home markets, and secondly offshore banks do not have access to central bank liquidity in a crisis in the offshore market they have borrowed in. The rollover risk hypothesis phrased by Gopalan et al.

(2014) is that firms with higher exposure to rollover risk should have a lower credit rating and should have a higher cost of borrowing. However, Gopalan et al. (2014) do not consider the international bond markets or SIBs from different jurisdictions as their sample comprises USD denominated bonds by domestic issuers.

Traditionally, non-bank firms obtained funds from banks, otherwise known as private debt in the form of unsecured loans. Loans are not securities and are therefore not tradeable like bonds. International bond markets developed significantly in the 1980s. Bearer form[6] trading was initially difficult across jurisdictions; however, since the introduction of Euroclear in 1968 and CEDEL in 1970 (which facilitated bond settlements and record keeping of outstanding securities) ownership and transfer of securities is much simpler. Offshore bond funding is important for banks as it facilitates access to more investors, currencies, and bond maturity tenor as onshore local markets can have capacity constraints. Bonds are part of the global fixed income markets with debt outstanding in 2021 recorded at US Dollars (USD) 126.9 trillion comparable to equity markets with global market capitalisation of USD 124.4 trillion in 2021 (SIFMA, 2022).

There are a variety of bond markets a bank can fund in, each market presenting distinct levels of regulation and financial disclosures. A Eurobond refers to a bond issued outside the United States market, and the first trade was in 1963 by Autostrade, an Italian motorway company. Eurobonds follow the rules of cross-border markets and are not subject to the rules of the domestic market. Eurobonds are governed by the International Capital Market Association and are not able to be sold in the United States. Many banks and companies are members of the International Capital Market Association, and issuer members receive support in the international debt markets through best market practice and regulatory guidelines. Eurobond issuers "face the lightest regulatory requirements" and sell mostly to institutional/wholesale investors (Fuertes & Serena, 2018, p. 136). Although many Eurobonds are listed on exchanges due to investor requirements, they are low in liquidity and do not trade as readily as public market bonds. Eurobonds are a form of private placement, but are not strictly a bank loan nor a registered bond in the local market like a Foreign Bond (Esho et al.,

6 In Bearer form trading, the issuer does not know who the investor is. This type of bond is the opposite of registered bonds.

2001). Eurobonds and Foreign Bonds sit between private and public debt offerings, termed non-public bonds in this study.

Alternatively, a Foreign Bond is a registered security and follows the rules of the domestic market. For example, if an Australian bank issues a Yen dominated bond in the Japanese market it is a called Samurai bond. If a European bank issues a Canadian dollar bond in the Canadian market it is called a Maple Bond. Foreign Bonds are sold internationally except in the United States[7] and avoid registration with the Securities and Exchange Commission (SEC) under Regulation S of the Securities Act 1933.

Non-United States banks issuing USD denominated bonds in the United States market are referred to as Yankee Bonds (for example, when a Canadian bank issues bonds in the United States and registers with the SEC). Yankee Bonds are more liquid than Eurobonds and Foreign Bonds due to the fact they are registered with the SEC and can be sold to institutions and retail individuals. Global Bonds are registered and sold at the same moment in two different markets. Global Bonds are a standardised security and are liquid and traded readily. Global Bonds have the strictest disclosure requirements with one tranche typically issued in the United States market and the other elsewhere, for example the Eurobond market (Fuertes & Serena, 2018). Yankee Bonds and Global Bonds are defined as public markets (Fuertes & Serena, 2018).

This chapter proceeds as follows. Section 2.2 provides an extensive literature review, and Section 2.3 outlines the bank selection in addition to the composition of the dependent and independent variables. Section 2.4 discusses the econometric approaches for multiple discrete dependent variable choices. Section 2.5 reports and discusses the results, and Section 2.6 performs robustness checks to validate the original results. Section 2.7 concludes the chapter, and Section 2.8 provides the chapter-specific appendix.

2.2 LITERATURE REVIEW: CORPORATE DEBT FINANCING

This section provides an overview of theories related to the selection of private and public debt, namely agency cost and reputation (Section 2.2.1), asymmetric information and pecking order theory (Section 2.2.2), market depth (Section 2.2.3), and flotation cost (Section 2.2.4). Section 2.2.5 examines the empirical research to date, revealing a lack of research regarding

[7] Unless a US144A bond is issued, which can be sold in the United States market under certain restrictions.

the onshore and offshore debt market choices for SIBs, which has financial stability implications for SIBs.

2.2.1 Agency Cost Hypothesis and the Reputation Hypothesis

The agency relationship involves a party (the agent) receiving authority from another party (the principal) to act on the principal's behalf. Jensen and Meckling (1976) note that the agent and principal are utility maximisers and suggest that the agent will act in their own best interests, and not that of the principal. This is known as the agency problem and occurs when there is asymmetric information. Asymmetric information describes the situation where one party has more information than the other party. This is evident in a firm with shareholders and management employees. One could expect that with proper incentives from the shareholders (principal) and management (agent), the agent will act in the best interests of the principal; however this is not necessarily guaranteed. Conflicts arise and agency costs are incurred to resolve the incentive problem.

Agency costs can be tangible. Shareholders can implement incentives to reduce this conflict, such as financial incentives including long-term stock bonuses awarded to management if certain firm hurdles are met. In the debt capital markets, underwriter costs to sell public debt are higher than private debt markets, and private market agency problems cost less to resolve than public markets (Blackwell & Kidwell, 1988). Agency costs can also be intangible. An example could be management not investing in valuable projects that shareholders believe would increase the value of the firm; this is referred to as the underinvestment problem (Myers, 1977). The underinvestment problem occurs if the benefits are to bondholders rather than shareholders. The asset substitution problem (Jensen & Meckling, 1976) occurs when managers choose higher risk projects, where the wealth benefits transfer from bondholders to shareholders. Diamond (1984, 1991) finds these incentive problems can be limited by increased monitoring. Myers (1977) believes monitoring through private rather than public debt best serves to mitigate these incentive problems.

Krishnaswami et al. (1999) advise that a firm's market value relative to book value to proxy for investment or growth opportunities increases with more growth options as intangible assets are not included in the book value of assets. Some studies find a significant positive relationship between market to book value and private debt selection (Johnson, 1997; Khang et al., 2016; Krishnaswami et al., 1999), while others do not (Barclay & Smith, 1995; Denis & Mihov, 2003; Esho et al., 2001). Antoniou et al. (2008) study private and public debt choices for United Kingdom and German listed non-financial firms and note country differences and an inverse relationship between private debt and growth opportunities for United Kingdom firms. Interestingly, large global banks may suffer from these agency costs in different jurisdictions.

Bond agency costs arise when lenders, or bondholders of the firm, are concerned about management engaging in risky activity to benefit shareholders and not bondholders. Bondholders do not have control of their invested funds and will not receive any upside from riskier projects as their bond transaction and price were previously agreed, whereas shareholders can receive upside from riskier projects, incentivising management (the agent) to invest in these projects. Any potential downside in the project is borne by both parties. Bondholders can minimise the agency problem by inserting covenants in the bond contract at the transaction date and instructing how their debt funds are to be used by management. Smith and Warner (1979) advocate that covenants should be added to debt contracts to protect bondholders; however, many are impractical for the agent to execute. Berlin and Loeys (1988) study a bond contract and a loan contract and find covenants to be either too harsh or too lenient, creating inefficiencies. However, a trade-off exists to balance the covenant inefficiencies with the costs of employing a bank as a delegated monitor. Restrictive covenants and credit monitoring are better at reducing agency costs between borrowers and bondholders, especially for risky borrowers that experience agency costs like asymmetric information. SIBs may not use covenants as much as riskier corporates because SIBs' credit ratings are normally higher, they are closely supervised by regulators, and maintain minimum levels of capital and liquidity. Jensen and Meckling (1976) advise that all the costs associated with provision writing and enforcing covenants are known as monitoring costs. Bondholders bear these costs when they agree that the contractual terms and ongoing costs of covenants are incurred by the issuer; therefore, the issuer's management seek to minimise these costs.

The incentive problem in debt capital markets, as outlined by Baron (1979), specifies a misalignment of best interests between the issuer and the investment banker, and when misaligned, the banker can act to suit their own agenda. Banks use underwriters to place debt in bond markets. To resolve this incentive problem, Diamond (1984) examines delegated monitoring and the delegated costs when using a financial intermediary for a direct lender and borrower situation. Diamond (1989) finds that borrowers with a shorter history rather than a longer history can be impacted by larger incentive problems. Adverse selection is impeded by a shorter track record or lower reputation and is therefore higher for high growth firms substituting higher for lower risk projects. So how does this impact issuers in multiple bond markets?

Esho et al. (2001), in a study of Asian firms (Japan and non-Japan) in four market choices of Eurobonds, Foreign Bonds, syndicated loans[8], and a small number of bank-guaranteed international bonds, advise that firms with greater incentive problems will receive more value from monitoring and will prefer private debt markets (Diamond, 1984, 1989, 1991; Rajan, 1992). Adverse selection refers to asymmetric information prior to an issue of a bond in which the borrower holds superior information over investors. Borrowers with a longer track record have lower incentive problems that do not incur adverse selection. Adverse selection reduces over time as the borrower's good reputation (i.e., a long record of repaying debt without a default) serves to reduce and potentially eliminate the conflict. Diamond (1991) investigates borrowers sourcing funds directly in the debt securities market without monitoring as opposed to from a bank with monitoring. The interaction between monitoring and reputation reveals that moral hazard can be limited when reputation replaces the function of bank monitoring. Firms with higher credit ratings do not require monitoring because they must maintain this credit rating to preserve greater present value of future profits. Arena (2011) and Johnson (1997) use firm age as a proxy for reputation, supporting the findings of Diamond (1989, 1991) with a positive (negative) relationship with higher proportions of public (private) debt. Khang et al. (2016) find firm age to have a negative relationship for non-bank private debt versus bank loans, and a positive relationship for public debt versus non-bank private debt.

Denis and Mihov (2003) argue that higher leverage, which is more debt relative to equity, indicates more access to debt markets, and therefore an enhanced reputation. In the period from 1995 to 1996, Denis and Mihov (2003) find that credit quality is the main factor explaining the 1,480 United States non-financial firms' choices between bank debt, non-bank debt, and public debt. High quality firms preferred public debt, medium quality firms preferred bank debt, and low-quality firms preferred non-bank debt. Consistent with Diamond (1991), in their study of

[8] Syndicated loans comprise a group of bank lenders and are typically arranged by a bank lead manager with bank co-managers.

non-financial United States firms from 1972 to 2002, Hale and Santos (2008) identify a U-shaped relationship with a firm's reputation. Firms that enter the public bond market on the first occasion have high or low reputation records, and firms entering on subsequent occasions have medium reputation records. Esho et al. (2001) find that rises in book value long-term debt to total debt for non-financial Japanese and non-Japanese firms from 1989 to 1998 indicates an increased probability of Eurobond and Foreign Bonds, and a decreased probability for private syndicated loans. This supports the seminal theories previously discussed in this section.

In investment grade global fixed income markets, it is common for issuers to use credit ratings as a proxy for a borrower's reputation. A Credit Rating Agency (CRA) can reduce asymmetric information between issuers and investors. Sophisticated wholesale investors rely on CRAs to meet with the senior management of issuers and deliver periodic in-depth credit analysis at the issuer and the bond level. CRAs use a set criterion for ratings, and each agency has their own criteria. The rating methodologies of the CRAs are comparable and investors can rely on one or more CRA. Moody's Investors Service (Moody's) uses a forward-looking Baseline Credit Assessment scorecard. This process analyses the macro profile in which the bank operates, the bank's financial profile, and qualitative judgement to achieve a standalone rating and probability of failure. The baseline rating is then adjusted for any affiliate support, loss given failure including any bank resolution with bail-in and levels of subordination to absorb losses, and any government support. The result is the final credit rating (Moody's, 2019). A range of empirical studies test the long-term bond credit rating (Arena, 2011; Esho et al., 2001; Fuertes & Serena, 2018; Kwan & Carleton, 2010; Tawatnuntachai & Yaman, 2008), revealing a positive relationship between higher credit ratings and public debt markets. SIBs use bond credit ratings more for public markets and less for non-public bond markets.

For all their good in reducing asymmetric information between issuers and investors, CRAs have received criticism from market practitioners and regulators for the role they played in the GFC. The CRAs were discovered to have inadequacies in their models that assigned complex bond securities the highest credit ratings[9], and the CRAs conflicted analyst and fee models that made the agencies beholden to investment banks. Arena (2011) measures reputation by the firm characteristic return on assets, an indicator of profitability for non-

[9] The higher and less subordinated tranches of CDOs prior to the GFC were rated triple A (or Aaa). Aaa for Moody's are obligations "judged to be of the highest quality and are subject to the lowest level of credit" (Moody's, 2022, p. 1).

financial United States firms from 1995 to 2003. The results indicate that a higher return on assets increases the probability of public and US144A[10] debt, and decreases the probability of a private loan, supporting the seminal works of Diamond (1989, 1991).

Rajan (1992) extends the work of Myers (1977) and Diamond (1991) by analysing the relationship between debt type and growth opportunities, indicating that banks perform rent extraction as they exert control over firm investment projects. Banks can have sway over running of the firm and impact the owner(s) incentive to exert effort. This represents a significant cost to debt and lowers project return. Rather than a firm using private bank debt exclusively and experiencing this issue, firms that fund in both private and public markets reduce this control and can achieve a balanced cost of funds. Therefore, a firm should balance their funding profile with both private and public debt.

2.2.2 Asymmetric Information and the Pecking Order Theory

Asymmetric information can have an impact on the capital choices firms make. Myers and Majluf (1984) discuss how asymmetric information impacts a firm's issue-invest decision, known as the Pecking Order Theory. Myers and Majluf (1984) examine the issue-invest choice and base capital market decisions on investment opportunities that have a positive net present value. The preference is to favour internal cash through higher earnings rather than external, and if external finance is selected then debt is preferred before new equity. Undervalued firms with asymmetric information will prefer debt before equity because debt is less informationally sensitive than equity (Gomes & Phillips, 2012). The problems of adverse selection impact the debt finance decision. Flannery (1986) argues that a certain bond maturity decision may signal inside information to the market and addresses the relationship between asymmetric information and a risky debt's preferred maturity. Adverse selection is mitigated by a shorter-term debt (Myers, 1977) because there is less time for shareholders to exploit riskier projects at the potential expense of bondholders. At its extreme during the GFC, asymmetric information was present between investment bankers selling collateralised debt obligations to unsuspecting investors. Investors appeared to rely more on the high bond credit rating, and

[10] In 1990, the SEC allowed non-United States firms to issue debt in the United States as unregistered issues to be sold only to wholesale investors. These debt issues do not face the same regulation as registered SEC bonds. The legislation introduced was called Rule US144A (Fuertes & Serena, 2018).

bankers exploited this, particularly in 2005 and 2006 knowing many of the assets were of inferior quality.

Gomes and Phillips (2012) show that a significant driver for debt selection of public and private equity, convertible securities, term loans, and revolving credit lines is the presence of asymmetric information. Although asymmetric information impacts private and public choices in separate ways, as well as risk and market timing, Gomes and Phillips (2012) find a positive relationship between asymmetric information and the choice of private over public debt. Kwan and Carleton (2010) indicate that non-financial firms select the choice that minimises borrowing costs from a sample of privately placed US144A bonds and public offered bonds from 1985 to 1994. A firm with higher information asymmetries will use covenants more heavily to reduce agency problem. Kwan and Carleton (2010) identify more restrictive debt covenants in private placement bonds than public bonds. Johnson (1997) notes that earnings growth volatility has a negative relationship with public debt. In a more comprehensive set of dependent variables of bank loans, US144A private placements, and other privately placed bonds, Arena (2011) reveals that highly rated firms prefer public bonds with good credit ratings that are constrained by size, and firms that suffer from asymmetric information and fixed issuing costs prefer private placement bonds. Moderately rated firms prefer loans, and poor credit quality firms prefer US144A bonds. These studies confirm the Pecking Order Theory of Myers and Majluf (1984).

Krishnaswami et al. (1999), in a study of 297 United States non-financial firms, conclude that increases in unexpected future earnings and future abnormal earnings, as asymmetric information proxies, have no support in cross-sectional data and limited support in a pooled regression for a positive relationship with private debt. Khang et al. (2016) find evidence that firm factors and economic variables play a vital role in the selection of US144A debt, bank loan, and public debt in the overall corporate debt mix. Earnings volatility for investment firms is not significant, and there is a positively significant relationship in speculative firms for non-bank and public funding versus bank loans.

Fuertes and Serena (2018) examine the issuance of Global Bonds, US144A bonds, and Eurobonds from emerging markets from 2000 to 2014. The results indicate that smaller and lower credit quality firms prefer US144A and Eurobonds because of lower regulation costs and greater information asymmetries. The opposite is true of larger firms and Global Bonds. Gao

(2011) examines the impact of the introduction of the Sarbanes-Oxley Act[11] on foreign non-financial firms regarding the issue choice of Yankee, Eurodollar, and US144A bonds. The results indicate that foreign firms are less likely to issue a Yankee Bond following the Sarbanes-Oxley Act due to the increased costs, and any issuance of a Yankee Bond is from United States listed firms or adopters of IFRS (as both of these reduce asymmetric information) or issuers of larger bond sizes. Tawatnuntachai and Yaman (2008) find that the issuance of Global Bonds over Onshore Bonds from 1995 to 2001 is preferred when the onshore economy is weak, offshore reputation is good, and bond sizes are larger for United States industrial firms.

2.2.3 Market Depth Hypothesis

Firms issue bonds in onshore markets as they are well known to investors and asymmetric information tends to be lower compared to offshore investors. Mizen et al. (2012) explain the market depth hypothesis as a limited onshore market that can motivate a firm to access offshore markets for greater bond size and bond tenor. The results of Mizen et al. (2012) support the market depth hypothesis based on data from Asian emerging markets from 1995 to 2007, but yield mixed results supporting the pecking order theory of Myers and Majluf (1984), in which onshore markets are preferred to offshore markets. Black and Munro (2010) examine the motivations for firms to use offshore bond markets for non-government Asia-Pacific investors from 1992 to 2009, including Australian banks. Onshore market size restrictions exert a positive and significant relationship on offshore markets for Australia, Hong Kong, Korea, and Singapore, indicating that offshore markets provide increased liquidity and diversity for issuers. Research on emerging market economies reveals that limited borrowing in onshore bond markets resulted in increased offshore bond issuance following the GFC. Emerging market economies use bond markets when external conditions are favourable (Serena & Moreno, 2016). An extended study from 1990 to 2016 of East Asian emerging markets by Abraham et al. (2021) examines the growth of onshore and offshore bond markets. The findings indicate Onshore Bond participation increased and the share of onshore currency debt increased

[11] The Sarbanes-Oxley Act of 2002 is a law that was passed in response to financial scandals such as Enron and WorldCom. The law establishes new, stricter standards for all US publicly traded companies. It does not apply to private companies. The Act is administered by the SEC: https://www.sox-online.com/the-sarbanes-oxley-act-summary/

relative to offshore post the GFC due to supply-side onshore investors rather than demand-side onshore issuers.

2.2.4 Flotation Cost Hypothesis

Blackwell and Kidwell (1988) describe flotation costs as fees paid to bankers to sell debt and other out-of-pocket expenses. In non-private markets underwriters are responsible for sourcing investors and arranging the primary issue of the debt. The underwriters also support secondary trading if the market is liquid enough and can warehouse debt. The out-of-pocket expenses include accounting and tax fees, legal fees, listing fees, custodial fees, and credit rating fees. In the United States public bonds are registered with the SEC and private placement bonds are not. Blackwell and Kidwell (1988) note that fees to bankers increase as the number of investors increases, known as increased search costs, so public bond banker fees are more costly than private bonds. These fees have a significant fixed component, so for public issues there are economies of scale for issuers typically due to their larger issue size. Previous research (Antoniou et al., 2008; Blackwell & Kidwell, 1988; Denis & Mihov, 2003; Esho et al., 2001; Fuertes & Serena, 2018; Johnson, 1997; Krishnaswami et al., 1999; Tawatnuntachai & Yaman, 2008) uses bond issue size and firm size as proxies for flotation costs, and Krishnaswami et al. (1999) use firm size and average debt issue size. Arena (2011) uses firm size only. These studies all identify positive relationships with issuance in public markets versus private markets for bond size and firm size due to economies of scale.

Blackwell and Kidwell (1988) classify firms on a dataset from 1979 to 1983 as *switch hitters* that move between private placement and public debt markets versus *nonswitch hitters* who do not move between these two markets. The lowest transaction costs drive the borrowing market choice. More specifically, elevated search costs and instability in interest rates drive *switch hitters* to private placement markets, whereas an environment of stable rates and lower search costs encourage *switch hitters* to select public bond markets. For *nonswitch hitters* elevated agency and flotation costs drive these firms to borrow in private markets.

2.2.5 Gaps in the Empirical Research

Corporate finance and seminal research largely focuses on the corporate debt choice of private debt and public debt. A range of seminal theories (Diamond, 1984, 1989, 1991; Jensen

& Meckling, 1976; Myers, 1977; Myers & Majluf, 1984; Rajan, 1992; Smith & Warner, 1979) that influence corporate debt choice have been tested through empirical studies over the past 40 to 50 years. Empirical studies to date have targeted emerging markets (Abraham et al., 2021; Esho et al., 2001; Fuertes & Serena, 2018; Mizen et al., 2012; Serena & Moreno, 2016) or United States firms (Arena, 2011; Gao, 2011; Gomes & Phillips, 2012; Krishnaswami et al., 1999; Kwan & Carleton, 2010; Tawatnuntachai & Yaman, 2008). Emerging market research focuses on Asian countries and United States non-financial firms. While Black and Munro (2010) sample Australia with other Asian countries, no study to date has considered SIB bond choices pre and post the GFC in developed country jurisdictions. Much of the empirical research on debt choices focuses on private loans, US144A bonds, Eurobonds, Global Bonds, Yankee Bonds, Onshore Bonds, and combinations of these.

None of the research to date has employed four to five bond market choices comprising Onshore Bonds. This is not surprising because the jurisdictional studies are mostly conducted in the United States for non-financial firm issuers. SIBs were identified in 2013. However, this does not suggest that prior to 2013 there were not systemic risks from these banks. SIBs are listed, regulated, and have investment grade credit ratings. Based on this one could argue that agency problems are not as relevant. Asymmetric information between SIBs and investors is lower because of continuous disclosure rules on stock exchanges, and Pillar 3 disclosures from SIBs. Furthermore, SIBs could be considered to not require monitoring because they must maintain an investment grade rating to preserve greater present value of future profits for reputational reasons (Diamond, 1991). However, SIBs in different jurisdictions have varying levels of information symmetry and growth opportunities as evidenced by Figure 2.7 in the chapter appendix. SIBs' debt choices are untested as reputation reduced following CRA bank credit rating downgrades and loss of confidence in CRAs. SIBs are *switch hitters* and try to achieve economies of scale with transaction costs, and Blackwell and Kidwell (1988) sample only utility firms, and not banks. Therefore, one can postulate that research to date on the relationship of agency costs, reputation, and flotation costs on SIB bond market choices is not substantive. This study tests this gap in the literature with a particular focus on Australian bank market choices.

2.3 BANK SELECTION AND DATA

2.3.1 Sample of Systemically Important Banks

The focus of this study is long-term bond market choices of SIBs in developed countries over the sample period 1 January 1999 to 31 December 2019. Banks were selected using the following process. In Step 1, the largest 100 banks by USD total assets were identified (see Table 2.12 in the chapter appendix in Section 2.8). This included 74 banks from developed countries[12]. A total of 26 banks from developing countries (including China, India, Russia, Brazil, and Qatar) were excluded. In Step 2, each of the 74 banks had to be active issuers in the global bond markets over the observation period. Each bank had to have issued at least five[13] times in the five[14] bond markets. Table 2.13 lists the qualified and unqualified banks. In Step 3, each bank in the sample had to be publicly listed, have a long-term credit rating, and financial statements for the observation period that demonstrated a record of performance. In Step 4, each selected bank had to be classified as either a D-SIB or G-SIB entity, this is based on an assessment methodology by the Financial Stability Board (FSB). Both classifications require these banks to hold more capital and are subject to higher levels of supervision than regular banks. This reduced the sample to 21 banks as the Japanese, South Korean, and Singapore Banks did not qualify for the study due to inactivity issuing in Global Bond and Yankee Bond markets. The three G-SIB Japanese banks only issued three times in aggregate in the Yankee Bond market, and the four D-SIB Japanese banks did not issue in the Yankee Bond and Global Bond markets. The South Korean and Singapore banks did not issue a Yankee Bond and two South Korean banks issued in total between them three Global Bonds.

Table 2.1 outlines the sample of 21 banks selected for Study 1. The collation of parent and subsidiary tickers into a universal ticker, jurisdiction, and systemic importance were manually added.

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[12] Today, the largest offshore bank issuers are from developed countries. Outstanding offshore fixed income securities for Australia is USD 296 billion, Canada USD 455 billion, Japan USD 287 billion, United Kingdom USD 1,360 billion, United States USD 505 billion, and larger European countries such as the Netherlands USD 690 billion, France USD 541 billion, and Germany USD 380 billion (BIS, 2022).

[13] A minimum in the variation of bond choices is crucial for the validity of the subsequent econometric methodologies (Schwab, 2002).

[14] Four for the United States banks because the Yankee Bond market is the Onshore Bond market.

Table 2.1: Sample of Largest Banks by Total Assets

Bank name	Ticker	Country	Jurisdiction	Total assets (USD billion)	Importance
BNP Paribas	BNP	France	Europe	2,429.26	G-SIB
Societe Generale SA	SG	France	Europe	1,522.05	G-SIB
Deutsche Bank	DEUT	Germany	Europe	1,456.26	G-SIB
Banco Santander	SANT	Spain	Europe	1,702.61	G-SIB
Credit Suisse Group AG	CREDS	Switzerland	Europe	812.91	G-SIB
Svenska Handelsbanken AB	SHB	Sweden	Europe	328.59	D-SIB
Barclays PLC	BAR	United Kingdom	Europe	1,510.14	G-SIB
Lloyds Banking Group PLC	LLOYDS	United Kingdom	Europe	1,104.42	D-SIB
Natwest PLC	NATW	United Kingdom	Europe	957.60	D-SIB
JP Morgan Chase	JP	United States	United States	2,687.38	G-SIB
Citigroup Inc.	CITI	United States	United States	1,951.16	G-SIB
Wells Fargo	WF	United States	United States	1,927.26	G-SIB
Morgan Stanley	MS	United States	United States	895.43	G-SIB
Goldman Sachs	GS	United States	United States	992.97	G-SIB
Royal Bank of Canada	RY	Canada	Canada	1,116.31	G-SIB
Scotiabank	BNS	Canada	Canada	872.62	D-SIB
Toronto-Dominion Bank	TD	Canada	Canada	1,102.04	G-SIB
Canadian Imperial Bank of Commerce	CIBC	Canada	Canada	495.99	D-SIB
Commonwealth Bank	CBA	Australia	Australia	688.4	D-SIB
National Australia Bank	NAB	Australia	Australia	571.34	D-SIB
Westpac Banking Corp	WBC	Australia	Australia	611.47	D-SIB

The table lists the sample of Systemically Important Banks (SIBs) selected for Study 1, including the bank name, ticker, country of the parent company, jurisdiction, book value of total assets (in USD as at 2020), and whether the bank is a domestic (D-SIB) or global SIB (G-SIB). Sources: S&P Global Market Intelligence, FSB, and local regulators.

Cross-sections of transaction level issued bond trades from the selected banks were sourced from Refinitiv. Advanced corporate bond searches were completed for each of the banks for the active and inactive bonds with an issue date between 1 January 1999 and 31 December 2019. The year 2020 was excluded due to the global COVID-19 pandemic that significantly impacted issued bond trades for global banks. The issuer[15] and subsidiaries in Refinitiv were selected to capture bonds on a consolidated basis to match the consolidated bank financial characteristics of each bank. Bond size amounts less than USD 5 million were excluded to limit the non-wholesale market size parcels and "blank" bond size amounts. Figure 2.1 charts the sum of all bond sizes for the sample of global banks selected. Table 2.14 outlines the search template. The observation period incorporates the introduction of the euro currency in 1999, the GFC of 2007 to 2008, the European Sovereign Debt Crisis, Brexit, and the regulatory reforms of the Dodd-Frank Act and Basel III.

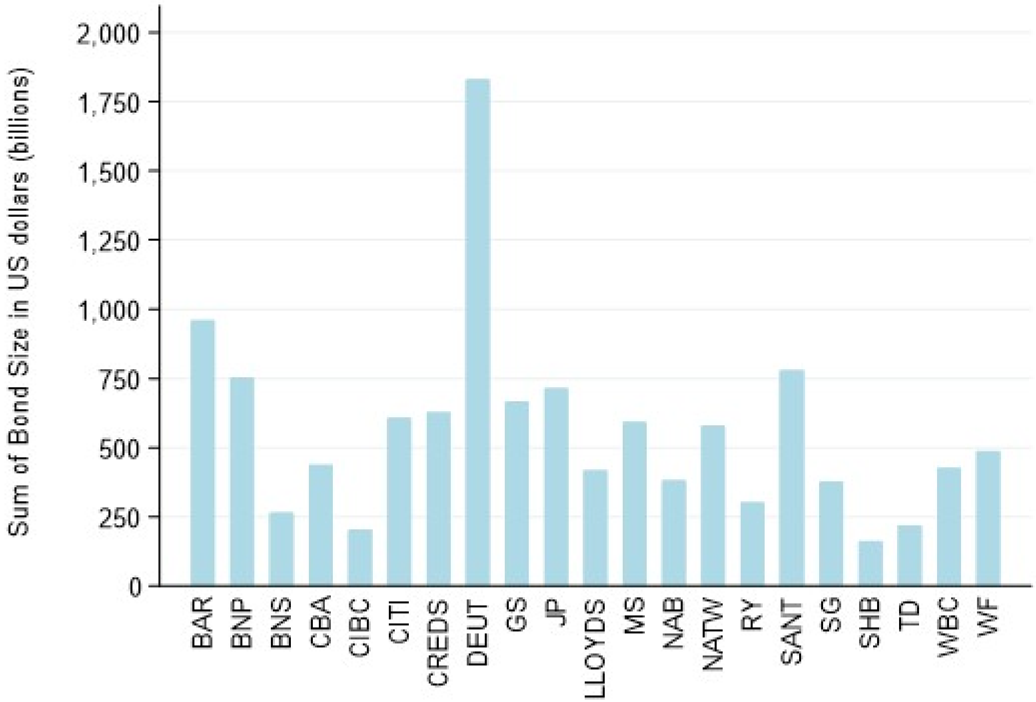
The data extracted for each bond choice included 119 fields of bond static data. Bonds with no fixed maturity date and short-term bonds less than one-year in bond maturity tenor were excluded (Arena, 2011; Gomes & Phillips, 2012). Sukuks[16] were excluded; however, convertibles, callable, extendible, sinking funds, and putable bonds were included as these can reduce asymmetric information between issuers and investors. Parent and subsidiary issuing entities were both included as some banks did most of their borrowing through their subsidiaries. The focus of the study is banks, and therefore the sectors *Banking* and *Mortgage Banking* were included and other sectors[17] were excluded.

[15] Some issuer market choices had to be excluded prior to the institutions being acquired by one of the 21 selected banks, many at the time of the GFC. The issuers impacted were Abbey National International Ltd., Alliance and Leicester Ltd., Bank of Scotland Ltd., Fortis, GE Money Bank Gmbh, and Banca Nazionale del Lavoro.

[16] Sukuks are a sharia-compliant bond-like instrument used in Islamic finance that is not interest bearing (Investopedia).

[17] These sectors include Financial – Other; Food Processors; Home Builders, Leasing; Life Insurance; Oil and Gas; Property and Casualty Insurance; Real Estate Investment Trust; Securities; Service – Other; and Utility – Other.

Figure 2.1: Sum of Bond Size (USD reported by Refinitiv) by Individual Banks from 1999 to 2019 in the Study 1 Sample. Source: Stata, Refinitiv.



The figure charts the total issuance of bond size amounts in USD for each of the twenty-one Systemically Important Banks (SIBs) selected for Study 1. The SIBs are Barclays PLC (BAR), BNP Paribas (BNP), Scotiabank (BNS), Commonwealth Bank (CBA), Canadian Imperial Bank of Commerce (CIBC), Citigroup Inc. (CITI), Credit Suisse Group AG (CREDS), Deutsche Bank (DEUT), Goldman Sachs (GS), JP Morgan Chase (JP), Lloyds Banking Group PLC (LLOYDS), Morgan Stanley (MS), National Australia Bank (NAB), Natwest PLC (NATW), Royal Bank of Canada (RY), Banco Santander (SANT), Societe Generale SA (SG), Svenska Handelsbanken AB (SHB), Toronto-Dominion Bank (TD), Westpac Banking Corp (WBC), and Wells Fargo (WF). Source: Refinitiv, and Stata.

2.3.2 Bond Market Choice Classification

The Market Choice (MC) is defined by the Refinitiv field *Market of Issue* and comprises five bond market choices: 1) Eurobond; 2) Foreign Bond; 3) Global Bond; 4) Onshore Bond; and 5) Yankee Bond. Domestic bonds are termed Onshore Bonds and all other non-domestic bonds are termed Offshore Bonds. The base category is Onshore Bonds. The current research, to the best of the author's knowledge, is the first study of five discrete choices for SIBs before and following the GFC. As discussed in Section 2.1, Eurobonds are non-public bonds and not strictly private debt, Foreign Bonds and Onshore Bonds are mostly registered and rank between Eurobond and public debt, and Yankee and Global Bonds are classified as public debt. For United States banks there is no Yankee Bond choice because this refers to their Onshore Bond, which is public debt. Refinitiv *Market of Issue* Foreign Bonds are an amalgamation of all bond market choices equal to foreign currency issuing in the local currency of the country market, such as the Royal Bank of Canada issuing a Yen denominated bond in the Japanese market. Bond types include Dim Sum[18], Samurai[19], Kauri[20], Maple[21], Alpine[22], and Kangaroo[23].

2.3.3 Construction of Agency Cost, Reputation, and Flotation Cost Variables

Bond or bank issuer credit ratings for bonds can proxy for credit quality and therefore, reputation. There are limitations on retrieving long-term credit ratings at the bond transaction level and hence bond credit ratings are "patchy at best" (Black & Munro, 2010, p. 11). This is partly due to historical data collection issues as many bonds were matured when the data was collected, and the bond rating had been withdrawn. In addition, many bank bonds were not rated at issue date, and investors relied on the issuer's reputation and/or underlying issuer credit rating (IRATING). The issuer and bond credit ratings are sourced from Refinitiv and matched to the bond choice through the unique International Securities Identification Number (ISIN) code. The selection of developed country global banks in the sample are highly rated investment grade companies. The use of a dummy investment grade and sub-investment grade for credit ratings (Black & Munro, 2010; Denis & Mihov, 2003; Fuertes & Serena, 2018; Gao, 2011; Tawatnuntachai & Yaman, 2008) is not required in this study. Instead of credit rating proxying for reputation, some research uses credit rating as a proxy for asymmetric information (Fuertes & Serena 2018; Tawatnuntachai & Yaman, 2008). Gao (2011) allocates credit rating categories of high, medium, and none for below investment grade. Kwan and Carleton (2010) do not use CRAs but rather the National Association of Insurance Commissioners scale from 1 for Aaa to 5 for Caa. Issuer and bond credit ratings (BRATING) for this study are sourced from Moody's long-term credit ratings at the time of the bond choice issue date, and allocated a numeric score based on the long-term credit rating (Arena, 2011).

This study utilises a similar approach to Mizen et al. (2012) to proxy for bond reputation. Rather than rely on financial characteristics from statements reported each year (Esho et al.,

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[18] Bonds issued outside of China but denominated in Chinese Yuan or Renminbi.
[19] Bonds issued in Japan denominated in Yen by a non-Japanese company.
[20] Bonds issued in New Zealand dollars by a non-New Zealand company.
[21] Bonds issued in the Canadian market denominated in Canadian dollars by a non-Canadian company.
[22] Bonds issued in the Switzerland market denominated in Swiss Francs by a non-Swiss company.
[23] Bonds issued in Australian dollars by a non-Australian company.

2001), or the ratio of the onshore market to onshore and offshore markets (Mizen et al., 2012), this study utilises a dynamic reflection of bond issuance activity. A database of the outstanding bonds issued at the bank and bond seniority transaction level from Refinitiv was computed[24] as per Equation 2.1. The outcome for each month was then divided by FitchConnect[25] (Fitch) Total Liabilities excluding Preference Shares and Debt Hybrid Capital (TL) for the preceding year to ascertain the outstanding onshore bond reputation (ONSBOND). This is similar to the ratio of foreign currency bonds to total liabilities employed by Mizen et al. (2012), although it is hard to determine the frequency or the source of the bonds. The ONSBOND variable is outstanding bonds in the market reported each month. A larger ratio indicates a greater reputation in bond markets. The variable incorporates a timely frequency of market bond funding.

Equation 2.1

$$ONSBOND_{i,t} = \frac{(\sum_{i=1}^{n} SENIORITY\ AMOUNT_{i,t})}{TL_{i,t}}$$

where:
n = sum of bank bond seniority amounts
i = bank bond seniority amount
Seniority Amount = Refinitiv Amount Issued USD of Refinitiv Seniority Senior Secured, Senior Secured First Lien, Senior Secured Mortgage, Secured, Subordinated Secured, Senior Unsecured, Unsecured, Senior Preferred, Senior Non-Preferred, Senior Subordinated Unsecured, and Subordinated Unsecured
t = previous month/year

Reputation can also be measured by the age of a firm. Hale and Santos (2008) calculate age from the time of issue and the time the firm was first listed in the Compustat[26] system. Alternatively, studies measure age based on the time the firm has been listed on a stock

[24] Two bond searches in Refinitiv were performed. The first search applied the existing advanced bond search for market choices for all bond choices from 1999 to 2019. A second bond search was performed to capture the outstanding onshore and offshore bonds that had not matured as of 1 January 1999. The second bond search used the same criteria as the first search except the Issue Date was changed to before 1 January 1999 and the Maturity Date was added after or equal to 1 January 1999. The database summed face value USD of all outstanding bond choices by universal ticker and seniority at the end of each calendar month. A universal ticker was created to capture all banks' issuing and subsidiaries tickers related to the consolidated entity.
[25] Fitch Solutions, Inc., Fitch Ratings, Inc.
[26] Compustat is a database of financial, statistical, and market information on global firms.

exchange (Arena, 2011; Esho et al., 2001; Mizen et al., 2012). For banks age based on listing date can be problematic as banks can grow by acquisition, and therefore it can be hard to understand definitively when banks as a consolidated entity existed, and therefore reputation began. This study follows Johnson (1997) and calculates bank age (AGE) as the issue date of the bond choice less the incorporation date of the bank legal parent entity. The incorporation date for each bank is sourced from Fitch. A higher bank age indicates a stronger reputation.

For information asymmetries, this study follows Krishnaswami et al. (1999) and Esho et al. (2001) for unexpected future earnings (UFE) for earnings surprise to confirm managers have better quality of information than bondholders. UFE as per Equation 2.2 is calculated as earnings per share (EPS) for the next period less forward EPS (FEPS) for the next period divided by the results of the bank's share market price (MPX) in the current period. Data is sourced from Refinitiv and Datastream.

Equation 2.2

$$UFE_{i,t} = \frac{EPS_{i,t+1} - FEPS_{i,t+1}}{MPX_{i,t}}$$

To proxy for callable bonds (CALL) this study assigns a binary dummy variable of one for callable bonds, and zero otherwise. Callability of bonds can be used to evaluate the level of asymmetric information. Higher quality banks are less likely to issue bonds with these features. For investment or growth opportunities the market value to book value (MVBV) is employed as per Equation 2.3 to quantify project quality to replicate other empirical studies (Esho et al., 2001; Johnson, 1997; Krishnaswami et al., 1999). The metric is calculated as the book value of total assets as at the yearly reporting date less the book value of total equity plus the market value of equity divided by the book value of total assets, in USD. Total assets and total equity are sourced from Fitch, and the market value of equity sourced from Datastream.

Equation 2.3

$$MVBV_{i,t} = \frac{TA_{i,t} - BVTE_{i,t} + MVTE_{i,t}}{TA_{i,t}}$$

Access to flotation costs is determined through bank characteristics and bond characteristics. SIBs report financial statements in different currencies, which constrains meaningful comparison. SIBs make bond choices in multiple currencies to access a diverse range of investors and arbitrage foreign exchange differentials when swapped back into local currency. The bond market choices exhibit more than sixty-six different principal currencies. To overcome these obstacles, Fitch converts each financial statement characteristic and Refinitiv each bond size into USD. As expected, there is material variability in total assets and bond size in the banks selected for the sample. In USD, the total assets of the three Australian banks as at 2019 averaged $624 billion, the four Canadian banks averaged $897 billion, the nine European banks averaged $1,314 billion, and the five United States banks averaged $1,691 billion (S&P, 2020). This study employs the logarithm of bank total assets (TA) following previous studies (Arena, 2011; Blackwell & Kidwell, 1988, Denis & Mihov, 2003; Fuertes & Serena, 2018; Gao, 2011; Gomes & Phillips, 2012; Krishnaswami et al., 1999; Kwan & Carlton, 2010; Tawatnuntachai & Yaman, 2008) and the logarithm of bond issue size (SIZE) (Arena, 2011; Black & Munro, 2010; Blackwell & Kidwell, 1988; Fuertes & Serena, 2018; Gao, 2011; Gomes & Phillips, 2012; Krishnaswami et al., 1999; Kwan & Carlton, 2010; Tawatnuntachai & Yaman, 2008).

2.3.4 Control and Other Variables

Fuertes and Serena (2018) and Tawatnuntachai and Yaman (2008) use the bond maturity tenor (TENOR) expressed in years to proxy for information asymmetries (a reduction in agency cost). Bond maturity tenor (TENOR) is therefore employed in this study as a measure of financial stability. Greater bond maturity tenor reduces refinance risk, and is positively related to financial stability.

The characteristics of the individual banks were sourced from Fitch. Portfolios were established by jurisdictions, with the bank entity full name matched to a unique Fitch ID. A bank in the sample must have had a Fitch market sector of Universal Commercial Banks[27]. The Universal Commercial Banks category facilitated the financial bank data on a consolidated basis. This aligns with the Refinitiv bond bank legal name search for the dependent variable. Financial data was retrieved on a yearly basis from 1998 to 2019 in USD in local reporting and

[27] Some Universal Commercial Banks converted to Bank Holding Companies following the GFC.

in accordance with International Financial Reporting Standards (IFRS). If International Financial Reporting Standards could not be accessed, then local accounting standards were used as a default.

As the sample period covers more than 20 years, the study requires an indicator of market conditions through time. This study follows Gomes and Phillips (2012) and employs the Chicago Board Options Exchange's CBOE Volatility Index (VIX) to determine market conditions. VIX is a measure based on the S&P 500® Index options on future volatility in the share market. It is the most widely accepted global index for market volatility[28]. Serena and Moreno (2016) find a positive relationship between emerging market economies' offshore bond issuance and "abnormally" lower VIX, and the opposite when VIX increases. For the present study, daily VIX prices were sourced from Refinitiv and matched to the issue date of each MC. From 1999 to 2019 the VIX peaked at 129.8 on 20 November 2008 following the Lehman collapse and financial system instability. Comparatively, COVID-19 volatility (although not in the sample period) reached a high of 132.1 on 18 March 2020, exceeding the GFC peak. The Merrill Lynch Option Volatility Estimate (MOVE)[29] is a US yield implied volatility measured as mid-implied volatilities for at-the-money bond options and swaptions in a basket of one-month, 2-year, 5-year, 10-year, and 30-year Treasuries. Fuertes and Serena (2018) use an average MOVE 20 business days before issue date. Serena and Moreno (2016) replace VIX with MOVE for a robustness test to reflect global bond conditions.

A motivating factor to issue offshore relative to onshore is arbitraging cost of funds. This is to be expected for active SIBs, and Black and Munro (2010) discuss the opportunistic nature of foreign currency issuance, whereby the costs of onshore are equal to offshore issuance costs when cross-currency swaps to convert back into the onshore currency are included. This is termed covered interest parity (McBrady & Schill, 2007). McBrady and Schill (2007) identify foreign currency issuance in 6 currencies across 31 countries, and estimate the gains of opportunistic offshore borrowing to onshore borrowing to be 4 to 18 basis points. However, the sample comprises government organisations and not banks, and only includes those organisations with onshore cash flows. SIBs have offshore branches in the countries of the

[28] Historical individual bank 5-year credit default swaps for the full sample period 1999-2019 were considered; however, due to licencing restrictions and concerns over inconsistent data and lack of liquidity for smaller banks, credit default swaps were not used.
[29] Intercontinental Exchange, Inc. (ICE) acquired Merrill Lynch Option Volatility Estimate (MOVE) Index and rebranded to ICE BofAML U.S. Bond Market Option Volatility Estimate Index.

foreign currency, which may not require a one hundred percent perfect hedge. Black and Munro (2010) acknowledge the hedge of bank offshore branches, finding a positive relationship with covered interest parity for Major Banks and that Major Banks borrow offshore rather than onshore when it is cheaper to do so. SIBs can also execute cross currency swaps prior to issuance of offshore bonds when markets are favourable and run this risk in their trading books prior to any offshore bond issue. Practically, there are other factors that may impact bond choices, and these are considered outside the scope of this study. One factor could be the need to balance up other funding avenues, for example raising funds in the onshore deposit markets and the liquidity benefits versus issuance of long-term bonds. Basel III Liquidity changes reward stable deposits with a higher value based on the behaviour characteristics, something the Black and Munro (2010) study does not reflect because the data period finished in early 2009 before the Basel III rules were implemented. Data in the present study has sixty-six currencies of issuance across the four jurisdictions, which makes it unfeasible to find historical interest rate differentials and basis swaps. Further, historical basis swaps data is limited in Datastream[30]. Studies with onshore and offshore bond issuance use different cost of funds proxies (Black & Munro, 2010; Gao, 2011; Mizen et al., 2012; Serena & Moreno, 2016; Tawatnuntachai & Yaman, 2008), whilst other studies of international securities such as Esho et al. (2001) and Fuertes and Serena (2018) do not use a cost of fund proxy.

Esho et al. (2001) use country dummy variables to control for country macro-economic conditions. This study employs macro-economic conditions from the parent domicile of the bank issuer to control for country variability in the samples. For the combined jurisdictions, gross domestic product per capita (GDPPC) is used, which is the economic output of each bank's country divided by its population, sourced from the World Bank on a yearly basis. Unfortunately, this variable is strongly correlated with financial characteristic independent variables in the jurisdiction models. Therefore, the consumer price index (CPI) on a quarterly basis for each bank's parent domiciled country is used as a substitute. CPI was sourced from the Organisation for Economic Co-operation and Development (OECD). A pre GFC binary dummy (GFC) prior to 1 January 2009 proxies for a regulatory environment before Dodd-Frank and Basel III implementation. A binary dummy variable of one was created to reflect G-SIB, otherwise D-SIB was zero.

[30] USDAUD basis swaps in Refinitiv and not retrievable prior to 2010.

2.3.5 Descriptive Statistics

Table 2.2 lists the market choices for the qualifying banks by juristiction. The sample size is 96,694. Table 2.3 lists the independent variables, the number of observations, the mean, standard deviation, and the minimum and maximum values of each independent variable.

Table 2.2: Market Choices for all Systemically Important Banks. Source: Stata and Refinitiv.

Market Choice	AU	CA	EU	US	Total
Eurobond	6,012	1,916	48,395	8,468	64,791
Foreign Bond	706	180	4,000	384	5,270
Global Bond	76	1,550	4,848	5,814	12,288
Onshore Bond	478	500	5,290	4,461	10,729
Yankee Bond	85	868	2,663	0	3,616
Total	**7,357**	**5,014**	**65,196**	**19,127**	**96,694**

The table reports the market choices (MC) for the twenty-one Systemically Important Banks by jurisdiction. Eurobonds follow the rules of cross-border markets and are not specific to the rules of the domestic market. Eurobonds are not able to be sold in the United States. Eurobonds have the lightest regulatory requirements of bonds and are sold mostly to wholesale institutions. Eurobonds are non-public debt and are a form of private placement; however, they are not strictly a bank loan nor a Foreign Bond. Foreign Bonds are registered securities and follow the rules of the domestic market, also non-public debt. Foreign Bonds are sold internationally except in the United States and avoid registration with the SEC under Regulation S of the Securities Act 1933, and like Eurobonds can only be sold to wholesale institutions. Non-United States banks issuing USD denominated bonds in the United States market are Yankee Bonds. Yankee Bonds are more liquid due to the fact they are registered with the SEC and can be sold to institutions and retail individuals. Global Bonds are registered and sold at the same moment in two different markets, are a standardised security, and are liquid and traded readily. Global Bonds have the strictest disclosure requirements with one tranche issued in the United States market and the other elsewhere. Yankee and Global Bonds are public markets.

The number of bond market choices prior to the GFC represent 44 percent of the sample, and 56 percent following the GFC. Offshore market choices account for 85,965 (89 percent) and onshore 10,729 (11 percent). D-SIBs account for 22 percent and G-SIBs 78 percent of market choice. In Table 2.2, Eurobonds are the largest market choice with 67 percent, and Yankee Bonds the smallest market choice with 4 percent. This can be expected based on the lower issuance costs for non-public Eurobonds compared to public market Yankee Bonds. On a jurisdictional basis, Europe with 9 of the 21 SIBs accounts for 67 percent, United States 20 percent, Australia 8 percent, and Canada 5 percent.

Onshore and offshore bond market choices in different jurisdictions vary in part due to onshore structural environment. For example, the depth of the bond market in the United States is greater than other jurisdictions. The United States banks fund 23 percent in Onshore Bonds compared to 7 to 10 percent for Australia, Canada, and Europe. Australia and Europe fund 82 percent and 74 percent, respectively, in the Eurobond markets. Australia funds only 2 percent in Global and Yankee Bond markets. Canadian banks are more evenly spread over offshore bond choices with 38 percent in Eurobonds, 31 percent in Global Bonds, and 17 percent in Yankee Bonds.

Table 2.3: Study 1 Descriptive Statistics for Combined Independent Variables of Australia, Canada, Europe, and the United States. Sources: Multiple Sources.

Variable	Obs.	Mean	Std. dev.	Min	Max
SIZE	96,701	16.867660	1.425017	15.424950	21.416410
TENOR	96,646	6.058697	5.742838	1.000000	30.021920
IRATING	96,701	18.835140	1.668387	14.000000	22.000000
BRATING	8,269	18.960210	1.877988	13.000000	22.000000
ONSBOND	96,305	0.037865	0.056008	0.000639	0.355871
OFFBOND	96,305	0.156004	0.081232	0.044907	0.494036
AGE	96,701	104.295600	51.086440	3.408219	168.887700
ROAE	96,690	11.122860	8.309963	-11.230000	32.870000
UFE	96,533	-0.276911	1.166897	-4.916944	4.649256
FAE	96,392	-0.093431	1.529716	-9.365012	3.749407
MVBV	96,541	1.016770	0.036693	0.958906	1.158731
TA	96,690	13.886650	0.703897	11.677430	14.935590
TE	96,690	10.808840	0.691071	8.733570	12.309840
VIX	95,489	23.718180	11.488190	12.194420	72.217040
MOVE	89,194	84.919540	28.964730	46.596200	190.000000
LIQDB	96,690	73.749880	53.286830	9.620000	294.200000
LIQTA	96,690	35.319210	17.595740	6.660000	82.300000
CPI	96,701	0.442518	0.540832	-0.852040	1.893491
GDPPC	96,701	41,135.93	10,168.50	23,359.01	67,139.05
GLIQ	94,421	17.827150	2.367603	10.745670	21.409000

The table reports descriptive statistics for the independent variables for the sample of 96,694 market choices. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, IRATING is a dummy variable for Moody's long-term issuer credit rating, BRATING is a dummy variable for Moody's long-term bond credit rating, ONSBOND is the bond onshore reputation, OFFBOND is the bond offshore reputation, AGE is the bank age in years, ROAE is the return of average equity, UFE is unexpected future earnings, FAE is the future abnormal earnings, MVBV is market value to book value, TA is the logarithm of the book value of total assets, TE is the logarithm of the book value of total equity, VIX is the Chicago Board Options Exchange's Volatility Index, MOVE is the Merrill Lynch Option Volatility Estimate, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, LIQTA is a bank's liquid assets divided by book value of total assets, CPI is the consumer price index for each parent country of the bank, GDPPC is the gross domestic product per capita for each parent country of the bank, and GLIQ is the global liquidity indicator. Dummy binary variables have been excluded. For a full description and calculation of the independent variables refer to Table 2.24 in the chapter appendix. The independent variables are winsorised at 1 percent and 99 percent levels.

Table 2.4: Correlation Matrix of the Sample Bank Independent Variables

	SIZE	TENOR	CALL	LIST	IRATING	ONSREP	AGE	UFE	MVBV	TA	VIX	LIQDB	CPI
SIZE	1.0000												
TENOR	0.0438	1.0000											
CALL	-0.0212	0.3751	1.0000										
LIST	0.3377	0.2263	0.0513	1.0000									
IRATING	-0.0004	-0.0140	-0.0234	-0.1256	1.0000								
ONSBOND	0.0954	0.0085	-0.0207	0.0360	-0.4581	1.0000							
AGE	0.0606	-0.1005	-0.0170	0.0596	-0.2770	0.1356	1.0000						
UFE	0.0423	0.0201	-0.0080	-0.0140	0.1208	0.1203	-0.0594	1.0000					
MVBV	0.0924	0.0597	0.0484	-0.1684	0.4769	-0.1287	-0.1229	0.1707	1.0000				
TA	-0.0406	-0.0254	-0.0382	0.1946	-0.2113	-0.0087	-0.0352	-0.1337	-0.6842	1.0000			
VIX	0.0313	-0.0296	-0.0795	-0.0765	0.2592	-0.0005	-0.1248	0.0763	0.2076	-0.2213	1.0000		
LIQDB	-0.1002	0.0049	-0.0184	0.0055	-0.3061	0.0858	0.2535	0.0250	-0.3411	0.1651	-0.0966	1.0000	
CPI	0.0209	0.0099	0.0018	-0.0029	0.1611	-0.0618	-0.1085	0.0096	0.1281	-0.0058	0.0387	-0.0759	1.0000

This table reports the correlation matrix of independent variables for the twenty-one Systemically Important Banks selected. Observations total 94,852. SIZE is the logarithm of bond size in USD, TENOR is the bond tenor from issue date to maturity date in years. CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from incorporation date of the bank issuer to the bond market choice issue date, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of each country of parent bank. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. The independent variables are winsorised at 1 percent and 99 percent levels.

For the independent variables, winsorising is performed at the lower 1 percent and upper 99 percent (Fuertes & Serena, 2018) to limit influential outliers. This is important, for example because callable bonds with no legal maturity date calculate as negative 121 years, which distorts the bond maturity tenor variable. Extremities in market conditions like VIX can cause bond markets to be illiquid, significantly impacting MC. Table 2.4 displays the correlation matrix for the independent variables. The chapter appendix charts the continuous independent variables in Figures 2.2–2.8 for the jurisdictions.

2.4 DISCRETE MULTINOMIAL CHOICE METHODOLOGY

Bond market choices of global banks are discrete in nature and logistic methodologies are required to determine the likelihood and predictive probabilities of these choices. The primary methodology used in this study is multinomial logistic regression to model viable alternative categorical market choices. The general model specification in Equation 2.4 for each MC is:

Equation 2.4

$$MC_{i,t} = \beta_0 + \beta_1 \boldsymbol{X}_{i,t} + \beta_2 \boldsymbol{Z}_{i,t-1} + \beta_3 \boldsymbol{C}_{i,t-1} + \varepsilon_{0i,t}$$

In the models $MC_{i,t}$ is the bank bond market choice i for the issue date of the bond at time t. β_0 represents the constant, $\boldsymbol{X}_{i,t}$ is a vector of bond characteristics, $\boldsymbol{Z}_{i,t-1}$ is a vector of bank characteristics proxied for agency costs, reputation, and flotation costs, and $\boldsymbol{C}_{i,t-1}$ is a vector controlling for macro-economic and market conditions to ensure business cycles and market impacts do not change the results. Epsilon $\varepsilon_{0i,t}$ is the error term.

The multinomial logistic methodology uses a generalised linear model that connects a linear combination of independent variables to the MC outcome using a link function, providing a non-linear transformation. The parameters of the generalised linear model are estimated using maximum likelihood by minimising the unexplained variance in the MC outcomes (Sage, 2015). Stata defaulted the bond choices in alphabetical order as follows: Eurobond (1), Foreign Bond (2), Global Bond, (3), Onshore Bond (4), and Yankee Bond (5). Onshore Bond (4) is the nominated base choice. The log odds of the alternative bond choices 1, 2, 3, and 5 in Equations 2.5 to 2.8, respectively, are generated as separate binary regressions with parameter estimates and error terms matching the general Equation 2.4. $\boldsymbol{X}$, $\boldsymbol{Z}$ and $\boldsymbol{C}$ are vectors. *Pr* is the probability a bond MC happens.

Equation 2.5

$$ln\left(\frac{Pr(y_{i,t}=1)}{Pr(y_{i,t}=4)}\right) = \beta_0 + \beta_1\boldsymbol{X}_{i,t} + \beta_2\boldsymbol{Z}_{i,t-1} + \beta_3\boldsymbol{C}_{i,t-1} + \varepsilon_{0i,t}$$

Equation 2.6

$$ln\left(\frac{Pr(y_{i,t}=2)}{Pr(y_{i,t}=4)}\right) = \beta_{10} + \beta_{11}\boldsymbol{X}_{i,t} + \beta_{12}\boldsymbol{Z}_{i,t-1} + \beta_{13}\boldsymbol{C}_{i,t-1} + \varepsilon_{10\ ,t}$$

Equation 2.7

$$ln\left(\frac{Pr(y_{i,t}=3)}{Pr(y_{i,t}=4)}\right) = \beta_{20} + \beta_{21}\boldsymbol{X}_{i,t} + \beta_{22}\boldsymbol{Z}_{i,t-1} + \beta_{23}\boldsymbol{C}_{i,t-1} + \varepsilon_{20i,t}$$

Equation 2.8

$$ln\left(\frac{Pr(y_{i,t}=5)}{Pr(y_{i,t}=4)}\right) = \beta_{30} + \beta_{31}\boldsymbol{X}_{i,t} + \beta_{32}\boldsymbol{Z}_{i,t-1} + \beta_{33}\boldsymbol{C}_{i,t-1} + \varepsilon_{30\ ,t}$$

The log odd results are converted to predictive probabilities at the independent variables' lower 5^{th} and upper 95^{th} percentiles for the base Onshore Bond MC and alternative bond MC. Arena (2011) uses the 25^{th} and 75^{th} percentiles and Krishnaswami et al. (1999) use the 10^{th} and 90^{th} percentiles for predictive probabilities. This study tests for a larger range of economic significance. The predictive probabilities are employed as per other studies (Arena, 2011; Denis & Mihov, 2003; Fuertes & Serena, 2018; Gomes & Phillips, 2012). Variations to methodology techniques are noted; for example, Arena (2011) employs a two-step multinomial logistic regression to mitigate multicollinearity of credit rating with other variables. Multicollinearity is not an issue for this study. Fuertes and Serena (2018) use multinomial logistic and ordered logit models to model choices of Global Bonds, US144A bonds, and Eurobonds in 36 countries, including emerging markets. Black and Munro (2010), Kwan and Carleton (2010), and Mizen et al. (2012) use probit models to calculate the binary outcomes of offshore and onshore borrowing or public to private debt, while others use logit models (Gao, 2011; Tawatuntachai & Yaman. 2008) and tobit models (Johnson, 1997). Other studies model a difference in difference (Abraham et al., 2021) when comparing two periods, and ordinary least squares (Krishnaswami et al., 1999).

A key assumption in a multinomial logistic model is independence of irrelevant alternatives (IIA). Hausman and McFadden (1984, p. 1219) describe the IIA as "the ratio of the probabilities of choosing any two alternatives is independent of the attributes of any other alternative in the choice set." To test for a violation of IIA, Hausman and McFadden (1984) developed two tests and Small and Hsiao (1985) a modified likelihood ratio test. It is important to note there can be inconsistencies in the test results, and researchers have urged caution when running these assumption tests (Amemiya, 1981; Long & Freese, 2014). Long and Freese (2014) believe these tests contradict each other and do not recommend their use because they are a statistical test, and are not necessarily a reflection of the real world.

Equation 2.9 uses bond characteristics and control variables to model SIBs from various jurisdictions. The United States banks are excluded because their Onshore Bond is the Yankee Bond public market. Bond characteristics use the logarithms of bond issue size (SIZE) and bond maturity tenor (TENOR) and dummy variables for callable bonds (CALL), listed bonds (LIST), and underwritten bonds (UNDERW) in vector $\boldsymbol{X}$ from the general specification in Equation 2.4. Control variables as part of vector $\boldsymbol{C}$ include market conditions (VIX) and macro-economic conditions (GDPPC). A binary dummy variable is used for G-SIB and D-SIB, and the period prior to the GFC (GFC). Equation 2.9 combines all jurisdictions, except the United States, and excludes financial characteristics. Financial characteristics and the United States are included in Equation 2.10.

Equation 2.9

$$MC_{i,t} = \beta_{0i} + \beta_1 SIZE_{i,t} + \beta_2 TENOR_{i,t} + \beta_3 CALL_{i,t} + \beta_4 LIST_{i,t} + \beta_5 UNDERW_{i,t} + \beta_6 GSIB_{i,t} + \beta_7 GFC_t + \beta_8 VIX_{i,t} + \beta_9 GDPPC_{i,t-1} + \varepsilon_{0i,t}$$

Equation 2.9 tests Hypotheses 1 to 4 for the MC in a combined jurisdictional regression. The hypotheses are listed below. It is expected that increases in underwriters to proxy for decreases in asymmetric information and G-SIB will have positive relationships with Yankee and Global Bond public markets, and increased market volatility and the period prior to the GFC will have negative relationships with these public market choices. The direction relationship of non-public Eurobonds is expected to be the opposite. The relationship direction of Foreign Bonds and Onshore Bonds is uncertain.

H_1: Decreases in bank asymmetric information have a significant positive relationship with Yankee and Global Bond market choices.

H_2: Increases in market volatility have a significant negative relationship with Yankee and Global Bond market choices.

H_3: Global Systemically Important Banks have a significant positive relationship with Yankee and Global Bond market choices.

H_4: The period prior to the Global Financial Crisis for banks has a significant negative relationship with Yankee and Global Bond market choices.

Equation 2.10 for each jurisdiction tests the additional Hypotheses 5 to 8. Financial characteristic variables to proxy for agency costs, reputation, and flotation costs are introduced. There are many types of reputation proxies in the empirical research, so this study uses an assortment of proxies for global banks. Bank issuer credit rating (IRATING), onshore bond reputation (ONSBOND) lagged for one period to fully incorporate current issues, and bank age (AGE) are all added to represent reputation. Unexpected future earnings (UFE) proxies for information asymmetries, and bank market value to book value (MVBV) proxies for investment and growth opportunities. Macro-economic variable (CPI) replaces GDPPC, and total assets of each bank (TA) and liquid assets as a percentage of deposits and borrowings (LIQDB) are added.

Equation 2.10

$$MC_{i,t} = \beta_{0i} + \beta_1 SIZE_{i,t} + \beta_2 TENOR_{i,t} + \beta_3 CALL_{i,t} + \beta_4 LIST_{i,t} + \beta_5 IRATING_{i,t-1} + \beta_6 ONSBOND_{i,t-1} + \beta_7 AGE_{i,t-1} + \beta_8 UFE_{i,t-1} + \beta_9 MVBV_{i,t-1} + \beta_{10} TA_{i,t-1} + \beta_{11} VIX_{i,t} + \beta_{12} LIQDB_{i,t-1} + \beta_{13} CPI_{i,t-1} + \varepsilon_{0i,t}$$

Equation 2.10 for each jurisdiction tests the additional hypotheses for banks across the developed countries to understand the relationship of agency costs, reputation, and flotation costs to the MC for SIBs. The four additional hypotheses are listed below. It is expected that reputation proxies will have positive relationships with public markets (Diamond, 1984, 1989); increases in asymmetric information (Myers & Majluf, 1984) and investment and growth opportunities (Myers, 1977) will have negative relationships with public markets; and increases in flotation costs (Blackwell & Kidwell, 1988) will have positive relationships with public markets. The direction relationship of non-public Eurobonds is expected to be the opposite. The relationship direction of Foreign Bonds and Onshore Bonds is uncertain. It is expected different jurisdictions will render different results, as evidenced by the different mean of proxy variables in Figure 2.2 to Figure 2.8 in the chapter appendix.

$\mathbf{H_5}$**:** Increases in bank reputation have a significant positive relationship with Yankee and Global Bond choices.

$\mathbf{H_6}$**:** Increases in bank asymmetric information have a significant negative relationship with Yankee and Global Bond choices.

$\mathbf{H_7}$**:** Increases in bank investment and growth opportunities have a significant negative relationship with Yankee and Global Bond choices.

$\mathbf{H_8}$**:** Increases in bank flotation costs have a significant positive relationship with Yankee and Global Bond choices.

2.5 RESULTS AND DISCUSSION

Table 2.5 reports the results of a combined regression for Australia, Canada, and Europe given five market choices, namely the log likelihood of Eurobond, Foreign Bond, Global Bond, and Yankee Bond to the base Onshore Bond. The combined regression tests Hypotheses 1 to 4 as per Equation 2.9. The model fits the data with a pseudo R2 of 0.19. The likelihood ratio x^2 and chi2 p-value < 0.0001 indicate that the models fit better than a null model.

Hypothesis 1, namely that decreases in asymmetric information have a positive relationship with public markets, is supported. As underwritten bonds increases, the likelihood of Yankee Bond and Global Bond choices too increases, and non-public Eurobond and Foreign Bond choices decreases. This supports the empirical results of Gomes and Phillips (2012).

Support is also found for Hypothesis 2 in line with Serena and Moreno (2016), as increases in market volatility proxied by VIX decrease the likelihood of a Foreign Bond and Global Bond. Intuitively, this makes sense as funding costs comparively increase in less known offshore markets compared to the onshore market. There is no support for Hypothesis 3, namely that G-SIB issuers are more likely than D-SIB issuers to use public markets over more non-public markets like Eurobonds, because all alternative choices are insignificant. Hypothesis 4 is supported, as the period prior to the GFC exhibits increased likelihood of Eurobond choices and a decreased likelihood of public market Global Bond issuance.

Table 2.6 reports the predicted probabilites of the Table 2.5 regression, and notably the largest economic impact to Onshore Bonds is a +19 percent increase as flotation cost proxy bond size increases (versus -27 percent for Eurobond). There is also a -10 percent decrease in Onshore Bonds as GDPPC increases (versus +5 percent Eurobond and +5 percent Foreign Bond) indicating improvement in economic conditions results in higher probability of offshore issuance.

Table 2.5: Market Choice Results for Australian, Canadian, and European Systemically Important Banks Log Pseudolikelihood Regression (Equation 2.9 – Hypotheses 1 to 4**)**

Regression 1

Dependent variables Independent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
SIZE	-0.5130***	-0.2041*	-0.3141**	-0.4047***
	(0.1085)	(0.1191)	(0.1361)	(0.1397)
TENOR	0.0560**	-0.0190	-0.0833**	-0.0615*
	(0.0225)	(0.0199)	(0.0336)	(0.0361)
CALL	0.4928**	-0.2261	1.4411***	1.1339***
	(0.1977)	(0.3754)	(0.3356)	(0.3328)
LIST	-0.2415	0.4217	-0.7819	-2.1691***
	(0.4151)	(0.5487)	(0.5053)	(0.4963)
UNDERW	-0.7069*	-1.0503**	3.2428***	2.8997***
	(0.3981)	(0.4704)	(0.6408)	(0.8307)
GSIB	-0.5279	-0.9391	0.6680	-1.1363
	(0.6012)	(0.7154)	(0.7639)	(0.8469)
GFC	0.8500***	0.5976	-1.9040***	-0.8053
	(0.2120)	(0.6209)	(0.3935)	(0.5541)
VIX	-0.0082	-0.0088*	-0.0230***	-0.0049
	(0.0060)	(0.0049)	(0.0068)	(0.0085)
GDPPC	0.0001**	0.0001*	0.0000	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	9.5207***	1.9518	3.0009	0.7318
	(1.7871)	(3.0308)	(2.7617)	(2.6093)
Log pseudolikelihood	-59,063.54	-59,063.54	-59,063.54	-59,063.54
Pseudo R2	0.1944	0.1944	0.1944	0.1944
Observations	76,417	76,417	76,417	76,417

This table reports multinomial logistic regressions for the combined Australian, Canadian, and European banks. The dependent variables are the bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. United States banks are excluded as the Yankee bond choice is their Onshore Bond and therefore only contain four choices. SIZE is the logarithm of bond size in USD and TENOR is the bond maturity tenor in years. CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, UNDERW is a binary dummy variable for underwritten bonds, GSIB is a binary dummy variable for Global Systemically Important Banks, GFC is a binary dummy variable for the period before 1 January 2009, VIX is the Chicago Board Options Exchange's Volatility Index, and GDPPC is gross domestic product per capita of the banks' parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.6: Market Choice Predictive Probabilities for Australian, Canadian, and European Systemically Important Banks (from Table 2.5)

	Eurobond	Foreign Bond	Global Bond	Onshore Bond	Yankee Bond
SIZE	-28%	6%	3%	19%	0%
TENOR	20%	-4%	-9%	-3%	-4%
CALL	-3%	-3%	7%	-3%	2%
LIST	1%	4%	-3%	2%	-5%
UNDERW	-16%	-4%	11%	3%	6%
GSIB	-3%	-3%	6%	3%	-4%
GFC	22%	0%	-14%	-4%	-4%
VIX	0%	0%	-3%	2%	1%
GDPPC	5%	5%	-10%	-10%	10%

This table reports the predictive probabilities at a confidence interval of 95 percent for the market choices Eurobond, Foreign Bond, Global Bond, Yankee Bond, and Onshore Bond implied by the multinomial logistic regression from Table 2.5. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. The sum of each of the independent variables' predicted probabilities in each row equals zero, subject to rounding. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, UNDERW is a binary dummy variable for underwritten bonds, GSIB is a binary dummy variable for Global Systemically Important Banks, GFC is a binary dummy variable for the period before 1 January 2009, VIX is the Chicago Board Options Exchange's Volatility Index, and GDPPC is gross domestic product per capita of the banks' parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix.

The jurisdictional regressions from Equation 2.10 test the proxies for agency costs, reputation, and flotation costs. Tables 2.7, 2.8, 2.9, and 2.10 report results for discrete bond MC for Australia, Canada, Europe, and the United States, respectively. Overall, the regressions fit quite well, with pseudo R2 ranging from 0.15 to 0.27 at an average of 0.21. This is comparable to Denis and Mihov (2003) who find an average of 0.23 across 4 models. The likelihood ratio x^2 and chi2 p-value < 0.0001 indicate the models fit better than a null model. The IIA assumptions are mostly violated, with significant tests in Hausman, Suest-based Hausman, and Small-Hsiao that provide evidence against the null hypothesis that the choices are independent of other alternatives. Long and Freese (2014) argue that multinomial logisitic regression is fine to use when the alternative choices compared to the base are dissimilar. This is the case in the current study as the market choices are distinctly different and not substitutes. A bond may share a similar coupon structure, but the market choices are distinctly dissimilar. For example, the flotation costs due to the disclosures and legal requirements of a Eurobond versus a Yankee Bond are significantly less, as is the liquidity of the bonds (Esho et al., 2011; Gao, 2011). The results of multinomial probit regressions relaxing the IIA assumption are discussed in Section 2.6 as a robustness check, validating the use of multinomial logistic modelling for Study 1.

The first set of variables analysed are the reputation proxies, namely issuer rating, onshore bond reputation, and bank age. Hypothesis 5 is not supported in terms of issuer rating, namely that issuer credit rating across the jurisdictions exhibits positive relationships with public markets Yankee and Global Bonds. Therefore, the results do not support the findings of Arena (2011), Esho et al. (2001), Fuertes and Serena (2018), Kwan and Carleton (2010), and Tawatnuntachai and Yaman (2008). Interestingly, Australia does not exhibit any statistical significance for market choices and issuer credit rating. Australia was the only jurisdiction on average to improve their issuer credit rating following the GFC. Canada exhibits a negative relationship between issuer credit rating and Eurobonds, Foreign Bonds, and Yankee Bonds, preferring to issue in onshore markets where brand name is strong and there are no offshore hedging costs. Europe has negative relationships with issuer credit rating and Global and Yankee Bonds. This indicates that improvements in credit quality result in greater likelihood of accessing Onshore Bond markets where funding costs are lower and brand recognition is stronger. SIBs are listed and have continuous disclosure rules on stock exchanges and are prudentially regulated. Banks issuing in offshore bond markets and not in local currency incur hedging costs to convert foreign currency bond issue proceeds back into local currency. This would impact Australian and Canadian banks who issue more in offshore markets and in foreign currencies. It could also impact European jurisdictions like United Kingdom banks and Swiss banks where they have not adopted the Euro currency.

As the onshore bond reputation increases Australia and Canada reduces the likelihood of non-public Eurobonds supporting Hypothesis 5, and Europe had reductions in both likelihoods of non-public and public offshore markets, not supporting Hypothesis 5. Bank age as a proxy for reputation is not significant for Europe. Australian bank age displays a significant negative relationship with Eurobonds and Foreign Bonds, and a significant positive relationship with public markets Yankee and Global Bonds. The Canadian bank relationships are positive with Yankee Bonds but negative for Global Bonds. The age findings for Australian banks support Hypothesis 5 and align with Diamond's (1984, 1989, 1991) notion that adverse selection lessens over time in line with a borrower's good reputation and the empirical findings of Arena (2011) and Johnson (1997).

Australian banks' unexpected future earnings are not significant, a result consistent with the cross-sectional OLS regressions of Krishnaswami et al. (1999) and logit regressions of Esho et al. (2001). Canadian banks display a negative significant relationship between unexpected future earnings and Global Bonds, consistent with Johnson (1997) who uses earnings growth volatility. European banks provide mixed support for Hypothesis 6 regarding a negative relationship between public bond markets and unexpected future earnings, as all offshore bond market choices are negatively significant. Australia and Canada report lower unexpected future earnings than European banks, which may explain some of the inconsistency in the results.

For increases in investment and growth opportunities measured by market value to book value under Hypothesis 7, expectations were for a negative relationship with public debt. Australian and Canadian banks support Hypothesis 7 with positive significant relationships between market value to book value and non-public Eurobonds. European banks also provide support for Hypothesis 7 with a negative significant relationship with public Yankee Bonds. This supports the empirical evidence of Krishnaswami et al. (1999) and Johnson (1997).

The flotation cost hypothesis, namely that increases in flotation costs have a positive relationship with public bond markets, is proxied by two variables. The bond size proxy displays a negative relationship with non-public Eurobonds for Australia, Canada, and Europe; however, these jurisdictions also exhibit negative relationships with public Global and Yankee Bonds. This provides mixed support for Hypothesis 8 and previous research (Blackwell & Kidwell, 1988; Denis & Mihov, 2003; Esho et al., 2001; Johnson, 1997; Tawatnuntachai & Yaman, 2008). Fuertes and Serena (2018) find positive relationships for Global Bonds to Eurobonds for bond size and total assets; however, their findings are based on emerging market issuers. These types of issuers typically have lower credit ratings and higher information asymmetries than SIBs, which may help explain the inconsistency. The second proxy, total assets, yields mixed results for Australian and European banks with regard to Hypothesis 8. However, Canada exhibits a decrease in likelihood of non-public Eurobonds and increases in public Yankee and Global Bonds, which supports Hypothesis 8 and the literature.

The United States bank regressions are treated separately as there is no Yankee Bond choice. The United States Onshore Bond market is the SEC registered public market. An increase in bond tenor has a positive relationship with Eurobonds and supports the findings for both Australia and Europe. Although not explicitly tested it supports the market depth hypothesis that limits in onshore markets can motivate banks to issue in offshore markets to access greater bond maturity tenor (Mizen et al., 2012). Eurobonds, Foreign Bonds, and Global Bonds are more likely choices as United States issuer credit rating improves, while Foreign Bonds and Global Bonds are more likely choices when onshore bond reputation increases. This evidence tends to contradict Abraham et al. (2021) and Black and Munro (2010), but may support Serena and Munro (2016) and Hypothesis 5 if United States banks are constrained in their local market. It is possible that investors, particularly wholesale investors, are full or near full on credit limit as United States banks' credit ratings have deteriorated on average over two notches since the GFC, as per Figure 2.2. Investment and growth opportunities proxied by market to book value indicate the likelihood of decreases in Global Bond and increases in Foreign Bond and provide mixed support for Hypothesis 6. Market volatility decreases the likelihood of all offshore choices, and United States banks prefer then to issue in the deep and liquid local United States public market. There could be other factors that motivate the United States banks. A potential motive could be arbitraging the cost of funds, and therefore maximising private and public market use (Rajan, 1992).

Considering the notable impacts on financial stability from bond market choices, it is simpler to analyse the net effect to the predicted probabilities for Onshore Bonds from the results in Table 2.11. Increases in bond sizes as part of the flotation cost hypothesis are positively related to financial stability with predicted probabilities on Onshore Bonds for Australia of +30 percent, Canada +39 percent, Europe +12 percent, and decreases in Eurobonds of -51 percent, -26 percent, and -20 percent, respectively.

For increases in reputation, the economic impacts on financial stability are small: -1 to +3 percent for Australia with only age significant and meaningful and +12 percent for Canada explained by improvement in issuer credit rating. The United States improvements in reputation (including issuer credit rating and onshore bond reputation) are negative with regard to financial stability, experiencing -15 percent and -18 percent predicted probability of issuing an Onshore Bond. Increases in bond tenor have a negative impact on financial stability for all jurisdictions, except Canada, as SIBs access the offshore Eurobond investor base. The United States exhibits a decreased predicted probability of Onshore Bonds selection of -19 percent.

Table 2.7: Market Choice Results for Australian Systemically Important Banks Log Pseudolikelihood Regression (Equation 2.10 – Hypotheses 5 to 8)

Regression 2

Dependent variables Independent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
SIZE	-0.9477***	-0.3982***	0.3513	-0.3428***
	(0.0640)	(0.0388)	(0.3370)	(0.1317)
TENOR	0.0807***	-0.0144	0.0557**	-0.1051*
	(0.0092)	(0.0247)	(0.0255)	(0.0628)
CALL	-0.9220***	-1.3190**	-1.1951	-0.8643***
	(0.3543)	(0.5705)	(0.8425)	(0.1656)
LIST	1.2849**	0.5265	2.1374***	0.8721***
	(0.5418)	(0.5000)	(0.2964)	(0.3297)
IRATING	0.0218	0.1975	0.5528	0.6097
	(0.1571)	(0.1707)	(0.3606)	(0.8329)
ONSBOND	-17.1502*	2.2691	12.0778	-2.7769
	(10.3943)	(11.1601)	(20.2832)	(22.3244)
AGE	-0.0079***	-0.0141***	0.0210*	0.0251***
	(0.0030)	(0.0042)	(0.0113)	(0.0036)
UFE	-9.9084	-6.8192	-7.1940	8.0215
	(8.0492)	(6.4878)	(21.5388)	(7.2480)
MVBV	3.8425***	12.6611***	-5.2064	-11.3073*
	(1.1785)	(2.0709)	(14.1954)	(5.9766)
TA	-0.6300*	0.8804***	-0.9108	-2.5536***
	(0.3589)	(0.2551)	(0.9324)	(0.3818)
VIX	-0.0007	-0.0073	-0.0998*	-0.0114
	(0.0020)	(0.0077)	(0.0543)	(0.0142)
LIQDB	-0.0107	0.0068	-0.1370***	-0.0147
	(0.0328)	(0.0303)	(0.0443)	(0.0757)
CPI	0.1486	-0.2239	0.0574	-0.1534
	(0.2289)	(0.1437)	(0.5599)	(0.6613)
Constant	24.2290***	-19.1055***	-3.6166	34.9057*
	(2.5557)	(1.4868)	(30.2778)	(18.4313)
Log pseudolikelihood	-3,624.51	-3,624.51	-3,624.51	-3,624.51
Pseudo R2	0.2473	0.2473	0.2473	0.2473
Observations	7,292	7,292	7,292	7,292

This table reports multinomial logistic regressions for Australian Systemically Important Banks. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.8: Market Choice Results for Canadian Systemically Important Banks Log Pseudolikelihood Regression (Equation 2.10 – Hypotheses 5 to 8)

Regression 3

Dependent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
Independent variables				
SIZE	-0.7157***	-0.1677	-0.6191***	-0.7564***
	(0.0539)	(0.2001)	(0.1304)	(0.2269)
TENOR	-0.0424	-0.0259	-0.0656***	-0.0994*
	(0.0523)	(0.0410)	(0.0201)	(0.0532)
CALL	-0.9156	-1.4632	0.1381	-0.7832
	(0.5886)	(1.2351)	(0.3350)	(0.7069)
LIST	2.2951***	2.0451**	1.2961*	-1.2294*
	(0.7257)	(0.8325)	(0.7468)	(0.6691)
IRATING	-0.4123***	-0.1094**	-0.0444	-0.7558***
	(0.1258)	(0.0439)	(0.1415)	(0.1916)
ONSBOND	-13.4209**	8.0000	-3.9539	10.0174
	(5.6301)	(8.6541)	(10.4926)	(18.8239)
AGE	0.0031	-0.0008	-0.0065***	0.0263***
	(0.0021)	(0.0026)	(0.0013)	(0.0031)
UFE	8.9248	-0.2706	-24.1983**	39.8302
	(15.2235)	(17.3693)	(10.1886)	(27.6514)
MVBV	10.7724*	13.1037***	8.9783***	-10.3344
	(5.7816)	(3.2165)	(1.8080)	(20.8225)
TA	-0.4928***	0.4833	2.5493***	2.6329***
	(0.1618)	(0.4662)	(0.4457)	(0.5673)
VIX	0.0280***	0.0151	0.0029	0.0172
	(0.0101)	(0.0160)	(0.0188)	(0.0266)
LIQDB	0.0237	0.0344	0.0190	-0.2070***
	(0.0151)	(0.0216)	(0.0157)	(0.0246)
CPI	-0.1308	0.2567*	-0.1794***	0.0699
	(0.1926)	(0.1324)	(0.0622)	(0.1158)
Constant	15.8130***	-18.4535***	-30.6099***	8.4771
	(5.2193)	(6.5484)	(7.4347)	(21.7836)
Log pseudolikelihood	-5,053.08	-5,053.08	-5,053.08	-5,053.08
Pseudo R2	0.2689	0.2689	0.2689	0.2689
Observations	4,998	4,998	4,998	4,998

This table reports multinomial logistic regressions for Canadian Systemically Important Banks. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2.9: Market Choice Results for European Systemically Important Banks
Log Pseudolikelihood Regression (Equation 2.10 – Hypotheses 5 to 8)

Regression 4

Dependent variables Independent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
SIZE	-0.4218***	-0.0405	-0.3440**	-0.4492***
	(0.1177)	(0.1167)	(0.1654)	(0.1568)
TENOR	0.0463*	-0.0216	-0.0832**	-0.0573
	(0.0261)	(0.0291)	(0.0410)	(0.0487)
CALL	0.9027***	0.1537	1.7767***	1.5838***
	(0.1948)	(0.2682)	(0.3998)	(0.3180)
LIST	-0.4233	0.4295	-1.7491***	-2.6781***
	(0.4956)	(0.5613)	(0.6063)	(0.5479)
IRATING	-0.1204	0.1182	-0.3512***	-0.5720***
	(0.1296)	(0.1085)	(0.1324)	(0.1483)
ONSBOND	-2.7990	-14.8350*	-10.3270*	-10.6959***
	(2.1605)	(8.3156)	(5.4440)	(2.2410)
AGE	-0.0074	-0.0012	0.0097	-0.0005
	(0.0066)	(0.0108)	(0.0116)	(0.0057)
UFE	-0.1378***	-0.1773***	-0.3107***	-0.3485***
	(0.0412)	(0.0575)	(0.1083)	(0.0544)
MVBV	5.8120	-10.3262	-6.9610	-25.6806**
	(8.1972)	(6.8378)	(12.1628)	(10.2451)
TA	0.1808	0.1783	2.2010***	-1.1508*
	(0.6115)	(0.5586)	(0.5925)	(0.5872)
VIX	-0.0073	-0.0130	-0.0201**	-0.0091
	(0.0101)	(0.0088)	(0.0098)	(0.0162)
LIQDB	0.0060	0.0025	-0.0048	0.0089
	(0.0074)	(0.0147)	(0.0125)	(0.0084)
CPI	0.1255	0.0283	0.0226	0.2366
	(0.1029)	(0.1922)	(0.3320)	(0.1618)
Constant	3.7897	6.6477	-11.6041	59.5856***
	(16.6341)	(12.7783)	(16.6389)	(16.9437)
Log pseudolikelihood	-47,898.06	-47,898.06	-47,898.06	-47,898.06
Pseudo R2	0.1791	0.1791	0.1791	0.1791
Observations	63,730	63,730	63,730	63,730

This table reports multinomial logistic regressions for European Systemically Important Banks. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2.10: Market Choice Results for United States Systemically Important Banks Log Pseudolikelihood Regression (Equation 2.10 – Hypotheses 5 to 8)

	Regression 5		
Dependent variables Independent variables	**Eurobond**	**Foreign Bond**	**Global Bond**
SIZE	-0.0746	0.4053**	0.0531
	(0.0702)	(0.1613)	(0.0606)
TENOR	0.1196***	0.0270	0.0166
	(0.0080)	(0.0215)	(0.0248)
CALL	-1.8616***	-2.4194***	-0.5831*
	(0.3863)	(0.3090)	(0.3335)
LIST	0.6384*	1.2682**	0.3577
	(0.3718)	(0.5686)	(0.2469)
IRATING	0.2213**	0.3639***	0.3427***
	(0.0970)	(0.0670)	(0.0803)
ONSBOND	9.5336	20.4729***	25.4361**
	(8.5680)	(6.6319)	(12.2337)
AGE	-0.0080	-0.0115	-0.0098
	(0.0117)	(0.0127)	(0.0110)
UFE	-3.8696	-12.6940*	-3.9759
	(6.6957)	(6.7147)	(4.6310)
MVBV	-7.7082	6.2943**	-13.7310***
	(6.3875)	(2.9377)	(3.3556)
TA	1.1457	1.8707***	1.6624
	(0.7900)	(0.5781)	(1.0608)
VIX	-0.0124***	-0.0360**	-0.0220***
	(0.0028)	(0.0173)	(0.0076)
LIQDB	-0.0023	0.0026	-0.0014
	(0.0034)	(0.0026)	(0.0011)
CPI	-0.0399	0.2392	-0.2623**
	(0.1021)	(0.1953)	(0.1171)
Constant	-9.7676	-48.4982***	-15.2454
	(16.5080)	(12.2300)	(12.5825)
Log pseudolikelihood	-18,305.19	-18,305.19	-18,305.19
Pseudo R2	0.1461	0.1461	0.1461
Observations	18,825	18,825	18,825

This table reports multinomial logistic regressions for United States Systemically Important Banks. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, and Global Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.11: Market Choice Predictive Probabilities for Australia (from Table 2.7), Canada (from Table 2.8), Europe (from Table 2.9), and the United States (from Table 2.10)

		Eurobond	Foreign Bond	Global Bond	Onshore Bond	Yankee Bond
Australia	IRATING	-4%	2%	1%	-1%	2%
	ONSBOND	-10%	6%	1%	3%	0%
	AGE	-2%	-5%	1%	3%	3%
	UFE	-3%	1%	0%	2%	1%
	TENOR	16%	-10%	0%	-5%	-2%
	MVBV	-2%	7%	-1%	-2%	-2%
	SIZE	-51%	16%	3%	30%	3%
	TA	-11%	16%	0%	4%	-9%
Canada	IRATING	-22%	2%	30%	12%	-22%
	ONSBOND	-10%	2%	1%	2%	6%
	AGE	5%	0%	-26%	-2%	23%
	UFE	8%	0%	-18%	0%	10%
	TENOR	3%	1%	-4%	5%	-5%
	MVBV	7%	1%	3%	-3%	-8%
	SIZE	-26%	8%	-10%	39%	-11%
	TA	-62%	1%	45%	-7%	23%
Europe	IRATING	5%	6%	-7%	4%	-8%
	ONSBOND	10%	-6%	-5%	5%	-3%
	AGE	-21%	3%	11%	5%	2%
	UFE	5%	-1%	-4%	4%	-3%
	TENOR	17%	-4%	-8%	-3%	-3%
	MVBV	19%	-6%	-5%	-2%	-7%
	SIZE	-20%	8%	0%	12%	-1%
	TA	0%	0%	19%	-3%	-16%
United States	IRATING	0%	1%	14%	-15%	
	ONSBOND	-13%	1%	30%	-18%	
	AGE	-4%	-1%	-10%	15%	
	UFE	-2%	-3%	-2%	7%	
	TENOR	44%	-1%	-23%	-19%	
	MVBV	-1%	4%	-22%	19%	
	SIZE	-14%	6%	9%	0%	
	TA	8%	3%	30%	-40%	

This table reports the predictive probabilities at a confidence interval of 95 percent for the market choices Eurobond, Foreign Bond, Global Bond, Yankee Bond, and Onshore Bond implied by the multinomial logistic regressions from Tables 2.7, 2.8, 2.9, and 2.10. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. The sum of each of the independent variables' predicted probabilities in each row equals zero, subject to rounding. IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, TENOR is the bond maturity tenor in years, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, SIZE is the logarithm of bond size in USD, and TA is the logarithm of the book value of total assets. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix.

2.6 ROBUSTNESS CHECKS

The first robustness check utilises multinomial probit regressions that relax the independence of irrelevant alternatives (IIA) assumption. In the main results, the IIA assumption test (Hausman test) was violated, providing evidence against the null hypothesis that the choices are independent of irrelevant alternatives (Gomes & Phillips, 2012). Long and Freese (2014) suggest that these assumptions contradict each other and do not recommend their use, arguing that these tests are largely theoretical and not necessarily a reflection of the real world. Multinomial probit regressions[31] and predictive probability results in Tables 2.15–2.21 in the chapter appendix indicate no material differences to the results in Tables 2.5–2.11 regarding multinomial logistic regressions and predictive probabilities. Gomes and Phillips (2012) note that for practical purposes multinomial probit is not possible due to its computational intensity, something this study is able to overcome.

The second robustness check substitutes independent variables to reinforce the stability of the models. The Australian banks are used because these banks collectively have the highest retrieval of bond credit rating, and Black and Munro (2010) identify this as an issue. Bond credit rating (BRATING) is substituted for issuer credit rating, with a significant decrease in the sample size to 2,339 from the original 7,292 market choices. Offshore bond reputation (OFFBOND) is substituted for onshore bond reputation, and the results support Tawatnuntachai and Yaman (2008) with increased predicted probability in Global Bonds due to an increase in offshore bond reputation and bond size. Return on average equity (ROAE), calculated as a bank's net income divided by average total equity, replaces bank age in the expectation that older firms will have a more established business and higher profitability, reflected in a stronger credit rating. SIBs' return on average equity reduced significantly following the GFC. Australian return on average equity appears to tell us more than bank age, as an increase in return on average equity as a measure of reputation decreases the likelihood of Eurobonds and Foreign Bond choices and increases the likelihood of a Yankee Bond choice,

[31] Multinomial probit models can also have an advantage over multinomial logistic models as the model allows for correlation between the error terms following multivariate normal distribution, unlike multinomial logistic models that assume errors to be independent. So, assuming the results of the IIA assumption test indicate a statistical violation, is the multinomial probit necessarily better than the multinomial logistic? Dow and Endersby (2004) argue that the multinomial logistic is often preferable to multinomial probit from findings on voter choices in the United States and France presidential elections; however, one disadvantage of multinomial probit is a possible problem with maximum likelihood optimisation. Multinomial probit relies on multiple integrals and can become unstable and not converge to global maximum likelihood estimates.

all at the one percent significance level, and supportive of the reputation hypothesis. Future abnormal earnings (FAE) is substituted for unexpected future earnings (Barclay & Smith, 1995; Krishnaswami et al., 1999). The logarithm of the book value of total equity (TE) replaces book value of total assets. MOVE replaces VIX as per Serena and Moreno (2016). A binary dummy variable for underwritten agent bonds (UNDERWA) is substituted for callable bonds. Underwriting costs are considered a flotation cost, with underwritten bonds requiring more fixed costs than a direct or private placement bond and reducing asymmetric information between issuers and investors. The global liquidity indicator (GLIQ) from the BIS replaces the consumer price index. Lastly, to control for the cost of capital in the second robustness check between onshore and offshore markets, an interest rate differential variable (INTDIFF)[32] is added to the regression. It calculates the spread between Australian dollar and USD markets. USD yields are selected because USD denominated bonds are the dominant offshore currency of issue and two of the offshore choices are United States markets. A higher spread indicates a lower cost of credit in US denominated issue markets relative to the onshore Australian dollar market. The results are statistically significant and negative for non-public Eurobonds and positive for public Global Bonds, which is consistent with expectations that SIBs access public bond markets more than non-public bond markets when credit spread is lower. This does not alter the results of the model. The results in Tables 2.22 and 2.23 are consistent with the original results in Tables 2.7 and 2.11. Overall, these robustness checks indicate that the original model results are valid.

2.7 CONCLUSION

There is vast amounts of literature on corporate finance decisions regarding private bank loans, non-private debt, and public debt (including Yankee and Global Bonds), focusing on emerging markets and United States non-financial firms. To the best of the author's knowledge, no research to date examines bond market choices for SIBs from developed economies and the impact on financial stability. This study attempts to fill this research gap. The sample for this study is based on a selection of active debt capital market borrowers that are global and

[32] The Australian dollar spread minus the USD spread. The Australian dollar spread is calculated by subtracting the Australian dollar 5-year risk-free yield from the Australian dollar 5-year swap yield. The USD spread is calculated by subtracting the USD 5-year risk-free yield from the USD 5-year swap yield. Both spreads are daily and matched to the issue date of the bond market choice.

domestic SIBs. The final sample comprises 21 banks covering 9 countries including France, Germany, Spain, Switzerland, Sweden, United Kingdom, United States, Canada, and Australia with a total sample size of 96,694. The sample period covers 1999–2019, spanning eight years before the GFC and eleven years after the GFC (excluding the COVID-19 pandemic). Multinomial logistic regression is employed to determine the log likelihood of statistical relationships between bond market choices and agency costs, reputation, and flotation costs. From the results, the predicted probabilities are computed from the 5^{th} to 95^{th} percentiles.

The ability to choose offshore compared to onshore markets can have impacts on financial stability. Most notable is a benefit to financial stability due to the positive relationship with bond size and onshore funding for Australia and Canada. However, this must be tempered with a tendency of some jurisdictions (including Australia) to access longer bond maturity tenors in offshore markets, which is positive for funding and liquidity risk, but negative for financial stability. For United States banks, stronger issuer credit rating and onshore bond reputation results in a negative outcome for financial stability.

Regulators could consider initiatives to improve onshore markets for Australia and Canada to better align with Europe and the United States. In Australia there are impediments to the development of the onshore bond market. For the Australian fixed income asset class there is an overallocation in superannuation and portfolios to equities that receive favourable tax treatment for investors. There is not a deep retail corporate bond market. Regulation changes to make it easier and less costly for issuers to access the retail market and tax incentives for resident investors to hold fixed income assets in their portfolios would be beneficial. Changes in Australia could also attract offshore capital into the Australian bond market. These initiatives would benefit market participants (including banks) with greater product and market liquidity, and in turn financial stability.

A limitation of this study is that the Asian developed countries, specifically China, South Korea, Singapore, and Japan are not included. China has the four largest banks in the world by total assets. Japan has four SIBs in the top twenty largest banks. For future research there are two ways these excluded countries and their respective SIBs can be included. Researchers could wait until these excluded banks become active issuers in all five bond markets; however, this is not a certainty. Alternatively, the five bond market choices could be reduced to three: Eurobond, Foreign Bond, and Onshore Bond. The alternative option however does not include public markets but rather non-public markets. A second limitation is the study does not consider other factors that can impact offshore market choices. This could include risk management where banks issue in offshore currencies as a natural hedge to offshore branch asset exposures.

2.8 APPENDIX

Figure 2.2: Mean of Numeric Moody's Long-Term Issuer Rating. Sources: Stata, Fitch, Refinitiv, and Author Calculations.

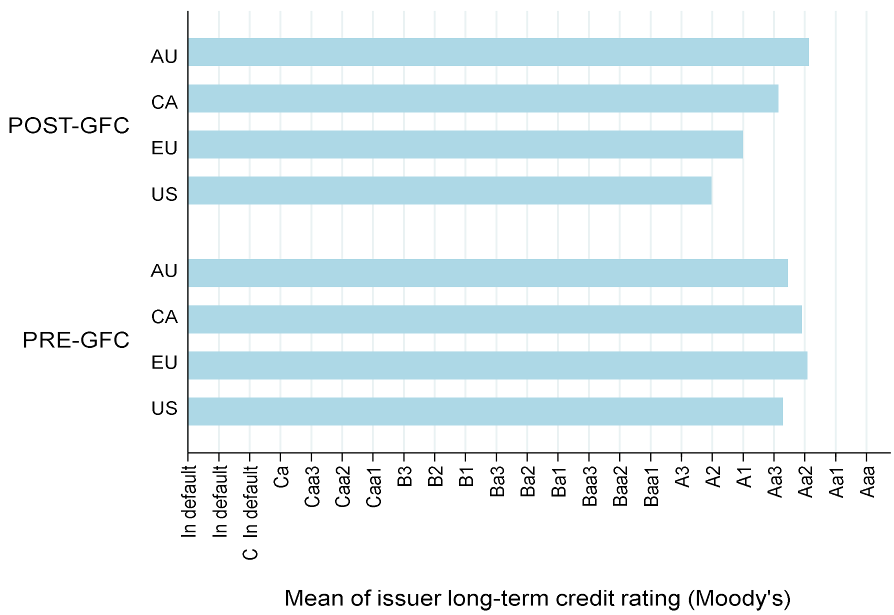


Figure 2.3: Logarithm of Total Assets and Logarithm of Bond Size. Sources: Stata, Fitch, Refinitiv, and Author Calculations.

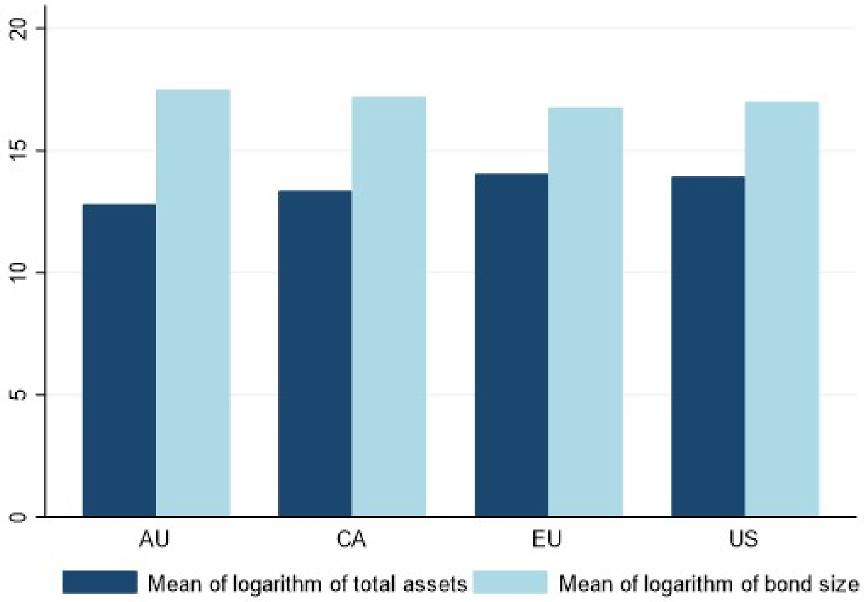


Figure 2.4: Onshore Bond Reputation by Period by Jurisdiction. Sources: Stata, Fitch, Refinitiv, and Author Calculations.

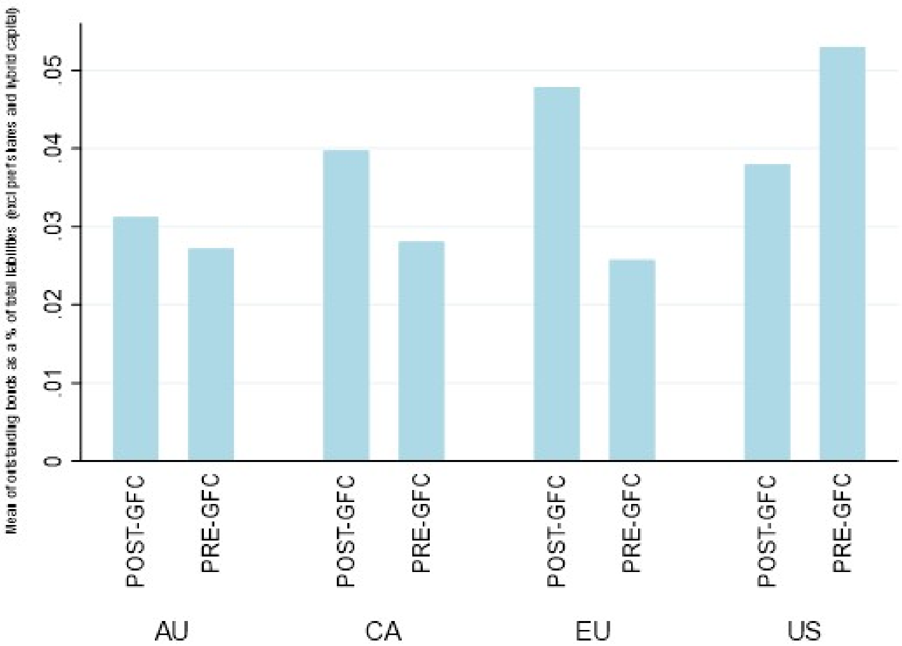


Figure 2.5: Mean of Bond Maturity Tenor by Jurisdiction. Sources: Stata, Refinitiv and Author Calculations.

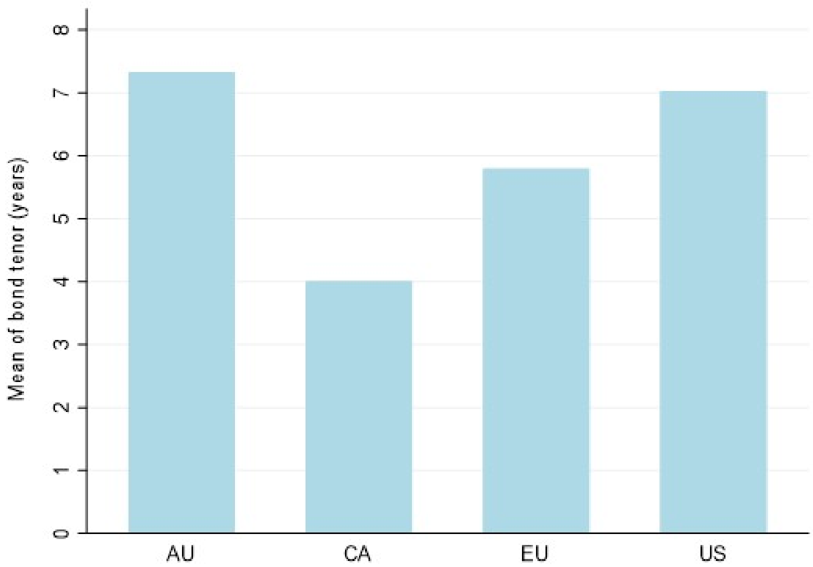


Figure 2.6: Mean of Bank Age. Sources: Stata, Fitch, Refinitiv, and Author Calculations.

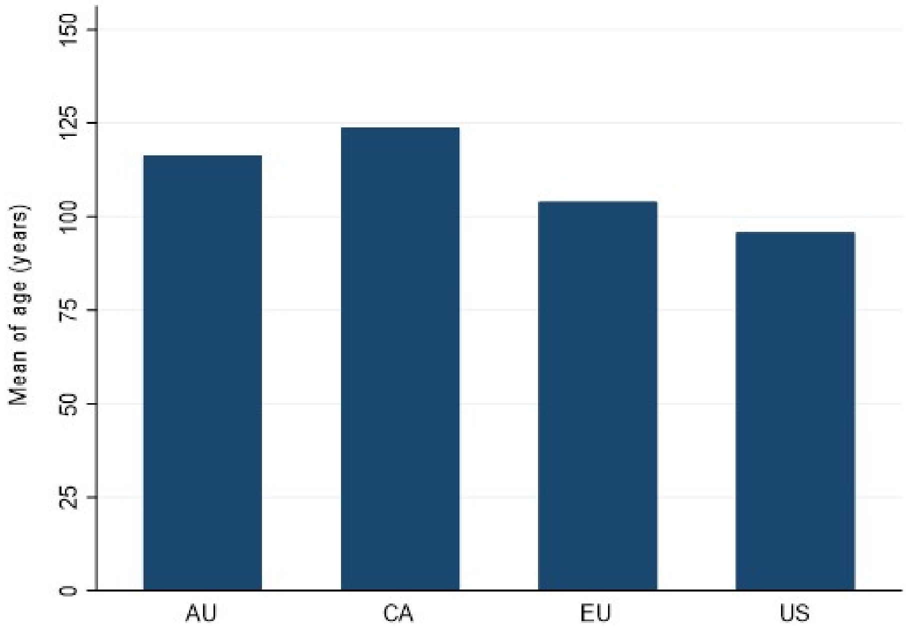


Figure 2.7: Mean of Unexpected Future Earnings and Mean of Market Value to Book Value by Jurisdiction. Sources: Stata, Fitch, Datastream, and Author Calculations.

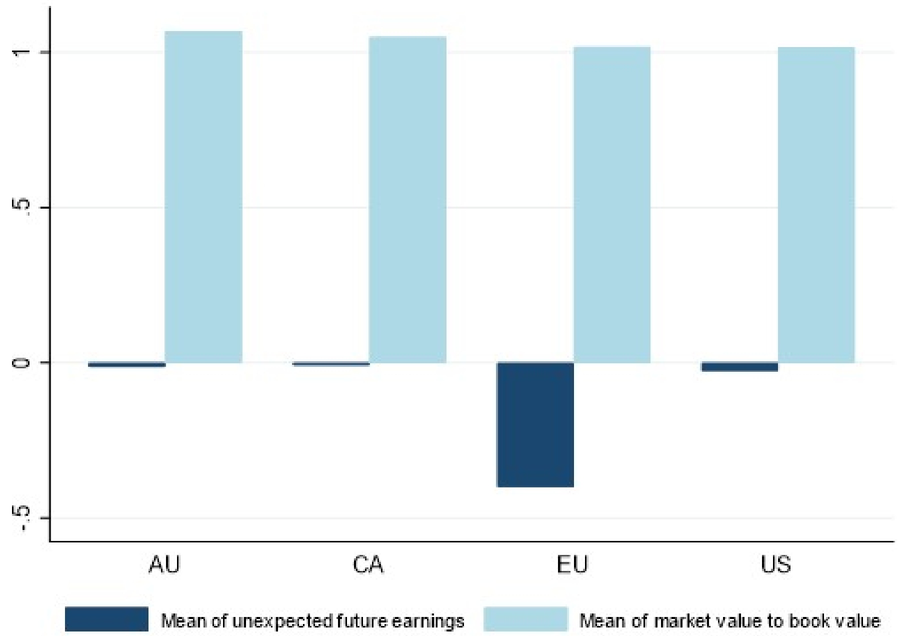


Figure 2.8: Logarithm of Liquid Assets to Deposits and Short-Term Borrowings by Jurisdiction. Sources: Stata, Fitch, and Author Calculations.

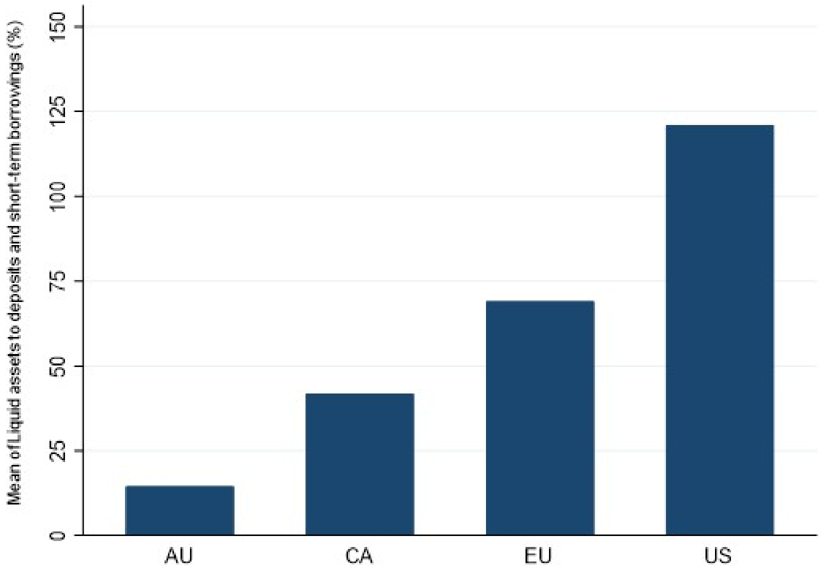
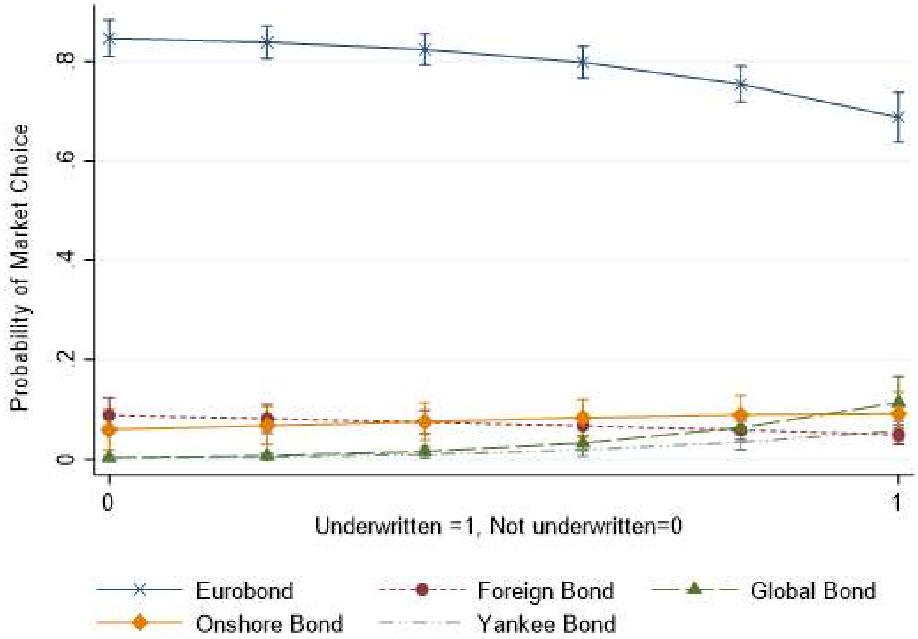
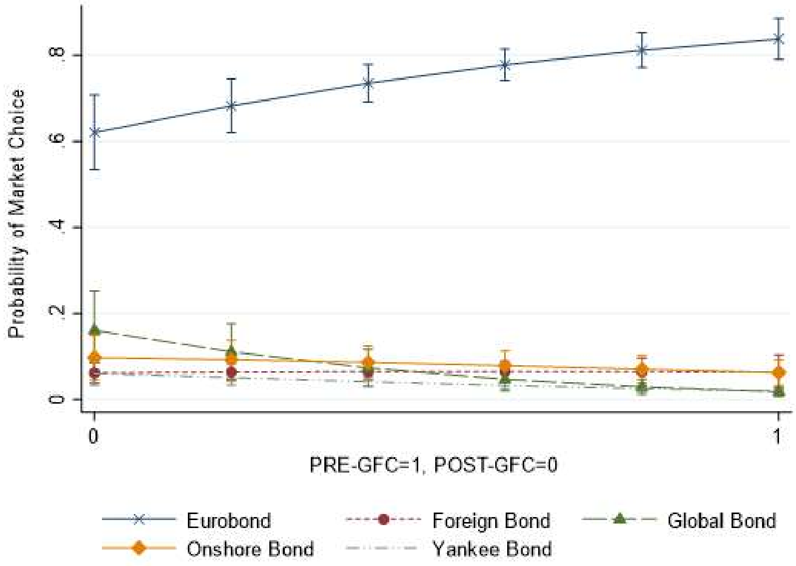


Figure 2.9: Australian, Canadian, and European Market Choices Predictive Probabilities – Underwritten Bonds (from Table 2.6)



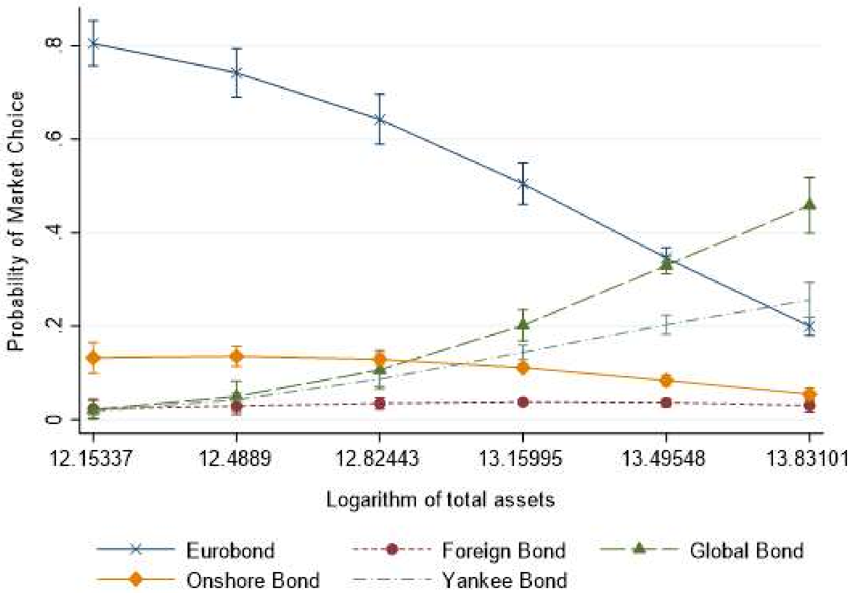
This figure charts the Austrailan, Canadian, and European banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.6. The change in probability is calculated from the 5th to the 95th percentile of the independent variable binary dummy underwritten bonds (UNDERW). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.10: Australian, Canadian, and European Market Choices Predictive Probabilities – Pre GFC (from Table 2.6)



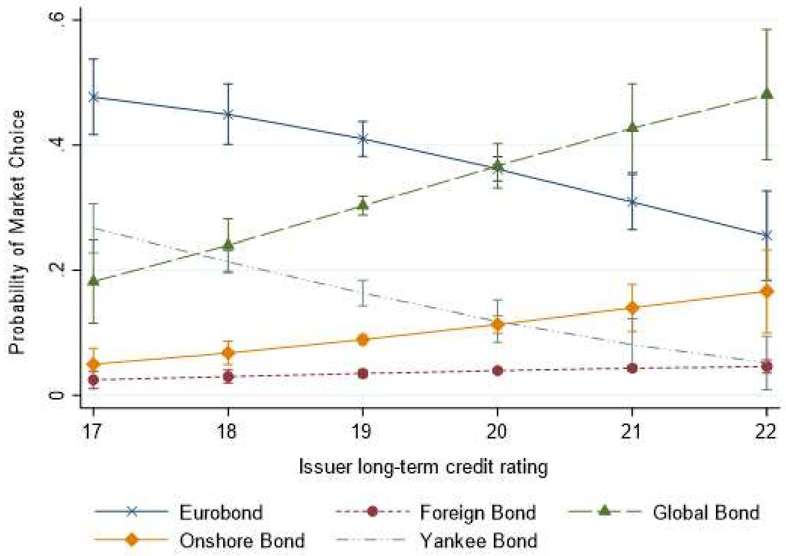
This figure charts the Austrailan, Canadian, and European banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.6. The change in probability is calculated from the 5th to the 95th percentile of the independent variable binary dummy prior to the Global Financial Crisis (GFC). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.11: Canadian Market Choices Predictive Probabilities – Logarithm of Total Assets (from Table 2.11)



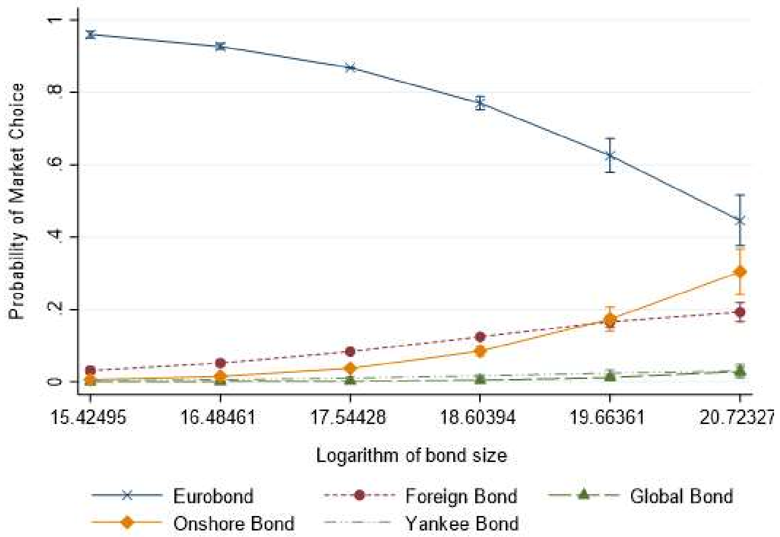
This figure charts the Canadian banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable logarithm of book value of total assets (TA). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.12: Canadian Market Choices Predictive Probabilities – Issuer Credit Rating (from Table 2.11)



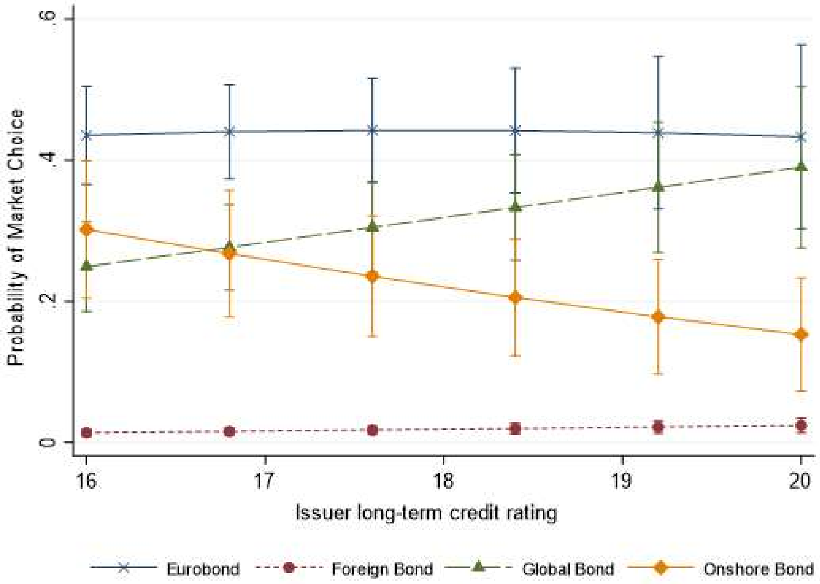
This figure charts the Canadian banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable dummy bank issuer long-term credit rating (IRATING). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.13: Australian Market Choices Predictive Probabilities – Logarithm of Bond Size (from Table 2.11)



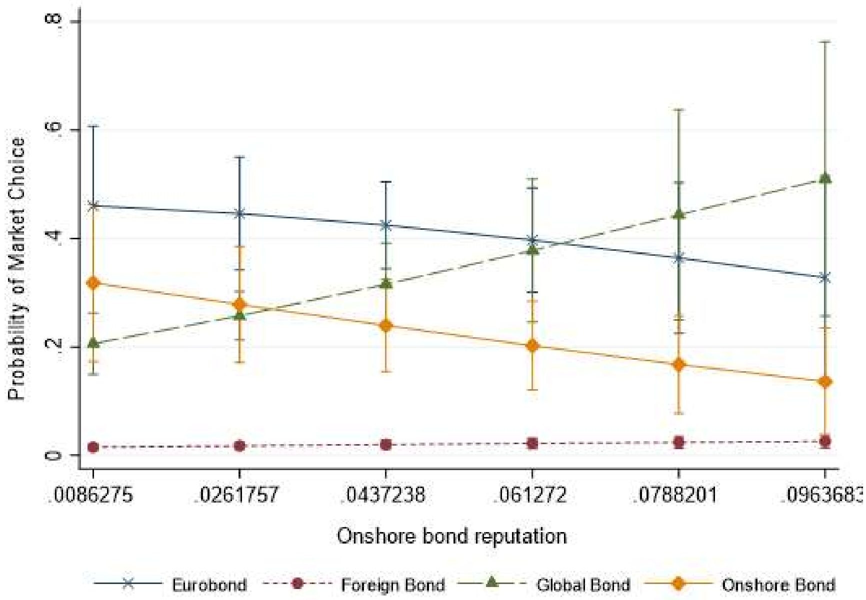
This figure charts the Australian banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable of the logarithm of bond size (SIZE). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.14: United States Market Choices Predictive Probabilities – Issuer Credit Rating (from Table 2.11)



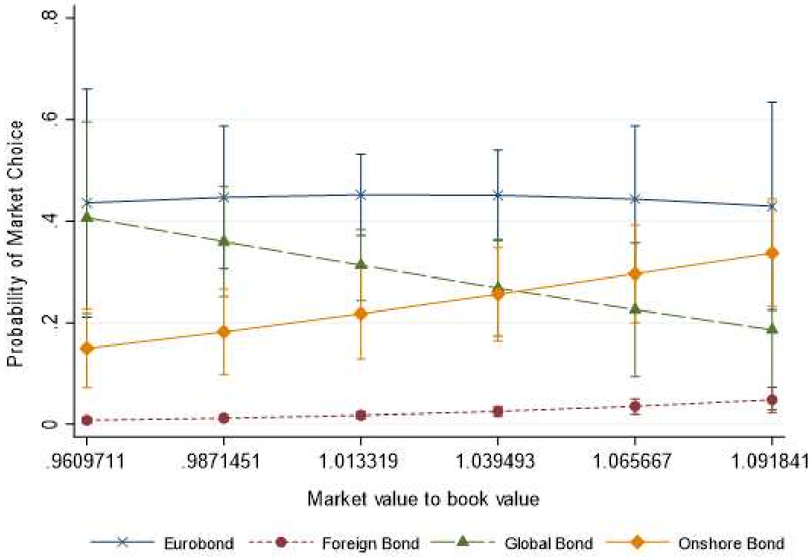
This figure charts the United States banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable dummy bank issuer long-term credit rating (IRATING). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.15: United States Market Choices Predictive Probabilities – Onshore Bond Reputation (from Table 2.11)



This figure charts the United States banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable onshore bond reputation (ONSBOND). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Figure 2.16: United States Predictive Probabilities – Market Value to Book Value (from Table 2.11)



This figure charts the United States banks predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial logistic regression from Table 2.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variable market value to book value (MVBV). The sum of the independent variable across the bond market choices predicted probabilities equals zero.

Table 2.12: Ranking the World's 100 Largest Banks as at 2019. Source: S&P Global Market Intelligence (2020).

Ranking the world's 100 largest banks

Pro forma for recent and pending acquisitions

Current rank^	Previous rank^^	Current vs. previous	Company (ticker-exchange)	Headquarters	Accounting principle	Total assets (US$B)
1	1	NC	Industrial & Commercial Bank of China Ltd. (1398-HKG)	China	IFRS	4,324.27
2	2	NC	China Construction Bank Corp. (939-HKG)	China	IFRS	3,653.11
3	3	NC	Agricultural Bank of China Ltd. (1288-HKG)	China	IFRS	3,572.98
4	4	NC	Bank of China Ltd. (3988-HKG)	China	IFRS	3,270.15
5	5	NC	Mitsubishi UFJ Financial Group Inc. (8306-TKS)	Japan	Japanese GAAP	2,892.97
6	7	▲	HSBC Holdings PLC (HSBA-LON)	U.K.	IFRS	2,715.15
7	6	▼	JPMorgan Chase & Co. (JPM-NYSE)	U.S.	U.S. GAAP	2,687.38
8	8	NC	Bank of America Corp. (BAC-NYSE)	U.S.	U.S. GAAP	2,434.08
9	9	NC	BNP Paribas SA (BNP-PAR)	France	IFRS	2,429.26
10	10	NC	Crédit Agricole Group	France	IFRS	2,256.72
11	12	▲	Japan Post Bank Co. Ltd. (7182-TKS)	Japan	Japanese GAAP	1,984.62
12	14	▲	Sumitomo Mitsui Financial Group Inc. (8316-TKS)	Japan	Japanese GAAP	1,954.78
13	11	▼	Citigroup Inc. (C-NYSE)	U.S.	U.S. GAAP	1,951.16
14	13	▼	Wells Fargo & Co. (WFC-NYSE)	U.S.	U.S. GAAP	1,927.56
15	15	NC	Mizuho Financial Group Inc. (8411-TKS)	Japan	Japanese GAAP	1,874.89
16	16	NC	Banco Santander SA (SAN-MAD)[1]	Spain	IFRS	1,702.61
17	18	▲	Société Générale SA (GLE-PAR)	France	IFRS	1,522.05
18	20	▲	Barclays PLC (BARC-LON)	U.K.	IFRS	1,510.14
19	19	NC	Groupe BPCE	France	IFRS	1,501.59
20	22	▲	Postal Savings Bank of China Co. Ltd. (1658-HKG)	China	PRC GAAP	1,467.31
21	17	▼	Deutsche Bank AG (DBK-ETR)	Germany	IFRS	1,456.26
22	21	▼	Bank of Communications Co. Ltd. (3328-HKG)	China	IFRS	1,422.63
23	23	NC	Royal Bank of Canada (RY-TSX)*	Canada	IFRS	1,116.31
24	24	NC	Lloyds Banking Group PLC (LLOY-LON)	U.K.	IFRS	1,104.42
25	26	▲	Toronto-Dominion Bank (TD-TSX)*	Canada	IFRS	1,102.04
26	27	▲	China Merchants Bank Co. Ltd. (600036-SGSE)	China	IFRS	1,065.25
27	35	▲	Intesa Sanpaolo SpA (ISP-MIL)[2]	Italy	IFRS	1,057.82
28	29	▲	Norinchukin Bank	Japan	Japanese GAAP	1,011.14
29	25	▼	ING Groep NV (INGA-AMS)	Netherlands	IFRS	1,000.72
30	33	▲	Goldman Sachs Group Inc. (GS-NYSE)	U.S.	U.S. GAAP	992.97
31	31	NC	Industrial Bank Co. Ltd. (601166-SGSE)**	China	PRC GAAP	976.79
32	28	▼	Crédit Mutuel Group***	France	IFRS	976.14
33	30	▼	UBS Group AG (UBSG-SWX)	Switzerland	IFRS	972.18
34	32	▼	UniCredit SpA (UCG-MIL)	Italy	IFRS	960.21
35	38	▲	China Minsheng Banking Corp. Ltd. (600016-SGSE)	China	IFRS	959.63
36	36	NC	Royal Bank of Scotland Group PLC (RBS-LON)	U.K.	IFRS	957.60
37	34	▼	Shanghai Pudong Development Bank Co. Ltd. (600000-SGSE)**	China	PRC GAAP	950.01
38	37	▼	China CITIC Bank Corp. Ltd. (998-HKG)**	China	IFRS	904.02
39	39	NC	Morgan Stanley (MS-NYSE)	U.S.	U.S. GAAP	895.43
40	40	NC	Bank of Nova Scotia (BNS-TSX)*	Canada	IFRS	872.62
41	41	NC	Credit Suisse Group AG (CSGN-SWX)	Switzerland	U.S. GAAP	812.91
42	42	NC	Banco Bilbao Vizcaya Argentaria SA (BBVA-MAD)[3]	Spain	IFRS	782.16
43	44	▲	Standard Chartered PLC (STAN-LON)	U.K.	IFRS	720.40
44	43	▼	Commonwealth Bank of Australia (CBA-ASX)	Australia	Australian GAAP	688.40
45	49	▲	China Everbright Bank Co. Ltd. (601818-SGSE)	China	IFRS	679.81
46	50	▲	Bank of Montreal (BMO-TSX)*	Canada	IFRS	665.20
47	46	▼	Rabobank	Netherlands	IFRS	662.77
48	45	▼	Australia & New Zealand Banking Group Ltd. (ANZ-ASX)**	Australia	Australian GAAP	661.72
49	51	▲	DZ BANK AG	Germany	IFRS	627.31
50	47	▼	Nordea Bank Abp (NDA SE-OME)	Finland	IFRS	622.66

51	48	▼	Westpac Banking Corp. (WBC-ASX)**	Australia	Australian GAAP	611.47
52	52	NC	National Australia Bank Ltd. (NAB-ASX)**	Australia	Australian GAAP	571.34
53	58	▲	Ping An Bank Co. Ltd. (000001-CNSSE)	China	PRC GAAP	565.72
54	53	▼	Danske Bank A/S (DANSKE-CSE)	Denmark	IFRS	564.83
55	54	▼	State Bank of India (SBIN-NSE)	India	Indian GAAP	561.54
56	55	▼	Resona Holdings Inc. (8308-TKS)	Japan	Japanese GAAP	549.51
57	57	NC	Sumitomo Mitsui Trust Holdings Inc. (8309-TKS)	Japan	Japanese GAAP	509.28
58	59	▲	Canadian Imperial Bank of Commerce (CM-TSX)*[4]	Canada	IFRS	495.99
59	60	▲	U.S. Bancorp (USB-NYSE)	U.S.	U.S. GAAP	495.43
60	66	▲	PAO Sberbank of Russia (SBER-ME)	Russia	IFRS	482.53
61	65	▲	Shinhan Financial Group Co. Ltd. (A055550-KRX)	South Korea	Korean IFRS	478.50
62	56	▼	Commerzbank AG (CBK-ETR)[5]	Germany	IFRS	478.40
63	62	▼	Truist Financial Corp. (TFC-NYSE)	U.S.	U.S. GAAP	473.08
64	64	NC	KB Financial Group Inc. (A105560-KRX)	South Korea	Korean IFRS	449.15
65	61	▼	CaixaBank SA (CABK-MAD)	Spain	IFRS	439.25
66	68	▲	DBS Group Holdings Ltd. (D05-SGX)	Singapore	Singapore FRS	430.45
67	67	NC	Nomura Holdings Inc. (8604-TKS)	Japan	U.S. GAAP	425.50
68	71	▲	Hua Xia Bank Co. Ltd. (600015-SGSE)**	China	PRC GAAP	422.74
69	63	▼	ABN AMRO Bank NV (ABN-AMS)	Netherlands	IFRS	420.89
70	70	NC	PNC Financial Services Group Inc. (PNC-NYSE)	U.S.	U.S. GAAP	410.30
71	69	▼	Itaú Unibanco Holding SA (ITUB4-BSP)	Brazil	IFRS	407.37
72	73	▲	Capital One Financial Corp. (COF-NYSE)	U.S.	U.S. GAAP	390.37
73	75	▲	Bank of New York Mellon Corp. (BK-NYSE)	U.S.	U.S. GAAP	381.51
74	74	NC	Bank of Beijing Co. Ltd. (601169-SGSE)**	China	PRC GAAP	374.97
75	72	▼	NongHyup Financial Group Inc.	South Korea	Korean IFRS	369.92
76	78	▲	Oversea-Chinese Banking Corp. Ltd. (O39-SGX)	Singapore	Singapore FRS	365.57
77	76	▼	Banco do Brasil SA (BBAS3-BSP)	Brazil	BR GAAP	365.51
78	77	▼	Hana Financial Group Inc. (A086790-KRX)	South Korea	Korean IFRS	365.10
79	79	NC	Banco Bradesco SA (BBDC4-BSP)[6]	Brazil	IFRS	345.21
80	83	▲	China Guangfa Bank Co. Ltd.***	China	PRC GAAP	343.26
81	80	▼	Svenska Handelsbanken AB (publ) (SHB A-OME)	Sweden	IFRS	328.59
82	82	NC	KBC Group NV (KBC-BRU)[7]	Belgium	IFRS	327.87
83	81	▼	Caixa Econômica Federal	Brazil	BR GAAP	321.68
84	86	▲	DNB ASA (DNB-OSL)	Norway	IFRS	317.75
85	85	NC	Woori Financial Group Inc. (A316140-KRX)	South Korea	Korean IFRS	313.54
86	84	▼	Nationwide Building Society (NBS-LON)**	U.K.	IFRS	307.45
87	88	▲	Bank of Shanghai Co. Ltd. (601229-SGSE)**	China	PRC GAAP	306.04
88	87	▼	Skandinaviska Enskilda Banken AB (SEB A-OME)	Sweden	IFRS	305.79
89	91	▲	La Banque Postale SA	France	IFRS	304.88
90	89	▼	United Overseas Bank Ltd. (U11-SGX)	Singapore	Singapore FRS	300.68
91	90	▼	Bank of Jiangsu Co. Ltd. (600919-SGSE)	China	PRC GAAP	296.58
92	92	NC	Landesbank Baden-Württemberg	Germany	IFRS	287.99
93	93	NC	Erste Group Bank AG (EBS-WBO)	Austria	IFRS	275.72
94	94	NC	Industrial Bank of Korea (A024110-KRX)	South Korea	Korean IFRS	275.54
95	97	▲	Bayerische Landesbank AöR**	Germany	IFRS	266.27
96	-	▲	Qatar National Bank (QPSC) (QNBK-DSM)	Qatar	IFRS	259.48
97	99	▲	China Zheshang Bank Co. Ltd. (2016-HKG)	China	IFRS	258.63
98	96	▼	Swedbank AB (publ) (SWED A-OME)	Sweden	IFRS	257.79
99	-	▲	Raiffeisen Gruppe Switzerland	Switzerland	Swiss GAAP	256.43
100	95	▼	Banco de Sabadell SA (SAB-MAD)	Spain	IFRS	251.10

Banks and institutions with significant lending business are ranked by total assets for the most recent period available. Only one institution per corporate structure is included in the ranking. Rankings account for completed and pending SNL-covered bank deals on a best-efforts basis. Deals, where the assets sold are in excess of $300 million or the deal value is in excess of $200 million, have been adjusted using the most recent available assets of the target company or the deal announcement/completion assets where available.
Companies classified as "banks" or "savings banks/thrifts/mutuals," companies regulated in the U.S. as bank holding companies, or any financial holding companies with significant banking subsidiaries are included in these rankings. The rankings have been created on a best-efforts basis and exclude development banks and entities that act as central banks/banking associations/supervisors for banking groups.
Data is reported in native currencies and converted to U.S. dollars using end-of-period exchange rates.
^ Pro forma for mergers as of March 31, 2020.
^^ Based on previous rankings published April 5, 2019.
Total assets are as of Dec. 31, 2019, unless stated otherwise.
* Data is as of Jan. 31, 2020.
** Data is as of Sept. 30, 2019.
*** Data is as of Dec. 31, 2018.
[1] Financial data adjusted for the pending sale of U.S.-based Santander BanCorp.
[2] Financial data adjusted for the pending purchase of Italy-based Unione di Banche Italiane SpA.
[3] Financial data adjusted for the pending sale of Paraguay-based Banco Bilbao Vizcaya Argentaria Paraguay SA.
[4] Financial data adjusted for the pending sale of FirstCaribbean International Bank Ltd.
[5] Financial data adjusted for the pending sale of Poland-based mBank.
[6] Financial data adjusted for the pending purchase of U.S.-based BAC Florida Bank.
[7] Financial data adjusted for the pending purchase of Slovakia-based OTP Banka Slovensko a.s.
Banco de Sabadell SA agreed to sell its institutional depositary business to BNP Paribas SA unit BNP Paribas Securities Services for €115 million on March 28, 2020. This transaction has not been adjusted in this ranking due to unavailability of a precise figure.
NC = no change; dash indicates the company was not part of the top 100 banks in the previous ranking.
Source: S&P Global Market Intelligence

Table 2.13: Market Choice Qualification for Study 1 (Qualification Criteria from Section 2.3.1)

	BAR	BPCE	BNP	CREDA	CREDM	CREDS	DEUT	HSBC	INGB	SANT	SG	STANDC	UBS	UNIC	ABNA	BAYER	BBVA	CAIXA	COMMER
	GSIB	GSIB	GSIB	GSIB		GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	DSIB	DSIB	DSIB	DSIB	DSIB
Eurobond	8,334	5035	7,783	3,004	0	9,170	7,893	7,247	3,287	2,242	3,621	1,204	409	1,638	752	1,312	75	204	10,597
Foreign bond	901	191	76	186	0	1,213	585	171	149	109	105	74	14	163	69	71	12	0	167
Global bond	2,732	23	41	2	0	629	1,081	31	13	77	32	2	1	3	2	12	2	0	34
Onshore bond	81	1695	1,519	999	0	399	1,815	159	131	858	710	945	21	4,659	106	4,013	440	906	4,448
Yankee bond	765	5	124	16	0	1,256	157	0	3	57	210	1	1	0	6	100	0	0	0
Total	**12,813**	**6,949**	**9,543**	**4,207**	**0**	**12,667**	**11,531**	**7,608**	**3,583**	**3,343**	**4,678**	**2,226**	**446**	**6,463**	**935**	**5,508**	**529**	**1,110**	**15,246**
Qualify	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No

	DAN	DNB	DZBANK	ERST	INTESA	KBC	LABANQ	LLBW	LLOYDS	NATW	NBS	NORD	RABO	RAIFFS	SAB	SEB	SHB	SWED
	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB
Eurobond	723	19	742	81	1,452	27	11	1,213	3984	6,082	417	761	5,163	0	37	325	235	1389
Foreign bond	250	1	400	7	37	2	0	53	182	836	45	826	219	0	4	98	118	87
Global bond	1	0	0	0	4	1	0	4	64	190	1	0	33	0	0	3	10	0
Onshore bond	45	21	10,331	1,530	7,276	166	125	9,448	24	188	12	966	178	58	285	743	485	351
Yankee bond	0	0	0	0	6	1	0	79	23	62	1	1	91	0	1	4	11	1
Total	**1,019**	**41**	**11,473**	**1,618**	**8,775**	**197**	**136**	**10,797**	**4,277**	**7,358**	**476**	**2,554**	**5,684**	**58**	**327**	**1,173**	**859**	**1,828**
Qualify	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	Yes	No

	BA	BNYM	CITI	GS	JP	MS	WF	CAPITALO	PNCFIN	TRUISTB	USBANC	MIZUHO	MUFG	NOMURA	NORIN	RESONA	SMFG	SMTH	JAPPOST
	GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	GSIB	DSIB	DSIB	DSIB	DSIB	GSIB	GSIB	DSIB	DSIB	DSIB	GSIB	DSIB	
Eurobond	983	18	2,125	1,818	2,279	2,040	181	0	1	9	3	312	688	909	0	19	372	20	0
Foreign bond	67	1	81	74	65	166	24	0	0	0	0	26	38	11	0	3	14	10	0
Global bond	1,513	0	695	729	1,861	2,122	407	17	63	67	51	21	45	0	0	0	67	0	0
Onshore bond	1,342	56	173	2,365	912	404	610	37	454	114	240	596	522	6	590	61	162	67	3
Yankee bond	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0
Total	**3,905**	**75**	**3,074**	**4,986**	**5,117**	**4,732**	**1,222**	**54**	**518**	**190**	**294**	**955**	**1,294**	**926**	**590**	**83**	**618**	**97**	**3**
Qualify	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No

	RY	TD	BM	BNS	CIBC	ANZ	CBA	WBC	NAB	SHIN	NACF	HANA	WOORI	IBK	KB	OCBC	UOB	DBS
	GSIB	GSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB	DSIB									
Eurobond	990	211	0	369	345	1,585	3,534	1,333	1,145	164	21	147	119	0	189	116	128	1390
Foreign bond	80	28	0	44	29	141	326	168	212	33	5	30	43	0	22	10	6	22
Global bond	1,101	243	2	112	94	2	5	63	8	2	0	0	0	0	1	1	0	1
Onshore bond	168	58	39	112	162	142	150	200	128	5939	11613	9239	1730	728	10712	338	531	311
Yankee bond	249	12	0	342	265	8	10	70	5	0	0	0	0	0	0	0	0	0
Total	**2,588**	**552**	**41**	**979**	**895**	**1,878**	**4,025**	**1,834**	**1,498**	**6,138**	**11,639**	**9,416**	**1,892**	**728**	**10,924**	**465**	**665**	**1,724**
Qualify	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No

Qualify	21
Do not qualify	53

Table 2.14: Study 1 Refinitiv Advanced Corporate Bond Search

Search Category	**Description**
Issuer Type Bond Type Status Sukuks Convertibles	Corporate Bonds Active, Inactive Exclude Exclude
Issuer and Subsidiaries	Region bank names from Table 2.1.
Issue Date Between	01/01/1999 and 31/12/2019
Instrument Type	Negotiable Certificates of Deposit or Promissory note
Amount Issued ($USD) Greater Than or Equal To	5,000,000
Sample size	Various. Varied sizes for different jurisdictions.

Table 2.15: Market Choice Results for Australian, Canadian, and European Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check)

Regression 6

Dependent variable	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
Independent variables				
SIZE	-0.3733***	-0.1217*	-0.1935**	-0.2525***
	(0.0717)	(0.0677)	(0.0828)	(0.0866)
TENOR	0.0449***	-0.0109	-0.0557***	-0.0304
	(0.0143)	(0.0117)	(0.0210)	(0.0195)
CALL	0.3033**	-0.0912	0.9493***	0.7382***
	(0.1247)	(0.2214)	(0.2290)	(0.1839)
LIST	-0.1664	0.2389	-0.5596*	-1.2815***
	(0.2767)	(0.3014)	(0.3112)	(0.2948)
UNDERW	-0.5282**	-0.6511**	1.7197***	1.3986***
	(0.2415)	(0.2611)	(0.3798)	(0.3818)
GSIB	-0.3331	-0.5557	0.4330	-0.6019
	(0.3880)	(0.4342)	(0.4761)	(0.4757)
GFC	0.6872***	0.3516	-1.1660***	-0.3538
	(0.1349)	(0.3587)	(0.3147)	(0.2979)
VIX	-0.0056	-0.0057*	-0.0141***	-0.0021
	(0.0045)	(0.0033)	(0.0048)	(0.0059)
GDPPC	0.0000**	0.0000*	0.0000	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	7.0210***	1.0101	2.2083	0.6392
	(1.1398)	(1.7787)	(1.7509)	(1.5624)
Log pseudolikelihood	-59,059.37	-59,059.37	-59,059.37	-59,059.37
Observations	76,417	76,417	76,417	76,417

This table reports multinomial probit regression and relaxes the independence of irrelevant alternatives (IIA) assumption for the combined Australian, Canadian, and European Systemically Important Banks as a robustness check. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. United States banks are excluded as the Yankee Bond choice is their Onshore Bond and therefore only contain four choices. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, UNDERW is a binary dummy variable for underwritten bonds, GSIB is a binary dummy variable for global systemically important banks, GFC is a binary dummy variable for the period before 1 January 2009, VIX is the Chicago Board Options Exchange's Volatility Index, GDPPC is gross domestic product per capita of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.16: Market Choice Predictive Probabilities Results for Australian, Canadian, and European Systemically Important Banks – from Table 2.15 (Robustness Check)

	Eurobond	Foreign Bond	Global Bond	Onshore Bond	Yankee Bond
SIZE	-29%	7%	3%	19%	0%
TENOR	19%	-4%	-9%	-3%	-4%
CALL	-3%	-3%	7%	-3%	2%
LIST	1%	5%	-3%	2%	-5%
UNDERW	-15%	-4%	11%	3%	5%
GSIB	-3%	-3%	6%	3%	-3%
GFC	22%	0%	-14%	-4%	-4%
VIX	0%	0%	-3%	2%	1%
GDPPC	4%	5%	-10%	-10%	11%

This table reports the predictive probabilities at a confidence interval of 95 percent for the bond market choices Eurobond, Foreign Bond, Global Bond, Onshore Bond, and Yankee Bond implied by the multinomial probit regression from Table 2.15. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. The sum of each of the independent variables' predicted probabilities in each row equals zero, subject to rounding. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, UNDERW is a binary dummy variable for underwritten bonds, GSIB is a binary dummy variable for global systemically important banks, GFC is a binary dummy variable for the period before 1 January 2009, VIX is the Chicago Board Options Exchange's Volatility Index, and GDPPC is gross domestic product per capita of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix.

Table 2.17: Market Choice Regression Results for Australian Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check)

Regression 7

Dependent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
Independent variables				
SIZE	-0.6621***	-0.2349***	0.1255	-0.2789***
	(0.0330)	(0.0107)	(0.2167)	(0.0779)
TENOR	0.0578***	-0.0121	0.0300	-0.0339
	(0.0082)	(0.0151)	(0.0247)	(0.0278)
CALL	-0.5386**	-0.7194*	-0.6388	-0.5209***
	(0.2660)	(0.3785)	(0.6234)	(0.1375)
LIST	0.8819**	0.3704	1.1429***	0.6409***
	(0.3575)	(0.3253)	(0.1409)	(0.1937)
IRATING	0.0091	0.0867	0.3030	0.4081
	(0.1177)	(0.1149)	(0.2110)	(0.3838)
ONSBOND	-11.9491*	1.6898	3.9904	-3.0184
	(6.3399)	(6.4403)	(11.3064)	(9.7790)
AGE	-0.0057***	-0.0089***	0.0093	0.0115***
	(0.0013)	(0.0022)	(0.0061)	(0.0030)
UFE	-6.3965	-4.8468	-0.3884	4.7837
	(6.3050)	(4.2342)	(11.7398)	(6.0933)
MVBV	2.2530***	9.2834***	-4.9056	-7.3437*
	(0.4418)	(1.6286)	(5.0685)	(4.2087)
TA	-0.4983**	0.5809***	-0.5733	-1.4333***
	(0.2409)	(0.1400)	(0.3512)	(0.1799)
VIX	0.0004	-0.0025	-0.0447	-0.0068
	(0.0010)	(0.0041)	(0.0326)	(0.0076)
LIQDB	-0.0071	0.0058	-0.0726**	-0.0133
	(0.0249)	(0.0218)	(0.0307)	(0.0211)
CPI	0.0805	-0.1579*	0.0822	-0.1548
	(0.1699)	(0.0892)	(0.2574)	(0.3889)
Constant	18.3431***	-13.4085***	2.7600	21.3976**
	(0.8027)	(2.2029)	(12.1039)	(10.8830)
Log pseudolikelihood	-3,624.99	-3,624.99	-3,624.99	-3,624.99
Observations	7,292	7,292	7,292	7,292

This table reports multinomial probit regression and relaxes the independence of irrelevant alternatives (IIA) assumption for Australian Systemically Important Banks as a robustness check. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.18: Market Choice Regression Results for Canadian Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check)

Regression 8

Dependent variables Independent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
SIZE	-0.4539***	-0.0950	-0.3737***	-0.4607***
	(0.0545)	(0.1227)	(0.0967)	(0.1577)
TENOR	-0.0292	-0.0275	-0.0512***	-0.0528*
	(0.0358)	(0.0204)	(0.0164)	(0.0280)
CALL	-0.6109*	-0.7523	0.2060	-0.4964
	(0.3679)	(0.5514)	(0.2090)	(0.4749)
LIST	1.5595***	1.1947**	0.7485	-0.6621
	(0.5827)	(0.5137)	(0.6131)	(0.4694)
IRATING	-0.2718***	-0.0934***	-0.0038	-0.4782***
	(0.0907)	(0.0308)	(0.1006)	(0.1285)
ONSBOND	-6.9890*	6.2722	1.8182	5.6565
	(4.1753)	(5.5535)	(7.7639)	(11.8272)
AGE	0.0014	0.0001	-0.0059***	0.0153***
	(0.0019)	(0.0021)	(0.0008)	(0.0017)
UFE	5.4041	-2.1923	-21.1785***	21.3606
	(10.2840)	(10.9836)	(6.1938)	(18.8075)
MVBV	9.6415**	7.7013***	8.2288***	-6.5776
	(4.2729)	(1.7188)	(1.2721)	(13.4936)
TA	-0.4439***	0.3746	1.8132***	1.5341***
	(0.1332)	(0.2722)	(0.2908)	(0.3345)
VIX	0.0198***	0.0093	-0.0028	0.0094
	(0.0074)	(0.0111)	(0.0127)	(0.0176)
LIQDB	0.0183**	0.0180	0.0138	-0.1236***
	(0.0086)	(0.0114)	(0.0107)	(0.0103)
CPI	-0.1341	0.1038	-0.1817***	0.0411
	(0.1350)	(0.0661)	(0.0484)	(0.0801)
Constant	8.8932**	-11.5559***	-25.3908***	6.8022
	(3.6686)	(4.2725)	(4.5248)	(13.5110)
Log pseudolikelihood	-5,113.27	-5,113.27	-5,113.27	-5,113.27
Observations	4,998	4,998	4,998	4,998

This table reports multinomial probit regression and relaxes the independence of irrelevant alternatives (IIA) assumption for Canadian Systemically Important Banks as a robustness check. The dependent variables are market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.19: Market Choice Results for European Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check)

Regression 9

Dependent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
Independent variables				
SIZE	-0.3126***	-0.0280	-0.1898**	-0.2901***
	(0.0776)	(0.0633)	(0.0964)	(0.0916)
TENOR	0.0370**	-0.0152	-0.0514**	-0.0290
	(0.0155)	(0.0159)	(0.0216)	(0.0275)
CALL	0.5528***	0.1336	1.1198***	1.0234***
	(0.1032)	(0.1560)	(0.2589)	(0.1590)
LIST	-0.2550	0.2333	-1.0560***	-1.4136***
	(0.3041)	(0.3127)	(0.3786)	(0.2761)
IRATING	-0.0679	0.0685	-0.2178**	-0.3387***
	(0.0907)	(0.0717)	(0.0849)	(0.0840)
ONSBOND	-1.5363	-7.4127**	-6.3505*	-6.6737***
	(1.4677)	(3.6647)	(3.3620)	(1.7168)
AGE	-0.0051	-0.0002	0.0056	-0.0008
	(0.0038)	(0.0064)	(0.0069)	(0.0034)
UFE	-0.0793***	-0.1300***	-0.2101***	-0.2161***
	(0.0278)	(0.0405)	(0.0719)	(0.0340)
MVBV	4.8870	-6.0638	-3.0249	-14.1216**
	(5.9556)	(4.0573)	(7.0395)	(7.0393)
TA	0.0558	0.1021	1.1591***	-0.6783*
	(0.3944)	(0.3403)	(0.4295)	(0.3539)
VIX	-0.0052	-0.0075	-0.0107	-0.0060
	(0.0067)	(0.0061)	(0.0068)	(0.0092)
LIQDB	0.0040	0.0014	-0.0051	0.0054
	(0.0045)	(0.0087)	(0.0078)	(0.0049)
CPI	0.0868	0.0216	0.0293	0.1307
	(0.0695)	(0.1275)	(0.1981)	(0.0991)
Constant	2.8884	3.9701	-5.7380	34.6743***
	(11.4507)	(8.1801)	(9.9385)	(11.1817)
Log pseudolikelihood	-48,161.96	-48,161.96	-48,161.96	-48,161.96
Observations	63,730	63,730	63,730	63,730

This table reports multinomial probit regression and relaxes the independence of irrelevant alternatives (IIA) assumption for European Systemically Important Banks as a robustness check. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.20: Market Choice Results for United States Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check)

Regression 10

Dependent variables	**Eurobond**	**Foreign Bond**	**Global Bond**
Independent variables			
SIZE	-0.0643	0.2366***	0.0476
	(0.0526)	(0.0841)	(0.0392)
TENOR	0.0840***	0.0121	0.0028
	(0.0074)	(0.0102)	(0.0164)
CALL	-1.3656***	-1.3832***	-0.3788*
	(0.2397)	(0.1906)	(0.2109)
LIST	0.4758**	0.7963***	0.2526*
	(0.2376)	(0.2716)	(0.1458)
IRATING	0.1508**	0.2334***	0.2439***
	(0.0752)	(0.0456)	(0.0593)
ONSBOND	8.2229	15.1993***	19.5596**
	(6.2771)	(5.2281)	(9.4122)
AGE	-0.0052	-0.0066	-0.0061
	(0.0081)	(0.0074)	(0.0071)
UFE	-2.9579	-7.7345**	-3.3329
	(4.3560)	(3.6683)	(2.6496)
MVBV	-6.0839	2.1046	-10.0746***
	(4.9446)	(1.8774)	(2.0900)
TA	0.9255	1.3165***	1.2429*
	(0.5830)	(0.4230)	(0.7236)
VIX	-0.0088***	-0.0215**	-0.0163***
	(0.0029)	(0.0086)	(0.0057)
LIQDB	-0.0019	0.0011	-0.0014**
	(0.0026)	(0.0014)	(0.0007)
CPI	-0.0153	0.0985	-0.1926**
	(0.0772)	(0.1040)	(0.0845)
Constant	-7.6373	-30.2723***	-11.5760
	(12.3229)	(8.0290)	(8.8617)
Log pseudolikelihood	-18,327.44	-18,327.44	-18,327.44
Observations	18,825	18,825	18,825

This table reports multinomial probit regression and relaxes the independence of irrelevant alternatives (IIA) assumption for United States Systemically Important Banks as a robustness check. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, and Global Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, CALL is a binary dummy variable for callable bonds, LIST is a binary dummy variable for listed bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, VIX is the Chicago Board Options Exchange's Volatility Index, LIQDB is a bank's liquid assets divided by book value of total deposits and borrowings, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 2.21: Market Choice Predictive Probabilities Results for Australian, Canadian, European, and United States Systemically Important Banks – from Tables 2.17, 2.18, 2.19, and 2.20 (Robustness Check)

		Eurobond	**Foreign Bond**	**Global Bond**	**Onshore Bond**	**Yankee Bond**
Australia	IRATING	-3%	1%	1%	-1%	2%
	ONSBOND	-9%	6%	1%	3%	0%
	AGE	-3%	-4%	1%	3%	2%
	UFE	-3%	0%	0%	2%	1%
	TENOR	16%	-10%	0%	-5%	-2%
	MVBV	-3%	7%	-1%	-2%	-2%
	SIZE	-50%	17%	3%	28%	2%
	TA	-13%	17%	-1%	4%	-8%
Canada	IRATING	-20%	2%	28%	12%	-21%
	ONSBOND	-9%	2%	3%	0%	4%
	AGE	4%	0%	-25%	-1%	22%
	UFE	9%	0%	-18%	1%	9%
	TENOR	3%	0%	-5%	5%	-3%
	MVBV	8%	1%	4%	-4%	-9%
	SIZE	-25%	9%	-8%	34%	-10%
	TA	-60%	1%	46%	-8%	21%
Europe	IRATING	5%	6%	-7%	4%	-8%
	ONSBOND	8%	-5%	-5%	5%	-3%
	AGE	-20%	3%	10%	5%	2%
	UFE	6%	-1%	-5%	4%	-3%
	TENOR	17%	-4%	-8%	-3%	-3%
	MVBV	18%	-6%	-4%	-2%	-7%
	SIZE	-22%	9%	2%	13%	-2%
	TA	-2%	0%	17%	-2%	-14%
United States	IRATING	0%	1%	14%	-14%	
	ONSBOND	-10%	1%	29%	-20%	
	AGE	-4%	-1%	-8%	13%	
	UFE	-1%	-3%	-3%	7%	
	TENOR	42%	-2%	-24%	-17%	
	MVBV	-3%	4%	-21%	19%	
	SIZE	-15%	6%	9%	0%	
	TA	11%	3%	28%	-42%	

These tables report the predictive probabilities of bond market choices Eurobond, Foreign Bond, Global Bond, Yankee Bond, and Onshore Bond implied by the multinomial probit regressions from Tables 2.17, 2.18, 2.19, and 2.20, respectively. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. The sum of each of the independent variables' predicted probabilities in each row equals zero, subject to rounding. IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, TENOR is the bond maturity tenor calculated in years, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, SIZE is the logarithm of bond size in USD, and TA is the logarithm of the book value of total assets. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix.

Table 2.22: Market Choice Results for Australian Systemically Important Banks Log Pseudolikelihood Regression (Robustness Check #2)

	Regression 11			
Dependent variables	**Eurobond**	**Foreign Bond**	**Global Bond**	**Yankee Bond**
Independent variables				
SIZE	-0.9272***	-0.4277***	0.9000*	-0.9286***
	(0.0331)	(0.0916)	(0.4920)	(0.0574)
TENOR	0.0597***	-0.0285	-0.0294	-0.0782***
	(0.0231)	(0.0238)	(0.0278)	(0.0298)
UNDERWA	0.1759	-0.7444	-2.0990	1.8137***
	(0.2857)	(0.4867)	(1.3650)	(0.4301)
LIST	0.8908*	-0.1183	1.7387***	2.6206***
	(0.5039)	(0.4833)	(0.4494)	(0.1062)
BRATING	0.3263*	0.3270*	0.1369**	0.8475***
	(0.1737)	(0.1861)	(0.0571)	(0.1263)
OFFBOND	7.6604**	3.0879	-36.0535***	-19.9117
	(3.5194)	(7.3747)	(13.0601)	(16.2746)
ROAE	-0.0578***	-0.1105***	-0.0209	0.5569***
	(0.0129)	(0.0134)	(0.0328)	(0.1099)
FAE	-1.9327**	-3.6402	33.1285***	9.9139
	(0.9641)	(4.7637)	(4.8551)	(11.3375)
MVBV	4.5988	5.9671	-3.8352	-38.7845***
	(7.6561)	(9.5150)	(24.9291)	(13.3226)
TE	-0.0822	0.7885***	0.7475	0.3878
	(0.1707)	(0.1633)	(1.3758)	(0.3010)
MOVE	-0.0020	0.0046	-0.0205**	-0.0093
	(0.0054)	(0.0029)	(0.0099)	(0.0191)
LIQTA	-0.0293***	-0.0234	-0.4171***	-0.0961
	(0.0048)	(0.0355)	(0.0301)	(0.2123)
GLIQ	0.0551	0.1406	0.4866	0.1931
	(0.2117)	(0.2714)	(0.3834)	(0.3802)
INTDIFF	-1.6049*	-0.4883	3.3035**	1.5599
	(0.8434)	(1.2155)	(1.3906)	(1.4173)
Constant	7.4782	-13.4769	-25.7007	24.6530*
	(8.4480)	(9.1853)	(43.6135)	(14.6737)
Log pseudolikelihood	-1354.79	-1354.79	-1354.79	-1354.79
Pseudo R2	0.2821	0.2821	0.2821	0.2821
Observations	2,339	2,339	2,339	2,339

This table reports multinomial logistic regression for Australian Systemically Important Banks as a second robustness check. The dependent variables are bond market choices. The offshore market choices are Eurobond, Foreign Bond, Global Bond, and Yankee Bond. These are alternative choices to an Onshore Bond (base choice). Onshore Bonds are not reported in the table. SIZE is the logarithm of bond size in USD, TENOR is the bond maturity tenor in years, UNDERWA is a binary dummy variable for underwritten agent banks, LIST is a binary dummy variable for listed bonds, BRATING is a dummy variable for Moody's long-term bond credit rating, OFFBOND is the bond offshore reputation, ROAE is the return on average equity calculated as a bank's net income divided by book value of average total equity, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TE is the logarithm of the book value of total equity, MOVE is the Merrill Lynch Option Volatility Estimate, LIQTA is a bank's liquid assets divided by book value of total assets, GLIQ is the global liquidity indicator as the average of Residual developed countries, Euro area, and United States banks' claim as percentage of GDP, and INTDIFF is the spread between the Australian dollar 5-year swap rate less the Australian dollar 5-year risk-free rate and the USD 5-year swap rate less the USD risk-free rate. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix. Robust standard errors are clustered at the bank ticker level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2.23: Market Choice Predictive Probabilities Results for Australian Systemically Important Banks – from Table 2.22 (Robustness Check #2)

	Eurobond	**Foreign Bond**	**Global Bond**	**Onshore Bond**	**Yankee Bond**
BRATING	2%	1%	0%	-4%	1%
OFFBOND	28%	-1%	-15%	-4%	-8%
ROAE	-6%	-8%	0%	4%	10%
FAE	-2%	-2%	4%	0%	1%
TENOR	18%	-10%	-2%	-4%	-2%
MVBV	5%	2%	-1%	-2%	-4%
SIZE	-47%	15%	6%	27%	-1%
TE	-12%	11%	2%	-2%	1%

This table reports the predictive probabilities at a confidence interval of 95 percent for the market choices Eurobond, Foreign Bond, Global Bond, Yankee Bond, and Onshore Bond implied by the multinomial logistic regressions from Table 2.22. The change in probability is calculated from the 5^{th} to the 95^{th} percentile of the independent variables. The sum of each of the independent variables' predicted probabilities in each row equals zero, subject to rounding. BRATING is a dummy variable for Moody's long-term bond credit rating, OFFBOND is the bond offshore reputation, ROAE is the return on average equity calculated as a bank's net income divided by book value of average total equity, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, TENOR is the bond tenor calculated in years, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, SIZE is the logarithm of bond size in USD, and TE is the logarithm of the book value of total equity. For a more detailed explanation of the variables refer to Table 2.24 in the chapter appendix.

Table 2.24: Study 1 Variable Definitions

Variable	Name	Definition	Source(s)
Dependent			
MC	Market Choice	Market of issue field. Eurobond, Foreign Bond, Global Bond, Onshore Bond, or Yankee Bond.	Refinitiv, author calculations
Independent			
AGE	Bank age	Issue date of the bond choice less the incorporation date of the bank legal parent entity.	Refinitiv, Fitch, author calculations
BRATING	Bond long-term credit rating	Moody's bond long-term credit rating discrete choice converted to sequential continuous variable by ISIN. Aaa equal to 22 / Baa3 equal to 13 at issue date of bond.	Refinitiv, author calculations
CALL	Bond callable	Binary dummy indicator equal to 1 for callable notes/bonds, otherwise 0.	Refinitiv
CPI	Consumer price index	Inflation measured by consumer price index (CPI) is defined as the change in the price of a basket of goods and services that are typically purchased by specific groups of households, reported as the annual growth rate, quarterly.	Organisation for Economic Co-operation and Development (OECD)
FAE	Future abnormal earnings	(Bank's earnings per share for next period less bank earnings per share for current period) divided by current bank market share price, USD, annually.	Fitch, Datastream, author calculations
GDPPC	Gross domestic product per capita	Gross domestic product per capita on an international comparison programme, in USD, annually.	World Bank
GFC	Pre-Global Financial Crisis period	Binary dummy indicator equal to 1 for bonds issued prior to 1 Jan 2009, indicator equal to 0 for bonds issued after 1 January 2009.	FSB, Local regulator
GLIQ	Global liquidity Indicator	Ease of financing in global financial markets. Average of Residual developed countries, Euro area, and United States banks' claim as percentage of GDP.	BIS, author calculations
GSIB	Global Systemically Important Bank	Binary dummy indicator equal to 1 for banks classified as Global Systemically Important Bank, indicator equal to 0 for banks classified as Domestic Systemically Important Bank.	FSB, local regulator, author calculations
INTDIFF	Australian-USD spread	The Australian dollar spread is calculated by subtracting the Australian dollar 5-year risk-free yield from the Australian dollar 5-year swap yield. The USD spread is calculated by subtracting the USD 5-year risk-free yield from the USD 5-year swap yield. The USD spread is subtracted from the Australian dollar spread and is daily and matched to the issue date of the bond market choice.	Datastream, author calculations
IRATING	Issuer long-term credit rating	Moody's bank parent long-term credit rating discrete choice converted to sequential continuous variable. Aaa equal to 22 / Baa3 equal to 13.	Fitch, author calculations
LIQDB	Liquid assets to total deposits and borrowings	Banks' liquid assets divided by book value of deposits and short-term borrowings, in USD, annually.	Fitch

Variable	Name	Definition	Source(s)
LIQTA	Liquid assets to total assets	Banks' liquid assets divided by book value of total assets, in USD, annually.	Fitch
LIST	Listed bonds	Binary dummy indicator of 1 for listed bonds on an exchange, 0 otherwise.	Refinitiv, author calculations
MOVE	Merrill Lynch Option Volatility Estimate	Merrill Lynch Option Volatility Estimate, end of month.	Datastream
MVBV	Market value to book value	(Book value of banks' total assets less book value of total equity plus market value of total equity) divided by total assets, in USD, annually.	Fitch, Datastream
OFFBOND	Offshore bond reputation	The outstanding offshore bonds each month by bank and bond seniority in USD millions divided by Fitch's Total Liabilities excluding Preference Shares & Debt Hybrid Capital, with one lag period, monthly.	Refinitiv, Stata, author calculations
ONSBOND	Onshore bond reputation	The outstanding onshore bonds each month by bank and bond seniority in USD millions divided by Fitch's Total Liabilities excluding Preference Shares & Debt Hybrid Capital, with one lag period, monthly.	Refinitiv, Stata, author calculations
ROAE	Return on average equity	Banks' net income divided by book value of average total equity, annually.	Fitch
SIZE	Logarithm of bond size	Logarithm of bond size.	Refinitiv, Stata
TENOR	Bond tenor	(Maturity date less issue date of bond) divided by 365.	Refinitiv
TA	Logarithm of total assets	Logarithm of book value of bank total assets, annually.	Fitch, Stata
TE	Logarithm of total equity	Logarithm of book value of bank total equity, annually.	Fitch, Stata
UFE	Unexpected future earnings	(Bank forward earnings per share for next period less earnings per share for next period) divided by current bank market share price, in USD, annually.	Fitch, Datastream, author calculations
UNDERW	Underwritten bonds	Binary dummy indicator equal to 1 for all bonds underwritten, 0 otherwise.	Refinitiv, author calculations
UNDERWA	Underwritten bonds agent	Binary dummy indicator equal to 1 for underwritten bonds of agent, 0 otherwise.	Refinitiv, author calculations
VIX	Chicago Board Options Exchange's Volatility Index	Chicago Board Options Exchange's Volatility Index, daily.	Datastream

Chapter 3: The Complex World of Structured Notes: Global Banks and Financial Stability (Study 2)

3.1 INTRODUCTION

Ben-Horim and Silber (1977) and Sibler (1983) note that to preserve utility maximisation, firms must continue to innovate. SIBs through bond funding innovate and issue non-traditional bonds using derivatives to transfer risks to investors. SIBs issue types of on-balance sheet securities that are different to the off-balance sheet complex securities. Off-balance sheet complex securities include subprime mortgages that were a main cause of the GFC (RBA, 2018). This study selects a sample of unsecured structured notes and secured covered bonds, which can generate non-interest income through underwriter fees, diversify a bank's funding profile, and improve bank costs of funds[33]. This is beneficial to financial stability. However, unsecured structured notes do have risks, including increased market volatility and low liquidity (Crabbe & Argilagos, 1994), and can increase financial instability in times of market stress. Covered bonds, which are popular in Europe and an alternative funding source to unsecured markets in times of market stress, can be issued by SIBs onshore and offshore. Covered bond issuance can contribute positively or negatively to financial stability.

The empirical literature focuses on the investor aspect of unsecured structured notes (Crabbe & Argilagos, 1994; Telpner, 2004) and mispricing in the primary market (Henderson & Pearson, 2011; Rathgeber & Wang, 2011; SEC, 2015). Studies to date do not focus on motivating hypotheses like agency cost, reputation, or flotation cost to issue structured notes. Further, the post GFC regulation oversight of credit derivatives (UCS, 2010), increased liquidity and capital requirements (BCBS, 2011), and the relationship between the issuance of

[33] Crabbe and Argilagos (1994) indicate the funding advantage for the issuer must be 5 to 15 basis points, and higher if the unsecured structured note is more complex. It is likely that this funding advantage has since reduced as competition between bank issuers increased from the 2000s.

unsecured structured notes rather than traditional bonds, has not been researched. This study aims to answer Research Question 2: What influence does agency cost, reputation, flotation cost, and Global Financial Crisis regulatory reforms have on Systemically Important Banks' issuance of unsecured and secured structured notes, and what are the impacts on financial stability? The cross-sectional bond data for traditional and non-traditional bonds at primary issue are sourced from Refinitiv. Hypotheses are developed for the selection of bank bond types and tested using logistic regression to proxy independent variables. The findings indicate what agency cost, reputation, flotation cost and regulation variables are statistically and economically significant in the selection of bond types for SIBs. The impacts on financial stability are analysed.

This chapter proceeds as follows. Section 3.2 provides an in-depth review of the literature, including real world unsecured and secured structured notes. Section 3.3 describes the data and methodology. Active issuers of unsecured structured notes and secured covered bonds are selected as the dependent variables. This section also defines the regulatory and control variable proxies, hypotheses, and descriptive statistics. Section 3.4 presents and discusses the results, Section 3.5 details the robustness checks, and Section 3.6 concludes the chapter. Section 3.7 provides the chapter-specific appendix.

3.2 LITERATURE REVIEW

This section provides an overview of the literature on financial innovation (Section 3.2.1), derivatives and bonds (Section 3.2.2), over-the-counter unsecured structured notes (Section 3.2.3), real world unsecured structured notes (Section 3.2.4), secured covered bonds (Section 3.2.5), and financial stability and regulation (Section 3.2.6). Finally, Section 3.2.7 examines the empirical research to date, revealing a lack of research regarding the motivating factors driving the issuance of structured notes by SIBs.

3.2.1 Financial Innovation

Innovation is broadly defined as the introduction of a new product or a new process. Awrey (2013) discusses the concept of innovation and the expected benefit to society, and notes key discoveries like the printing press, the light bulb, and penicillin. Ben-Horim and Silber (1977) and Tufano (1989) examine innovation in terms of the development of new patents; however, this does not occur in financial innovation. Typically, financial innovation occurs when a new financial instrument or a new financial process is developed. Ben-Horim and Silber (1977) and Silber (1983) acknowledge that financial innovation can come about due to regulations, as firms innovate to circumnavigate regulatory burdens. Ben-Horim and Silber (1977) and Silber (1983) explain that financial constraints can encourage firms to innovate. To ensure a firm continues to maximise utility, a firm innovates to offset the constraints that have decreased the utility of the firm. These constraints can be internal, for example firm growth targets, or external like regulation. Financial instruments including negotiable certificates of deposit, commercial paper, loan repurchases, and subordinated debentures, all of which were introduced in the 1960s as forms of innovation, have been issued and traded by SIBs. Ben-Horim and Silber (1977) through a linear programming model[34] discover that a rise in adhering to existing constraints creates a stimulus to innovation. Silber (1983) assesses more financial instrument innovations[35] from 1970 to 1982, and lists exogenous causes such as inflation, volatility of interest rates, technology, legislation, internationalisation, and other factors. Over the period 1974 to 1986, Tufano (1989) studies 58 financial innovations of investment banks that moved with a financial innovation first, compared to those that imitated and followed later. The findings indicate that first mover innovating investment banks charge lower fees than imitator bank providers, but enjoy a larger market share of underwriter fees and lower relative costs.

Miller (1986) finds that financial innovations are not necessarily by chance, and that these innovations already existed and were awaiting a change in circumstance. He defines “truly significant innovations” that survive and grow. The Eurodollar market started following the United States Regulation Q[36], which became penal to United States onshore short-term borrowings and did not apply outside of the United States. Eurobonds, a bond issued outside of the United States market, originated due to a 30 percent withholding tax on coupons for non-resident investors in the United States. Silber (1983) advises the economic welfare benefits of innovation and references Regulation Q as a way around dated regulations. Miller (1986) gives credence to Eurobonds but stops short of announcing their brilliance because they did not

[34] This model assessed various assets, liabilities, and capital from 1952 to 1972 for New York City banks.
[35] Investment contracts like floating rate notes, zero coupon bonds, bonds with put options, commodity linked (Silver) bonds, eurocurrency bonds, interest rate and foreign exchange futures, and cash settlement on stock futures, options on futures, and pass-through securities.
[36] From 1933 until 1986 the Unites States Federal Reserve imposed maximum rates of interest on various other types of bank deposits, such as savings accounts and NOW accounts (Wikipedia).

spawn other innovations. The financial futures contract was announced as a "truly significant innovation." Options[37] followed on from futures; however, it was due to the link with alternative underlying asset classes like commodities, equities, and interest rates that Miller (1986) acknowledges their brilliance.

In their review of Minsky's (1982) theory of financial instability and other theories in the existing literature, Carter (1989, p. 781) notes that "the orthodox view suggests that much financial innovation either helps firms reduce the exposure of their portfolios to unforeseen interest and exchange rate changes or helps them avoid taxes and regulatory restraints on their behaviour." The first, at face value, appears to be a benefit to firms and society. The structuring and issuance of tailored unsecured structured notes is simply this, a transfer using derivatives to the end investor. The second appears to second guess the value of a proper and just legal and regulatory framework. Carter (1989) extends Minsky's (1982) work on financial instability, reviewing financial innovations of the 1980s. Carter (1989) criticises Minsky's (1982) lack of analysis of recent innovations and Tobin (1989) criticises Minsky's (1982) modelling for the endogenous systematic business cycle. Carter (1989) adds that the missing piece to financial innovation is the technological development of financial institutions due to international capital flows. Electronic price information and electronic transfer of funds has sped up financial innovation. SIBs have invested and benefited greatly from this innovation of structured notes. As SIBs have become more global, and access to information is easier and faster, financial innovation in structured notes has been rapid. Carter (1989) further notes that countries that do not allow their institutions access to the global markets suffer as these institutions become less competitive. In summary, although innovation provides benefits, it also adds to the fragility of the financial system as institutions take on higher risks and leverage. Interestingly, mortgage-backed securities, a form of securitisation to transfer risk and free up capital, were not considered financial innovations at the time of the publication of the literature.

[37] A contract in which the buyer has the right to purchase an underlying asset at a certain price upon expiry. The seller has no right but an obligation to sell an underlying asset at a certain price upon expiry of the contract. The buyer pays a premium to the seller. An option is executed to hedge or speculate on the future price of an underlying stock.

3.2.2 Innovation in Derivatives and Bonds

The evolution of derivatives goes back to the 1970s and 1980s. A derivative is a contract between two or more parties that references an underlying asset. A common type of derivative is an interest rate swap. An example is a borrower that has issued a local currency fixed rate bond and has fixed rate payable coupons and can execute an interest rate swap, receiving fixed payments, and paying floating payments to take advantage of expectations in a declining forward yield curve. Offshore borrowers can use cross-currency swaps to hedge foreign currency and interest rate risk. Investment bank Salomon Brothers arranged between IBM[38] and the World Bank[39] the first cross-currency swap in 1981 (Funk & Hirschman, 2014). The World Bank borrowed debt in multiple countries and currencies to diversify and lower its dependence on a singular market (Park, 1984). The World Bank needed to borrow in the Germany Deutsche Marks and Switzerland Swiss Franc markets, but were restricted by local governments. As per Figure 3.1, IBM had already issued fixed rate debt in Deutsche Marks and Swiss Francs and wanted to have USD exposures. The World Bank issued a bond in USD for funding and received on the swap USD coupons and principal at maturity from IBM to match the issued bond cash flows. World Bank paid on the swap Deutsche Marks and Swiss Francs on IBM's remaining fixed debt. The net effects were IBM had access to USD and had no foreign exchange risk as a United States parent-based company, and World Bank paid Deutsche Mark and Swiss Franc payments as it so desired.

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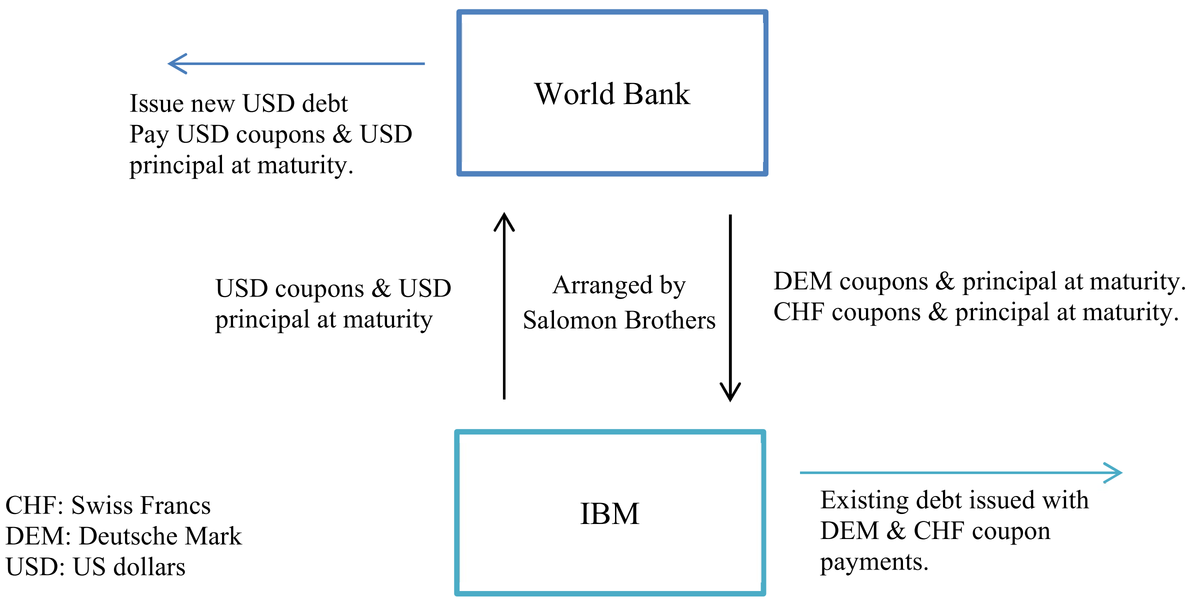
[38] A United States technology company.

[39] An international financial institution that provides loans and grants to the governments of low-and middle-income countries for the purpose of pursuing capital projects (Investopedia).

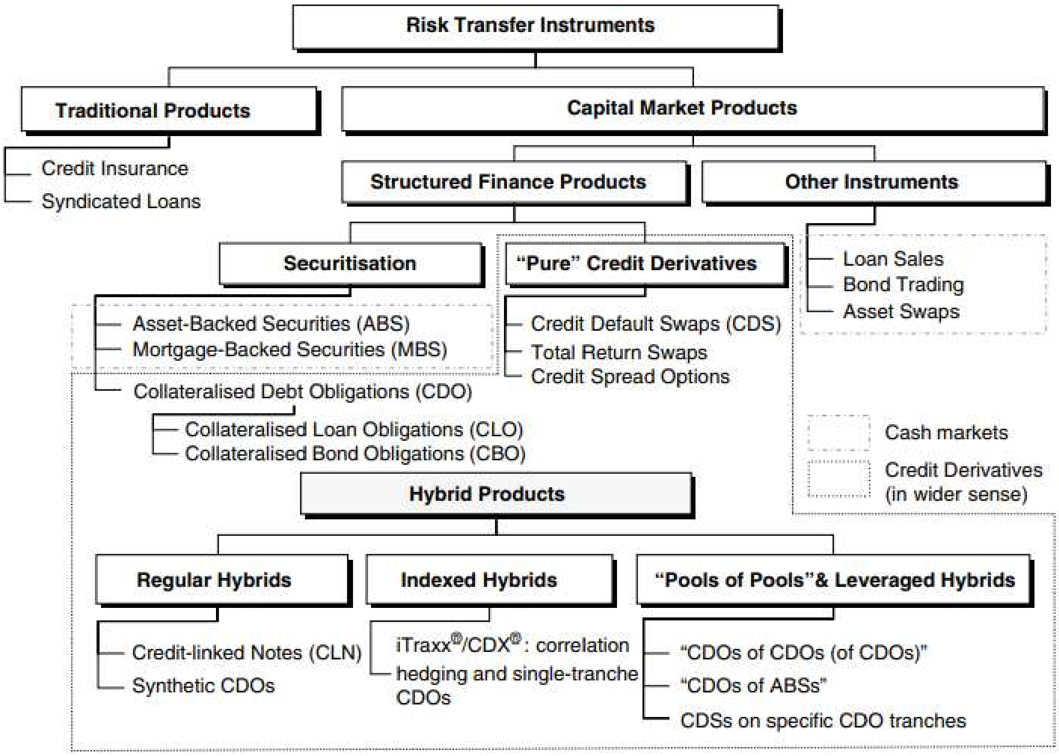
Figure 3.1: World Bank/IBM Cross-Currency Swap. Source: Author Elaboration.



Financial innovation spawned the growth of OTC swaps and by 1999 interest rate and foreign exchange swaps in notional outstanding had grown to USD 58.3 trillion (Funk & Hirschman, 2014). This growth was aided by the reluctance of authorities to regulate swaps, and competition between commercial and investment banks fostered growth in derivatives. Funk and Hirschman (2014, p. 694) comment that "there was also insufficient political will to write new legislation capable of bringing swaps into the Glass-Steagall framework, which would have meant defining swaps as either loans, or futures, or securities." The exemption of OTC contracts by the Commodity Futures Trading Commission from the Commodity Exchange Act (Ayadi & Behr, 2009; Funk & Hirschman, 2014) allowed OTC derivative markets, including credit derivatives, to prosper. The industry for OTC derivatives was self-regulated by the International Swaps and Derivatives Association, which was established in 1985 and supported by the very financial institutions that traded these derivatives. SIBs were beneficiaries of this growth issuing structured notes and trading swaps.

For banks, traditional financing includes deposits and capital market instruments like bonds, loans, and common equity to fund asset mortgages and investment securities. Innovation in derivative markets created a new class of bank financing called structured finance. Jobst (2007, p. 200) describes structured finance as follows: "most structured investments (i) combine traditional asset classes with contingent claims, such as risk transfer derivatives and/or derivative claims on commodities, currencies or receivables from other reference assets, or (ii) replicate traditional asset classes through synthetication or new financial instruments." Figure 3.2 outlines the types of risk transfer instruments.

Figure 3.2: Overview of Risk Transfer Instruments, Including Structured Finance and Hybrid Products. Source: Jobst (2007).



Structured finance has existed for decades through securitisation. Banks that originate secured mortgage assets use mortgage-backed securities to create funding. This process involves banks selling on balance sheet illiquid but eligible mortgage loans in a "true sale" to a separate legal entity, typically a special purpose vehicle. The transfer of the assets off the balance sheet facilitates a funding channel from the origination of loans and reduces the amount of capital a bank must hold. Jobst (2007) describes the securitisation process as disintermediation, and the motive of securitisation as economic and regulatory. In Australia, mortgage-backed securities were popular, with Australian banks comprising 10 percent share of total funding prior to the GFC[40]. Brunnermeier (2009) notes that the United States banks had transformed their traditional models into an "originate and distribute" model.

Collateralised debt obligations are like mortgage-backed securities although they can use credit derivatives to synthetically reference credit. Collateralised debt obligations require complex modelling with correlation and recovery assumptions in the reference portfolio, which has been aided by what Carter (1989) describes as technology advances. Investment banks structure collateralised debt obligations and warehouse risk to on-sell collateralised debt obligations to investors. A limitation of the Jobst (2007) overview of risk instruments is the brief reference to covered bonds by originators. These are in the securitisation family as part of structured finance. They are popular in Europe and following the GFC, Australia, Canada, and other countries started issuing these securities. Furthermore, Jobst (2007) fails to provide more detail on hybrid securities like the popular equity-linked or index-linked notes issued by banks. The underlying performance of these securities can have similar payoffs to credit-linked notes; however, they can also be fundamentally different.

According to the Bank of International Settlements (BIS)[41], OTC credit derivative notional outstanding amounts increased from USD 120.3 billion in 1998 to USD 68.1 trillion by 2007, as noted by Brunnermeier (2009) and Calistru (2012). Ayadi and Beher (2009) argue that the growth in credit derivatives is due to the innovation in financial products. Calistru (2012) acknowledges the ironic instability created by the development in derivatives that were intended to be used to mitigate risk. The first credit default swap (CDS) was launched by JP Morgan in 1997, and former United States Federal Reserve chair Alan Greenspan in 2006 applauded the CDS as a risk mitigator. For banks, the decision to use credit derivatives can provide a cost-effective way to transfer credit risk. For example, if a bank holds a bond and they are concerned about the default risk sometime in the future, the bank can buy protection in a CDS to offset the bond issuer credit risk and is not required to sell the bond. Alternatively, the sale of the bond would incur liquidation costs in the bid/offer spread. The opaque nature of OTC CDSs, speculative sales and trading by financial institutions, and a lack of regulation of CDSs created instability in financial markets and played a critical role in the GFC.

[40] Funding Composition of Banks in Australia Share of Total Funding (RBA, 2023a).

[41] An international organisation serving global central banks and regulators to promote monetary and financial stability (BIS, 2023).

The American International Group, a global insurance company, is an example of the misuse of credit derivatives, and was involved in the moral hazard bailout[42] by the United States government a day after the collapse of Lehman. This example highlights that credit derivatives can be used to increase risk and not mitigate risk (Calistru, 2012). Ayadi and Behr (2009, p. 180) ask the question: "under which conditions do they enhance the resilience of financial systems and under which conditions do they threaten the stability of the financial system?" Shin (2009) describes two views to address this question. The first view of CDS, prior to the GFC, was complementary to securitisation and how the transfer of credit risk overall enhanced the financial system. The second view was not complementary during and after the GFC as it discussed how incentives facilitated a "hot potato" of underperforming loans, to be passed to end investors.

Today innovation continues with bonds and derivatives providing solutions for environmental, social, and governance issues. Climate bonds (otherwise known as green bonds) issued by banks, corporates, and governments are funding organisations and supporting positive environmental outcomes. Other examples of innovation providing solutions include the International Bank for Reconstruction and Development, which issued a Wildlife Conversation Bond in 2022. The funds are used by park managers for rhino conservation, and the return for bond investors is linked to a final rhino population growth rate (IBRD, 2022). NAB assisted an English not-for-profit social housing provider by providing a sustainability-linked swap linked to additional homes, affordable homes, energy efficient new homes, resident wellbeing initiatives, and improved workforce diversity (NAB, 2021). These innovative products exemplify "good innovation." However, risks of misleading investors of sustainable benefits with greenwashing are starting to occur. In 2022 prosecutors began an investigation of fraud into DWS (a funds management business owned by Deutsche Bank) after a former DWS sustainability officer blew the whistle regarding fraudulent selling of DWS's green investments.

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[42] AIG attempted first to find a private sector solution in the form of a syndicated secured lending facility from JP Morgan and Goldman Sachs & Co. However, S&P (-3), Moody's (-2), and Fitch (-2) all downgraded AIG's long-term debt rating 2 to 3 notches late in the afternoon of 15 September and AIG suffered share price declines making the lending facility unfeasible (AIG Annual Report, 2008, p. 4). Failure was due to the securities lending business and its CDS business where AIG had sold protection unhedged on CDS contracts to global banks. Following the devaluation of the US mortgage market and securities referencing these assets, AIG had to write down its positions (McDonald & Paulson, 2015). AIG's credit rating was downgraded on 15 September 2008, and AIG was required to post collateral that it could not afford. AIG recorded a net loss of USD 99.3 billion in 2008 exceeding 2007 shareholder's equity of USD 95.8 billion (AIG Annual Report, 2008, p. 36).

3.2.3 Over-The-Counter Unsecured Structured Notes (Hybrid Securities)

The issuance of unsecured structured notes are an alternative funding avenue for SIBs. These types of notes are defined as hybrid securities (Fabozzi et al., 2007; Jobst, 2007; SEC, 2015; Telpner, 2004). Hybrid fixed income securities combine a bond with an imbedded derivative. Whilst these hybrid securities look like traditional bonds, unsecured structured notes include exposure to markets that are not available through traditional bonds (Telpner, 2004). Crabbe and Argilagos (1994) believe investors have a market view, and drive the origination of the unsecured structured notes, tailoring the structure to meet their requirements. Henderson and Pearson (2011) also note that these securities provide "tailored" solutions for investors and improve allocative efficiency. Investors can take a market view with the purchase of an unsecured structured note or hedge an exposure. A key benefit of unsecured structured notes is that they are issued and traded as OTC.

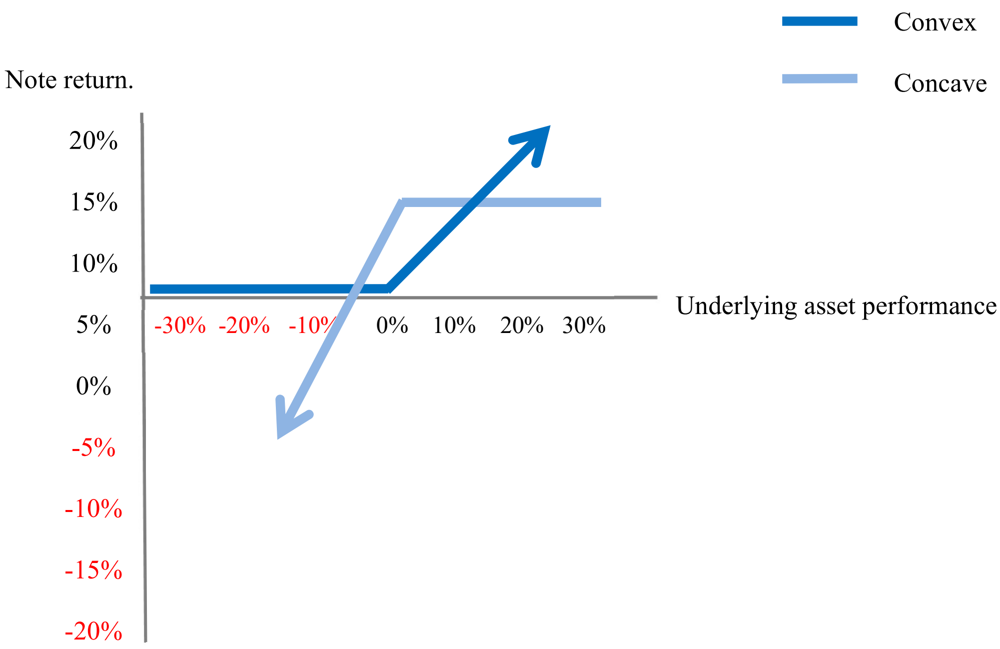
Unsecured structured notes have inherent limitations. The flexibility of unsecured structured notes to provide tailored solutions as an OTC transaction is traded off with liquidity risk. If a structured note is to be sold prior to maturity, the investor must ask the issuer bank to make a market. The cost for an investor is high due to the non-standardisation of the underlying derivative, and a higher transaction cost for the issuing bank to re-hedge their exposure. The costs can be higher if the unsecured structure is more complex and requires additional derivative transactions (Crabb & Argilagos, 1994). The risk profile and detail on the performance of the linked asset is opaque, and so pricing and tracking performance value can be difficult. Henderson and Pearson (2011) explain that financial institutions can exploit investors by pricing these securities to take advantage of investor cognitive bias to financial market events. The literature discusses the pricing of range accrual notes (Baaquie et al., 2014; Chiarella et al., 2014: Liao & Hsu, 2009; Lin et al., 2017; Li et al., 2020), pricing the note and hedge (Liao & Hsu, 2009; Li et al., 2020), and pricing of credit-linked notes (Rathgeber & Wang, 2011). Mispricing from the issuer in the primary market occurs (Henderson & Pearson, 2011; Rathgeber & Wang, 2011), and primary market unsecured structured note investors pay a premium between the offering price and the estimated fair value at an average 8.00 percent to 8.87 percent. Crabbe and Argilagos (1994) acknowledge mispricing of structured notes and advise that investment decisions are conditional on price. Hens and Rieger (2009) find evidence that fees charged by issuers of unsecured structured notes outweigh the utility gains for investors, and that investor behavioural factors explain most purchases in these notes. The SEC (2015) advises that offering documents on SEC registered unsecured structured notes must outline the issue price of the note and its fair value, so that investors are more informed of issuing costs.

The SEC (2015) notes that complexity can make unsecured structured notes difficult to value. Participation rates, capped returns, and knock-in features with triggers and buffers based on returns add to the complexity. There are other types of risks involved with investing in unsecured structured notes, distinctive to traditional bonds, including market risk. Crabbe and Argilagos (1994) identify market risk as an area of concern, and due to low liquidity, market volatility can impact the imbedded value of the derivative in the unsecured structured note. This played out during the GFC and was exacerbated by the collapse of Lehman, a systemic risk noted by Crabbe and Argilagos (1994).

The history of unsecured structured notes can be traced back to the 1980s with non-financial corporations issuing structured equity notes underwritten by investment banks (Henderson & Pearson, 2011). By the 1990s, investment banks issued structured equity notes directly to investors. Merrill Lynch in 1992 issued the first public structured equity note linked to the S&P 500® Index, called Market Index Target-Term Securities. The next year Salomon Brothers had begun issuing Equity-Linked Securities. Both banks offered a capped participation in the performance of the underlying reference assets. In 2001 Swiss bank UBS issued Bullish Underlying Linked Securities, linked to a basket of 10 equity stocks or the S&P 500® Index. Investors could participate in potential upside return or downside, which was limited by a threshold percentage (Chen & Wu, 2006).

Wohlwend et al. (2001) summarise neatly that there are two types of unsecured structured notes based on the payoff, either convex or concave. A convex payoff as per Figure 3.3 demonstrates the benefits to an investor from an appreciation in the underlying linked asset, and a floor to protect capital invested should the underlying asset(s) underperform by maturity. The concave payoff charts the downside risk of the investor and limited upside. If the underlying asset(s) performance for both structures is positive at maturity, the investor receives returns above that of a traditional bond. However, if the underlying asset(s) declines in value, the convex investor will lose part of or the full enhanced coupon while the principal is protected (Telpner, 2004). The concave investor loses part or full of the principal invested. Henderson and Pearson (2011) conclude in a sample of structured equity notes that concave payoffs are based more on single referenced assets and tend to attract overconfident investors, and most convex payoffs are based on an index or basket of underlying assets and investors display levels of under confidence as they wish to limit their downside.

Figure 3.3: Hypothetical Payoff Diagram. Source: Author Elaboration.



The figure charts the hypothetical payoff diagram of a convex and concave unsecured structured note. The note return is on the y-axis and underlying performance of the linked asset is the x-axis. The convex note performance is principal protected, and the concave note performance is principal at risk.

3.2.4 Review of Real-World Unsecured Structured Notes

This section presents an overview of real-world active SIB unsecured structured note types to inform the discussion and interpretation of the results in Section 3.4. In this section, the author selects a real-world example of each type of note from a note prospectus and explains the specific payoffs, risks, and benefits. From the selected notes the most common payoff profiles range from two to four with the more complex offerings having more payoff options. Table 3.1 outlines the type of note, the author’s acronym (which will be adopted throughout the chapter), the bank issuer, linked asset(s), the payoff structure (either convex or concave), and key features of the structured notes.

Table 3.1: List of Selected Unsecured Structured Notes, From Bank Issuers, Linked to Various Assets, Payoff Type, and Key Features of the Note. Source: Author Elaboration.

Structured note	Acronym	Bank Issuer	Linked asset(s)	Payoff	Key features
1. Range accrual	RAN	JP Morgan Chase	Interest rate index	Convex	Fixed or floating payments, dependent of performance of index.
2. Equity-linked	ELN	Lehman*	Equity index	Convex	Zero-coupon, limited downside.
3. Credit-linked	CLN	Credit Suisse	European corporate	Concave	Floating payments with minimum and maximum payment.
4. Multiple-linked	MLN	Barclays	Basket of equity indices	Concave	Zero-coupon, unequal basket of assets, leverage upside.

*Lehman is not in the Refinitiv issuer samples. It is used for illustrative purposes.

A common unsecured structured note is a range accrual note (RAN), a convex payoff for investors. The investor is compensated with a premium if a single underlying benchmark rate, for example USD LIBOR[43], stays within a predefined range. If the underlying benchmark rate moves outside this range for a given day the investor is penalised with no coupon for that day. The investor is selling interest rate caps that are imbedded in the note structure (Crabbe & Argilagos, 1994). The bank as issuer hedges the note by undertaking a swap to receive the interest rate caps and pay, for example, a fixed rate to a swap counterparty. The bank again hedges the coupon linked payments with a swap counterparty and locks in a borrowing cost payment, for example, fixed. JP Morgan issued in October 2010 a callable range accrual note[44] linked to 6-month USD LIBOR. If the performing index, 6-month USD LIBOR, stays within 0.00 percent to 5.75 percent for the 90-day period as per Figure 3.4 and Equation 3.1, if C = 5.25 percent the coupon, A = 90, and B = 90 the investor receives the full 5.25 percent coupon for the 90-day period. If LIBOR falls outside of the 0.00 percent to 5.75 percent range, the investor is penalised with 0.00 percent for the days outside of the "blue zone." If for example,

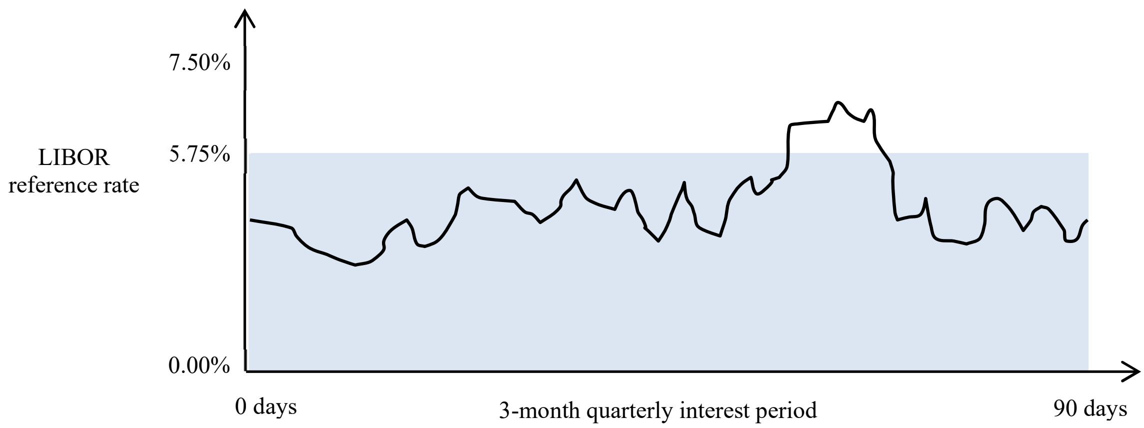
[43] London Interbank Offering Rate (LIBOR).
[44] ISIN: US48124AS731.

LIBOR was in total 10 days of the 90-day period out of the range, therefore A = 80, the adjusted coupon to the investor for the period is equal to 4.67 percent. If LIBOR was outside the "blue zone" range of 0.00 percent to 5.75 percent for all 90 days, then the investor would receive 0.00 percent because A = 0.

Equation 3.1

$$C \times \left(\frac{A}{B}\right)$$

Figure 3.4: Range Accrual Note Linked to USD LIBOR performance. Source: JP Morgan (2010) and Author Illustration.



Crabbe and Argilagos (1994) describe the common features of range accrual notes and observe other risks, including issuer call risk and reinvestment risk. The issuer normally has an option to call the range accrual note periodically, and the expectations are that this would not be done in a rising interest rate environment because the issuer has locked in at a lower funding cost. If the note is called, the investor faces reinvestment risk because rates would be falling, and the proceeds would be reinvested at lower market rates. Morgan Stanley issued a more complex range accrual note[45] providing a fixed rate for the first 2 years then thereafter a floating rate linked to the CMS curve, the S&P 500® Index, and the Russell 2000® Index. The note

[45] ISIN: US61745EJ280.

allowed the investor(s) to access a shorter period fixed rate and then a longer period floating rate linked to the performance of the three different indices (Morgan Stanley, 2011).

A second type of unsecured structured note is the convex payoff structure of an equity-linked note (ELN). Instead of paying coupons over the life of the note, the ELN has no cashflows until maturity and is known as a zero-coupon bond. Ramaswami et al. (2001) outline a Lehman ELN with the payoff structure of a call option and a bond. Using the Lehman example, an ELN investor today could buy a zero-coupon discounted bond. P in Equation 3.2 equals the notional amount of the zero-coupon bond, c is the yield on the bond, and y is the tenor in years of the bond. For an assumed yield of 4 percent for 5 years on a \$10,000,000 notional, the discounted price equals \$8,219,271.07. At the same time, a 5-year S&P 500® Index at-the-money call option on notional face value \$10,000,000 is purchased for \$1,780,728.93 at a strike price K of 3,500. The initial cash of the note is a summation of the price of the discounted bond and the cost of the option, equalling \$10,000,000. If at ELN maturity the S&P 500® Index S in Equation 3.3 is below 3,500, the option is worthless, and the investor receives \$10,000,000 principal guarantee back, the same as the cost of initial investment. The principal is protected; however, there is an opportunity cost in this approach as the investor receives 0 percent interest. By investing in an ELN, if the equity linked S&P 500® Index has not appreciated to a certain level at maturity of the note, then the investor has forgone income. In the example the compounded income for 5 years at 4 percent forgone equates to \$2,166,529.02. If on the other hand the S&P 500® Index rose to a level of 5,000 at maturity, then the ELN would return \$4,285,714.29 as per Equation 3.4 from the in-the-money call option, when r is 100 percent participation rate. Overall, the investor receives \$14,285,714.29 as per Equation 3.3. This would be significantly more than the 4 percent zero-coupon bond compounded and redeemed at par for \$12,166,592.02 (Ramaswami et al., 2001). Figure 3.5 illustrates the convex payoff of the structure and principal protected note.

Equation 3.2

$$\left(\frac{P}{(1+c)\hat{}y}\right)$$

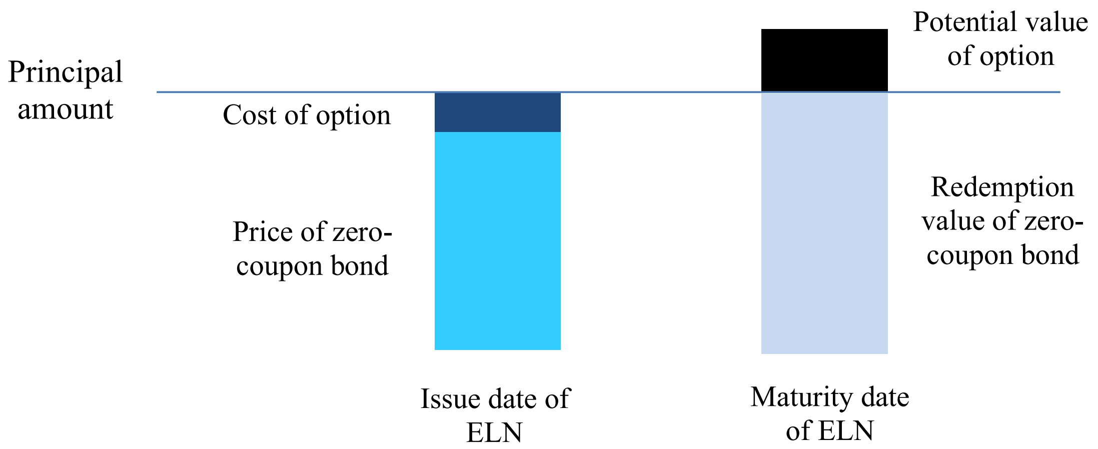
Equation 3.3

$$P + r \times \left(\frac{S}{K} - 1\right) \times P \quad if\ K \geq S$$

Equation 3.4

$$\left(\frac{S - K}{K}\right) \times r \times P \qquad if\ K < S$$

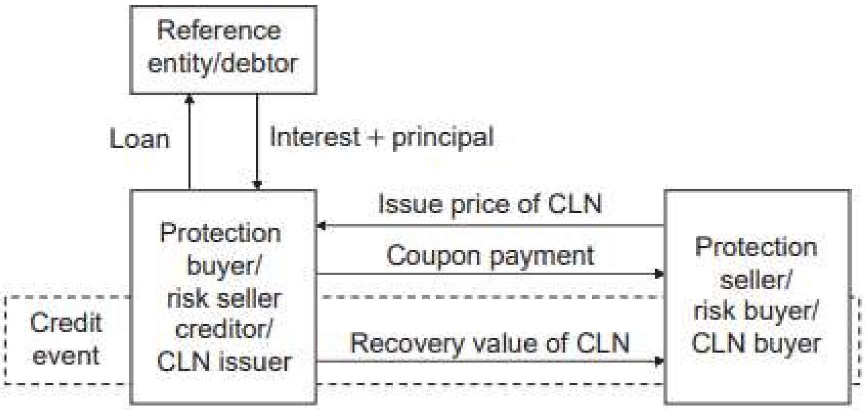
Figure 3.5: Equity-Linked Note Diagram. Source: Investopedia, Lehman (2001), and Author Elaborations.



Since the emergence of credit derivatives in the late 1990s, the credit-linked note (CLN) has become popular for bank and corporate issuers and investors (Fabozzi et al., 2007). This is the third type of unsecured structured note and the first concave payoff in Table 3.1. Imbedded in a CLN is a CDS. A CLN pays coupons on a scheduled basis and does not offer principal protection. A CDS on a single name reference entity is a private contract negotiated between two counterparties. The purchase of a CLN by an investor awards an investor access to credit exposures otherwise unattainable if the investor cannot trade derivatives, or the reference entity bonds are not available. Figure 3.6 illustrates the credit risk transfer process. The creditor has lent funds to a debtor, and to hedge the credit risk the creditor issues a CLN to an investor. The creditor is the buyer of protection in a CDS transaction with the CLN investor now bearing the credit risk of the reference entity. The creditor and issuer of the note has hedged a physical loan and a synthetic derivative (Rathgeber & Wang, 2011).

In 2013, Swiss bank Credit Suisse through their London branch issued a CLN[46] linked to the credit performance of Jaguar Land Rover Automotive PLC. The coupon paid to the investor was the floating rate 3-month Euribor with a minimum Euro 3.00 percent and a maximum Euro 5.00 percent. The coupon was calculated on the original principal of Euro 5 million assuming there were no declared credit events on the reference entity, Jaguar Land Rover (Credit Suisse, 2013a).

Figure 3.6: The Concept of CLNs. Source: Rathgeber and Wang (2011).



As the issuer, Credit Suisse is buying protection and pays a credit premium to the CLN investor who bore the credit risk and was effectively selling credit protection. If there was a credit event[47] and Jaguar Land Rover was declared bankrupt, failed to pay principal or interest on the reference obligation, or the debt obligation was restructured, the investor will receive less than the original principal invested (Credit Suisse, 2013a). Under a credit event all coupons and principal payments are ceased, and the note is physically exchanged from the investor to the issuer for the reference entity recovery value. Fabozzi et al. (2007) advise that market practitioners use the market value of the reference entity at the time of the credit event as the

[46] ISIN: XS0953450003.

[47] These include a failure to pay, bankruptcy, restructuring, repudiation or moratorium, an obligation acceleration, and obligation default (Ayadi & Behr, 2009). Credit events are defined in offering circular/information memorandum.

total amount that must be repaid to investors. The calculation of the recovery value can be a lengthy process because of the legal proceedings. Following the legal process, the Auction Final Price is calculated, and settlement occurs. Settlement[48] can be physical with the issuer delivering the reference obligation to the CLN investor. Cash settlement, which is common, can occur while the reference obligation remains. If there is no credit event a coupon of Euro 3.00 to 5.00 percent is paid to the investor depending on the reference value. The coupon includes the credit default premium and a funding cost to Credit Suisse. This funding cost stripped out reflects the underlying credit risk of Credit Suisse as issuer counterparty.

Equation 3.5

$$C = P \times b \times \frac{n}{DCF} \qquad where\ b = Min[3\%], Max[5\%]$$

Equation 3.5 outlines the formula to calculate the coupon payments of the structured note. The principal as P is multiplied by the benchmark rate b with a floor of 3.00 percent and a cap of 5.00 percent per annum. This is multiplied by the number of days in the quarterly period n divided by the day count convention DCF until the maturity date. Table 3.2 details hypothetical scenarios of how a credit event can impact the cash flows. If there is a credit event the original principal amount is multiplied by the Auction Final Price, and the principal repaid to the investor is less than Euro 5,000,000. Redemption occurs before the originally scheduled maturity date if a credit event is declared.

[48] Physical settlement in a credit event is where the protection buyer delivers the defaulted debt to the protection seller and the seller pays the par value of the agreed face value amount. Alternatively, cash settlement involves one payment from the protection seller to the protection buyer calculated as the difference between the par value of reference entity and the defaulted market value. No security is transferred. Physical or cash settlement is defined in the legal terms at the point the contract is agreed.

Table 3.2: Hypothetical Scenarios Credit-Linked to Jaguar Land Rover. Sources: Credit Suisse (2013a) and Author Elaborations.

Credit event	Original principal amount	Auction Final Price	Redemption principal paid	Coupon
No	EUR 5,000,000	n/a	EUR 5,000,000	Final coupon payment (Eq. 3.5)
Yes	EUR 5,000,000	50 percent	EUR 2,500,000	EUR 0
Yes	EUR 5,000,000	25 percent	EUR 1,250,000	EUR 0
Yes	EUR 5,000,000	0 percent	EUR 0	EUR 0

Alternatively, a CLN can reference a basket of entities. A popular basket of European entities is the iTraxx Europe® of which there are 125 equally weighted reference entities. If a credit event(s) occurs in the index, then the principal amount is reduced 0.8 percent (1/125) for each reference entity credit event, and therefore the coupons reduce as the coupon for that entity ceases (Credit Suisse, 2013b).

The Multiple-Linked Note (MLN) introduces a return linked to multiple assets, typically a basket of assets where each reference entity is not necessarily equally weighted in the basket. For example, the concave payoff of the Barclays SuperTrack Notes[49] is linked to the performance of an unequally weighted basket of 4 equity-based reference assets as per Table 3.3. Table 3.3 lists the reference asset, its weighting in the basket, the initial value, the basket component returns, and the weighted average return ω_a $to\, \omega_d$.

[49] ISIN: US06746XC273.

Table 3.3: Multiple-Linked Note Basket Composition Calculations. Sources: Barclays (2018) and Author Elaborations.

Reference asset	Basket weight	Initial value	Basket Component Return	Weighted average return
S&P 500 Index	40 percent	2,733.29	$\frac{(\text{Final value} - \text{Initial value})}{\text{Initial value}}$	ω_a= basket weight × basket component return
Russell 2000 Index	20 percent	1,627.61	$\frac{(\text{Final value} - \text{Initial value})}{\text{Initial value}}$	ω_b= basket weight × basket component return
EURO STOXX 50 Index	20 percent	3,641.82	$\frac{(\text{Final value} - \text{Initial value})}{\text{Initial value}}$	ω_c= basket weight × basket component return
Emerging Markets ETF	20 percent	$46.49	$\frac{(\text{Final value} - \text{Initial value})}{\text{Initial value}}$	ω_d= basket weight × basket component return

There are three potential payoffs at maturity. If the basket return is:

Equation 3.6

$$1.\ > 0.00\%,\ \mathit{per\ \$1{,}000\ principal\ amount}$$

$$\$1{,}000 + (\$1{,}000 \times Basket\ Return \times Upside\ Leverage\ Factor),$$

Equation 3.7

$$2.\ \leq 0.00\%,\ \mathit{per\ \$1{,}000\ principal\ amount}$$

$$\$1{,}000,\ or$$

Equation 3.8

$$3.\ < -40.00\%,\ \mathit{per\ \$1{,}000\ principal\ amount}$$

$$\$1{,}000 + (\$1{,}000 \times Basket\ Return)$$

where

Equation 3.9

$$Basket\ Component\ Return = \frac{(Final\ value - Initial\ value)}{Initial\ value}$$

Equation 3.10

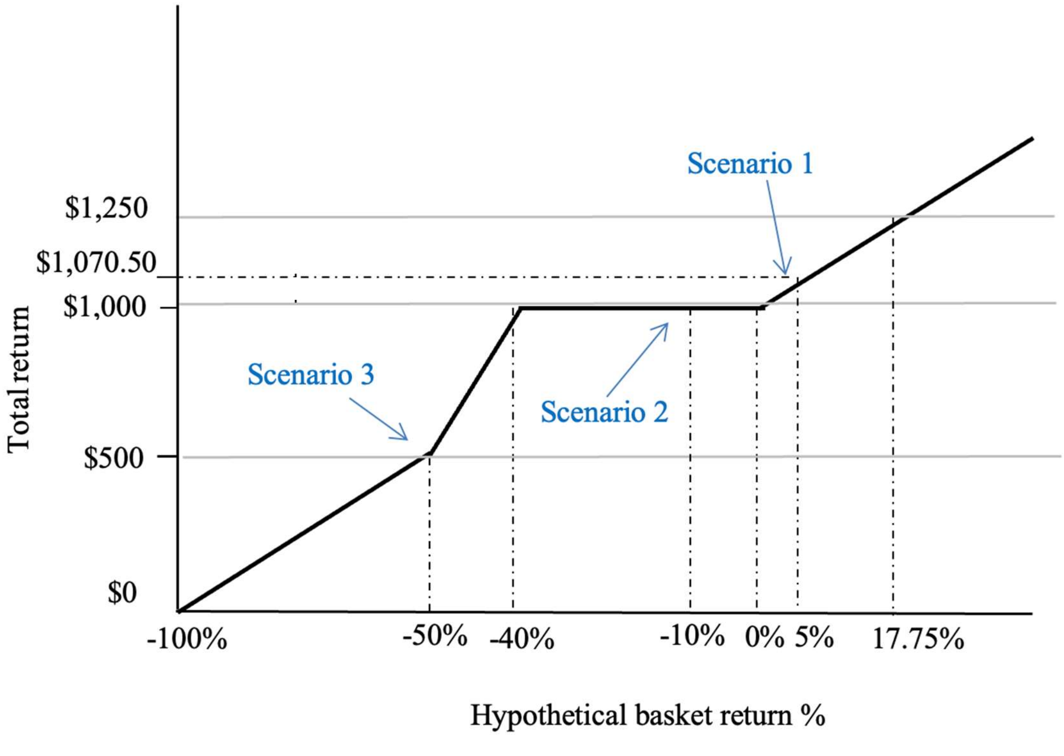
$$Basket\ Return = \omega_a + \omega_b + \omega_c + \omega_d$$

$$Upside\ Leverage\ factor = 141\%$$

$$Principal\ amount = \$1{,}000.00$$

The final value of each component ω_a to ω_d is determined as per Equation 3.9 and the basket return calculated as per Equation 3.10. If the basket return under Scenario 1 is 5 percent, then as per Equation 3.6 the total return would have been 7.05 percent, or $1,070.50. If the basket return under Scenario 2 is -10.0 percent, then Equation 3.7 would have calculated a payoff of $1,000.00. If on the other hand the basket return is much less than Scenario 2, say -50.0 percent, Equation 3.8 applied payoff total return would have been $500.00. This is Scenario 3 and the investor would have suffered a capital loss of $500 of the initial $1,000 (Barclays, 2018). Figure 3.7 charts the hypothetical payoffs.

Figure 3.7: Hypothetical Payoffs. Source: Barclays (2018) and Author Elaborations.



3.2.5 Secured Covered Bonds

The second category of structured securities for this study are covered bonds, which are secured obligations. Secured obligations are paid back before depositors and unsecured note investors in the event of liquidation. These are standardised securities and not OTC like unsecured structured notes. Covered bonds are an asset-backed security and are in the same securitisation family as mortgage-backed securities (Jobst, 2007). Covered bond underlying assets remain on-balance sheet and the bonds are issued under the bank legal name, unlike other securitisation structures such as collateralised debt obligations and mortgage-backed securities. Covered bonds are high-quality on-balance sheet "covered pool" assets, typically mortgages, and bondholders have dual recourse to unsecured creditors (Anand et al., 2012; Arif, 2020; RBA, 2017; Treasury, 2011). Dual recourse makes covered bonds distinctive to mortgage-backed securities that have no recourse, so if the over collateralisation of the assets in the special purpose vehicle cannot pay mortgage-backed securities bondholders, then the bondholders suffer a loss in a pass-through process (Arif, 2020; Schwarcz, 2013). Comparatively, if the on-balance sheet over collateralised covered pools cannot pay bondholders, these bondholders have a pari passu claim with the issuers' unsecured creditors (Schwarcz, 2013). Effectively, covered "bondholders have a claim against a cover pool of assets in priority to all other unsecured creditors of the financial institution" (RBA, 2017, p. 54). In Figure 3.8 Australian banks operate under a legislative structure, and the diagram CBA example illustrates that covered bondholders have recourse to the bank as issuer and recourse to the pool through the covered bond guarantee.

Mortgage-backed securities are tranched and have seniority ranking over collateralisation. Mortgage-backed securities typically reference a static loan portfolio and pass-through principal and interest to mortgage-backed securities noteholders over the life of the transaction (Schwarcz, 2013). Covered bonds do not have tranching and rely on the over collateralisation minimum set by bank regulators. Issuers of covered bonds, that is, banks in this study, are all supervised by regulators. Covered bonds are a deep market in Europe assisted by the 1988 EU Directive that created legislative harmony in the Euro area, increasing liquidity and investor participation.

In Australia, covered bond legislation passed in 2011, and in 2012 for Canada. Previously in Australia, covered bonds were not permitted under law due to dilution of protection for Australia bank depositors in the event an issuer is wound up under the Banking Act 1959 (RBA, 2017). Issuers of covered bonds in the United Kingdom, Germany, France, Sweden, and Norway operate under a legislative framework similar to Australia, New Zealand, and Canada. The legislation comes with a governance framework that includes restrictions, such as segregation of covered assets. In Australia, New Zealand, Canada, United Kingdom, France, and Norway special purpose vehicles segregate the assets. In Australia, APRA impose restrictions on the volume of funding in covered bonds and the covered pool itself for Australian banks (RBA, 2017). This provides further support to depositor protection as a set minimum of assets is available to depositors in the event of a bank wind-up. Covered bond issuance asset encumbrance total assets levels in Europe are much higher (or unlimited) compared to Australia at 8 percent (RBA, 2017; Treasury, 2011), New Zealand 10 percent, and Canada 4 percent[50]. Australia has a minimum over collateralisation of the covered pool of 3 percent, Canada 4 percent, United Kingdom 8 percent, Germany 2 percent, and France 5 percent, and these non-European countries place more subordination for depositors (Anand et al., 2012). In the United States currently there is no covered bond legislation. The United States Department of Treasury authored a paper in July 2008 on the best practices of covered bonds. The paper was timely because it was during times of stress in the United States housing market and residential mortgage securitisation markets. The paper outlined that covered bonds would provide additional on-balance sheet funding for United States organisations to diversify funding mixes, increase liquidity in residential mortgage bond markets, and lower the mortgages rates for homeowners (USDT, 2008). Companies can still issue covered bonds without a legislative framework. These are called structural covered bonds, and rely on contract and commercial law (Schwarcz, 2013; Treasury, 2011).

The size of the international covered bond market is large. In January 2013, the total outstanding was Euro 1.334 trillion and by April 2023, it had increased to Euro 2.140 trillion (CBL, 2023b). It is a low-cost form of borrowing for banks and a low-risk asset for investors as the structure is rated long-term Standard and Poor's AAA (Moody's Aaa). It is repo eligible to the European Central Bank, and in market stress can provide necessary liquidity to investors as they sell their stock to the European Central Bank for cash and agree to unwind this transaction at a future date. This was evident during the GFC.

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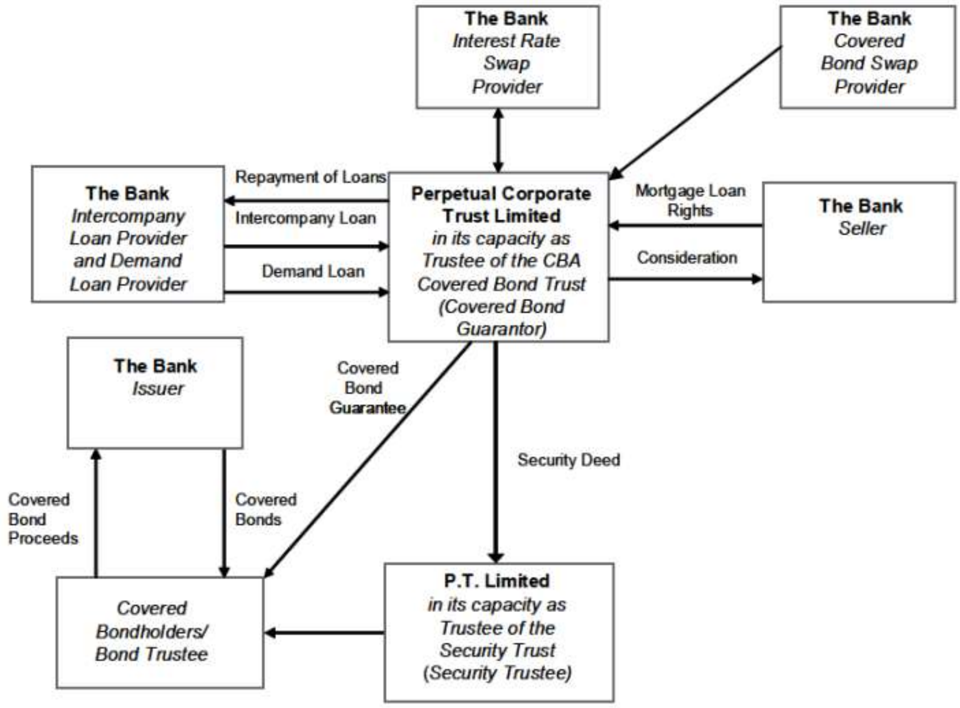
[50] Effective August 2019 the limit increased from 4 percent to 5.5 percent (OSFI, 2019).

Figure 3.8: CBA Covered Bond Structure. Source: CBA (2019).



3.2.6 Financial Stability and Regulation

Financial stability in the global economy remains a crucial component of economic prosperity. This is evident with the recent events of United States bank failures and fragilities in the global banking system due to expediated central bank tightening of interest rates. Instability can easily lead to economic downturn with a reduction in economic growth and increases in unemployment. Academia continues to attempt to define financial stability. Schinasi (2004) defines financial stability as a "continuum" whereby when most variables are within (outside) a certain range the economy is stable (unstable). Allen and Wood (2006, p. 154) suggest that "stability is regarded as a property of a system". Small deviations can be overcome, and the property can correct back to an equilibrium, and if the deviations are too large (like the GFC) then the property becomes unstable. Schinasi (2004) sources key concepts from central banks and academics, referencing financial markets, asset price stability, efficiency and smooth operation within the economy and financial system, confidence from investors, welfare impacts, and the ability to absorb shocks.

To ability to absorb shocks through capital levels is an accepted practice and the focus of capital structure. In December 1987, the Basel Committee on Banking Supervision (BCBS)[51] devised supervisory regulations on the capital adequacy of international banks. In consultation with the G10[52] and other country authorities, a framework was developed for the measurement of capital to be held as a minimum requirement. The BCBS had two overarching objectives. Firstly, "to strengthen the soundness and stability of the international banking system," and secondly, to ensure the framework was fair and consistent (BCBS, 1998, p. 1). This was known as The Basel Capital Accord, or Basel I, and was effective from July 1988 and with full implementation by 1992. Basel I devised rules on a target minimum capital ratio for banks of 8 percent with minimum 4 percent in core capital (Tier 1) and the residual as Tier 2 including hybrid debt and subordinated bonds. It also implemented risk weights for on and off-balance sheet exposures (BCBS, 1998).

It became clear, as financial instruments became more sophisticated in the mid to late 1990s after the adoption of Basel I by international banks, that regulatory arbitrage would occur. Jones (2000) termed this "regulatory capital arbitrage" and banks lowered the capital to be held without any or little economic risk change. Banks could "artificially" increase the numerator of capital and/or decrease the denominator of risk. Equity costs more than debt, so institutions with incentive problems will minimise the equity buffer over the prudential minimum requirements. If an institution can replace equity capital with debt capital, savings can be directed into the firm in the form of retained earnings or paid out to shareholders. This increased the risk-taking of banks as leverage increased. Brunnermeier (2009) terms this "regulatory and ratings arbitrage", recognising Jones (2000) but going a step further and noting that investors that were previously restricted from buying traditional Aaa credit rated bonds could now purchase Aaa tranches of structured notes that received preferential capital treatment. This practice of arbitrage circumnavigated Basel regulations and increased bank leverage, jeopardising global financial stability.

The Second Accord (Basel II) was introduced in June 2004[53] for cross-border and payment netting minimum standards in a 3-pillar approach to enhance risk management

[51] The BCBS develops international regulatory standards for banks.
[52] The Group of Ten (G10) is a group of countries established in 1962 that agreed to participate in the General Arrangements to Borrow, an agreement to provide the IMF with additional funds to increase its lending ability.
[53] The BCBS in November 2005 issued an updated version of Basel II and a comprehensive version in July 2006.

processes. Pillar 1 defines minimum capital requirements, Pillar 2 describes the supervisory review process, and Pillar 3 discusses market discipline (BCBS, 2006). While Basel II was being implemented, the GFC was forming. Schwarcz (2013) notes that the United States government was concerned about the affordability of home ownership and encouraged bank and mortgage providers to provide credit to risky borrowers prior to the GFC. Risky borrowers relied on products like adjustable-rate mortgages, which start as fixed rates and then convert into floating rates above a benchmark; however, these borrowers would refinance into a new loan before rates increased. As the house prices started to decline in 2007, risky borrowers could no longer refinance. There was a substantial increase in borrower defaults, weakening the United States economy. This weakening in United States asset prices spread to Europe and by September 2007 Northern Rock, the British bank, was bailed out by the Bank of England, and this caused a run on deposits for Northern Rock.

A second complication was that many mortgage-backed securities, asset-backed securities, and collateralised debt obligations referencing these underperforming assets were sold to investors, in synthetic portfolios, with the remaining securities held on bank balance sheets. These assets were illiquid and difficult to price; however, the market value was written down. Financial institutions faltered in 2008 or were bailed out by governments. Lehman failed on 15 September 2008 and was not supported by the United States government, which caused financial market turmoil and a deep global recession. The RBA (2018) summarises the main causes of the GFC as excessive risk-taking in a strong and stable global economy; increased leverage from banks; and laxation of regulation of subprime mortgage lending and of the institutions that sold complex securities referencing these underlying mortgages.

In April 2009, the Financial Stability Board (FSB) was established as part of the G20 response to the GFC and tasked with ensuring the global financial system was more resilient to shocks. The FSB prioritised six reforms. The priority was to build more resilient financial institutions through higher quality capital, enhanced risk management, and compensation aligned to better governance practices. The second priority was to address the moral hazard of large financial institutions and the notion that they are Too Big to Fail. The BCBS in 2013 defined the methodology to determine a SIB and provided a list of G-SIBs. G-SIBs are assessed on size; interconnectedness; substitutability; complexity; and cross-jurisdictional exposure. Those identified as a G-SIB are required to have 1) higher capital buffers; 2) total loss-absorbing capacity; 3) resolvability; and 4) higher supervision (FSB, 2019). A methodology to determine a D-SIB was developed by the FSB and provided to local regulators. The D-SIB approach mirrors the G-SIB framework except the cross-jurisdictional exposure of G-SIB is excluded. In Australia, APRA in 2013, effective 2016, labelled the four Major Banks as D-SIBs (APRA, 2013). The third priority suggested if financial institutions do fail, then the process should be orderly, and taxpayers should not be obliged to bail out the institution(s). Losses are absorbed by the subordination process with shareholders taking the first losses. The fourth priority was more effective supervision. The fifth was to centralise derivative markets and provide incentives like capital and margin charges if they are not centrally cleared (Calistru, 2012; FSB, 2009; Knaack, 2015). The sixth priority reform was to enhance the resilience of non-bank financial intermediation (FSB, 2022). Moshirian (2015) notes the work of BCBS and FSB, but nonetheless states that global risk cannot be eliminated, nor can market depressions be prevented. The International Monetary Fund (IMF), in its recent global financial stability report, notes the regulation of large banks since the GFC has been effective in building resilience (IMF, 2023).

Due to the substance of reforms in Basel III, Basel 2.5 was introduced in 2009 to enhance Basel II, while Basel III was being introduced. Basel III guidelines aimed to build resilience in the banking system by strengthening the regulation, supervision, and risk management of banks (BCBS, 2011). Basel III introduced new capital and liquidity requirements. Capital was increased and the quality of capital increased with Tier 1 common equity minimum raised to 4.5 percent from 2.0 percent; Tier 1 common equity and additional Tier 1 minimum 6 percent; and Tier 1 common equity, additional Tier 1, and Tier 2 to a minimum 8 percent. Up to 6 percent of minimum capital is recommended to absorb losses and reduce systemic risks. Tier 2 absorbs losses if a bank is deemed by the regulator as non-viable. Tier 1 absorbs losses when a bank is still a viable entity. A countercyclical capital buffer up to 2.5 percent ensures macro-economic factors are considered and a capital conservation buffer of 2.5 percent are now required as additional capital. The Liquidity Coverage Ratio (LCR) was introduced to build short-term resilience to banks' liquidity position. Banks must have sufficient high-quality assets to meet net cash outflows for at least 30 calendar days. Banks are afforded a higher LCR if assets are of higher-quality and more liquid, and liabilities are from stable sources (BCBS, 2019a). The Net Stable Funding Ratio (NSFR) ensures banks have sufficient stable funding to cover the duration of long-term assets and off-balance sheet activities. The NSFR measures the stability of a bank's funding profile over a 1-year time horizon and allows the bank to withstand disruptions to regular sources of funding without compromising the liquidity. This reduces the risk of systemic stress and maintains funding stability (BCBS, 2019b).

The BCBS, on behalf of the BIS, published progress reports[54] for the adoption of Basel III. The reports segregate the Basel standards in numerous categories, including capital, leverage ratio, SIB, interest rate risk in the banking book, liquidity, large exposures, and disclosures. Table 3.10 in the chapter appendix provides an overview of implementation for select Basel III indicators by country.

The Dodd-Frank Act, proposed by the Obama administration as part of United States financial regulatory reform in 2009, was passed in July 2010 and answered a call from the public to regulate the finance industry. The aim of the Dodd-Frank Act was "to promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'too big to fail', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes" (USC, 2010, p. 1).

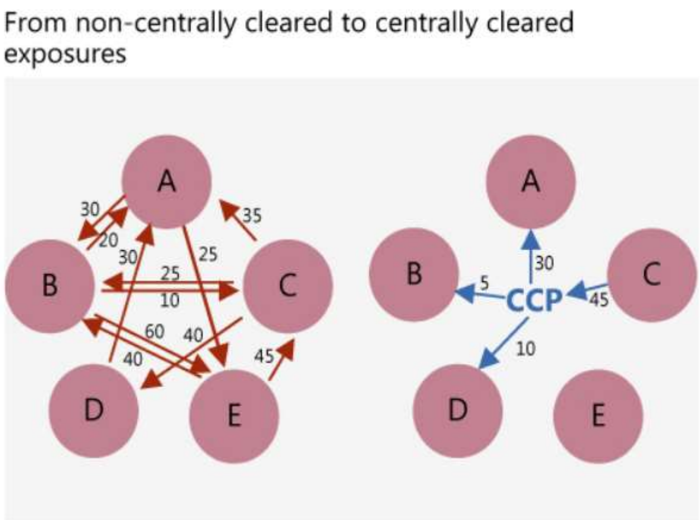
The Dodd-Frank Act established the Financial Stability Oversight Council, which is responsible for monitoring risks within the United States for large institutions. The goals of the FSB and Dodd-Frank Act aligned to address building resilience, ending Too Big to Fail and increasing supervision, derivative transparency, and regulation of Credit Rating Agencies. The Dodd-Frank Act targeted United States large financial institutions and their impact on the United States economy. Dodd-Frank, through the Volcker Rule, split speculative trading from bank depositors. This was, in effect, the reinstatement of the Glass-Steagall Act[55], which was repealed in 1999 by the Gramm-Leach-Bliley Act. A key reform from the Dodd-Frank Act was increased transparency of the OTC derivatives market. This aligned with the FSB reforms and the FSB set a goal to complete these reforms by the end of 2012. Knaack (2015) highlights the lack of actual reform more than two years following the 2012 deadline. The progress report at the end of 2014 by the G20 Summit highlights that less than 50 percent of FSB member

[54] Semi-annually since October 2011. These reports are based on the BCBS Regulatory Consistency Assessment Programme that monitors domestic implementation (BCBS, 2020).
[55] Following the Great Depression and the collapse of approximately 1,000 United States banks, the Glass-Steagall Act was enacted in 1933 to make large banks split investment banking from commercial banking to protect bank deposit customers (Funk & Hirschman, 2014).

countries had agreements in place for OTC derivatives to be reported electronically, and central clearing was slow.

Brown and Cleary (2010) advise that regulators and central counterparties determine the features of a standardised contract. Structured swaps that do not fit the standardised definition are left in a less liquid market, subject to the above margin requirements of a central counterparty (CCP)[56], with greater capital charges[57]. The primary objective is to reduce opacity and the interconnectedness of financial institutions. This would reduce systemic risk in the global financial system (FSB, 2022). Figure 3.9 illustrates the process of how central counterparty trades (RHS) differ from non-central counterparty bilateral OTC trades (LHS) and can reduce transactions and costs, credit risk, simplify cash flows, and reduce systemic risk. Counterparty B (LHS) originally had 6 OTC cashflows: B is receiving 30 from A, 25 from C, 40 from E, and paying 20 to A, 10 to C, and 60 to E. If B clears through a central counterparty as per RHS, then B net receives 5. B now no longer has rights or obligations to A, C or E as per the LHS diagram. CCP is a neutral cash flow. The CCP receives 45 from C and pays to A, B, and D. The CCP reduces the number of settlement transactions and guarantees default.

Figure 3.9: Central Clearing Trends and Current Issues. Source: BIS Quarterly Review (December 2015)



[56] The CCP provides clearing and settlement. For systemic risk to reduce in the financial markets system, the CCP must be robust themselves and have sufficient risk management procedures and processes. The CCP involves members posting margin. This varies as the mark-to-market value of the underlying instrument cleared changes.

[57] There could be different charges from the regulator and rating agencies (Brown & Cleary, 2010).

Steigerwald (2013) discusses how the CCP can be a substituted counterparty, say between A and B. One way is by novation, where existing contracts between A and B are ceased and new contracts are started between A and CCP and B and CCP with the same economics. The second way is an open offer where at the agreement of a contract between A and B, CCP is immediately inserted between A and B. Lehman and its swap counterparties would have benefited from clearing on the right-hand side.

The Dodd-Frank Act, as a priority initiative, was designed to restore creditability to Credit Rating Agencies, something Lupica (2009) argues was one consequence of the GFC. The Dodd-Frank Act increased supervision and rigor around the Credit Rating Agencies process. There were three areas of concerns for Credit Rating Agencies. Firstly, Credit Rating Agencies should verify their information and provide more transparency into how the end credit rating was achieved. Secondly, Credit Rating Agency modelling limitations reflected in the end credit rating. Thirdly, and lastly, there existed a conflict of interest between the product issuers and the Credit Rating Agencies analysis team. Dimitrov et al. (2015) find that following the GFC, ratings were conservative on the downside due to affirmation of the reputation hypothesis (Morris, 2001), rather than improving the quality of corporate bond ratings.

3.2.7 Gaps in the Empirical Research

The literature to date has defined unsecured structured notes and listed the benefits and limitations of these notes. The complexity of unsecured structured notes provides an advantage to large banking institutions that issue sophisticated financial instruments. Whilst the literature explains in detail the diverse types of unsecured structured notes based on expectations of investors (Chen & Wu, 2006; Crabbe & Argilagos, 1994; Fabozzi et al., 2007; Henderson & Pearson, 2011; Jobst, 2007; SEC, 2015; Telpner, 2004; Wohlwend et al., 2001), there is no study to the author's knowledge that details the issuing motivations of popular unsecured structured notes issued by SIBs. Nor has there been any research examining agency costs, reputation, flotation costs, and regulatory requirements affecting these decisions. Whilst we are aware that highly rated and standardised secured covered bonds provide an alternative funding source, we do not understand how offshore versus onshore issuance is impacted by corporate finance theory. Increasing our understanding of the impacts of corporate finance theory on covered bond issuers, particularly more recent starters like Australia and Canada, will advance the literature on financial stability.

Financial stability is important (as discussed previously), as is compliance by financial institutions to meet regulation and its intended purposes. Research has found that financial innovation, whilst beneficial on the one hand, can lose its purpose as banks find ways to innovate and arbitrage regulation. Basel III and the Dodd-Frank Act regulatory requirements enhanced financial stability following the GFC, with increased supervision and increased quality and levels of capital holdings. Liquidity requirements were overhauled following the GFC with a sophisticated regime to bolster liquidity resilience in times of stress. Derivative regulation through CCP has also reduced systemic risk. However, the literature is silent on the impact on unsecured structured notes and secured covered bonds that were not subprime and thus not specifically targeted in the initial regulatory reforms.

3.3 DATA AND METHODOLOGY

3.3.1 Active Structured Note Issuers

The dependent variable for unsecured notes is a dummy variable of 1 for an unsecured structured note, and 0 for a traditional bond. This study uses the same comprehensive Refinitiv bond dataset from Study 1 and examines nine bank issuers selected from the twenty-one active bond market choice issuers from Study 1 (displayed in Table 3.4). These banks are active unsecured structured issuers across multiple structured notes linked to various asset classes. The nine issuers are all G-SIBs. To provide external validation, eight of the nine banks were included in the Bloomberg League Table Reports Q1 2020 top 20 Global Structured Note issuers (Bloomberg, 2020).

Table 3.4: Study 2 Active Unsecured Structured Note Issuers, Ticker, Parent Country of Bank Issuer, Market Share from Sample, and FSB Importance. Source: Refinitiv and Author Elaborations.

Bank name	Ticker	Country	Importance
BNP Paribas	BNP	France	G-SIB
Deutsche Bank	DEUT	Germany	G-SIB
Credit Suisse	CREDS	Switzerland	G-SIB
Societe Generale	SG	France	G-SIB
Barclays PLC	BAR	United Kingdom	G-SIB
JP Morgan Chase	JP	United States	G-SIB
Morgan Stanley	MS	United States	G-SIB
Goldman Sachs Inc	GS	United States	G-SIB
Citigroup Inc.	CITI	United States	G-SIB

The first structured note category is composed from Refinitiv *Instrument Type* fields *Bond* and *Note* and *Seniority* for *Senior Unsecured* and *Unsecured*. RAN are selected from the *Coupon Type* field *Range Coupon*. CLN uses a combination of the *Instrument Type Credit-Linked Note* and *Asset-Linked Securities Type* fields. ELN, CULN, COLN, and MLN are selected from the *Asset-Linked Securities Type*[58] field labelled *Equity-Linked Security, Currency-Linked Security, Commodity-Linked Security,* and *Multiple-Linked Security,* respectively. The most common coupon type of unsecured structured notes is *Zero Coupon* bonds, and these are selected from the Refinitiv *Coupon Type* field. The traditional bonds for comparison with a dummy variable of 0 for the RAN and CLN are traditional fixed and floating rate bonds, and for comparison with ELN, CULN, COLN, and MLN are traditional zero-

[58] Commodity-Linked Security (COLN), Credit-Linked Security (CLN), Currency-Linked Security (CULN), Derivative-Linked Security (DLN), Equity-Linked Security (ELN), Fund-Linked Security (FLN), Index-Linked Security (ILN), Inflation-Linked Security (INLN), Interest Rate-Linked Security (IRLN), Multiple-Linked Security (MLN), Non-Inflationary Currency-Linked Security (NICLN), and Other Asset-Linked Security (OALN).

coupon bonds. Figure 3.10 in Section 3.3.3 illustrates the issuance of unsecured structured notes.

There are many complex types of unsecured structured notes and capturing data from Refinitiv can have limitations. Whilst Refinitiv static data supplies fields including issuer, issue date, maturity date, bond size, and seniority of structured notes, there are certain fields that cannot be consistently retrieved. An example of this is range accrual notes, where the actual performance index reference and the range of the index are inconsistently recorded. The Refinitiv *Underlying Index* may reference the index such as the "Citigroup Inc. issued callable LIBOR range accrual note"[59] or may be left blank such as "Bank of America range accrual note"[60]. There is no Refinitiv field to capture the lower and upper range of the index. Furthermore, if there is greater complexity to the structured note, this will not necessarily be captured in the Refinitiv data. For example, JP Morgan issued a 10 Year Callable CMS and CMS Spread Dual Range Accrual Note[61]. Refinitiv identifies *Coupon Type* as Range Coupon but makes no reference to CMS and therefore currently there is no way from the Refinitiv data to determine the CMS spread. Complex details and valuations like these are captured in bank systems to ensure the coupon and risk payoff paid to structured investors are accurate. The remaining debt issues are grouped in this study as traditional bonds and allocated a value of 0, after excluding all other non-traditional bond choices.

The second structured note category includes secured covered bonds issued by SIBs. The active SIB covered bond issuers in Table 3.5 totals eighteen. The SIBs are from nine countries and exhibit greater country diversity than the unsecured notes from five countries. Australian and Canadian banks entered the covered bond issuer list, and the United States banks exited the list. The split between G-SIBs and D-SIBs for covered bonds is more equal compared to the lopsided unsecured structured notes. The Refinitiv *Instrument Type* containing *Covered Bond*[62] and *Market of Issue* for onshore and offshore are combined. Figure 3.11 in Section 3.3.3

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[59] CUSIP: 1730T0EH8.
[60] ISIN: XS0261072291.
[61] ISIN: XS1163258533.

[62] Asset Covered Security (Covered Bond), Belgian Mortgage Pandbrieven (Covered Bond), Bonos Internacionalizacion (Covered Bond), Cedula Hipotecaria (Covered Bond), Cedula Territorial (Covered Bond), Chile Bono Hipotecario (Covered Bond), Covered Bond (Other), Fundierte Schuldverschreibungen (Covered Bond), Hypothekenpfandbrief (Covered Bond), Hypothekenpfandbrief Jumbo (Covered Bond), Letra Hipotecaria

illustrates that European banks dominate the issuance of covered bonds and highlights the introduction of covered bond legislation in 2011 for Australia and 2012 for Canada.

Table 3.5: Study 2 Active Covered Bond Issuers

Bank name	**Ticker**	**Country**	**Jurisdiction**	**Total assets (USD billion)**	**Importance**
BNP Paribas	BNP	France	Europe	2,429.26	G-SIB
Societe Generale SA	SG	France	Europe	1,522.05	G-SIB
Deutsche Bank	DEUT	Germany	Europe	1,456.26	G-SIB
Commerzbank AG	COMMER	Germany	Europe	478.40	D-SIB
Ing Groep NV	INGB	Netherlands	Europe	1,000.72	G-SIB
Credit Suisse Group AG	CREDS	Switzerland	Europe	812.91	G-SIB
Danske Bank A/S	DAN	Denmark	Europe	564.83	D-SIB
Nordea Bank Abp	NORD	Finland	Europe	622.66	D-SIB
Barclays PLC	BAR	United Kingdom	Europe	1,510.14	G-SIB
HSBC Holdings PLC	HSBC	United Kingdom	Europe	2,715.15	G-SIB
Lloyds Banking Group PLC	LLOYDS	United Kingdom	Europe	1,104.42	D-SIB
Natwest PLC	NATW	United Kingdom	Europe	957.60	D-SIB
Royal Bank of Canada	RY	Canada	Canada	1,116.31	G-SIB
Scotiabank	BNS	Canada	Canada	872.62	D-SIB
Canadian Imperial Bank of Commerce	CIBC	Canada	Canada	495.99	D-SIB
Australian and New Zealand Banking Group	ANZ	Australia	Australia	661.72	D-SIB
Commonwealth Bank	CBA	Australia	Australia	688.4	D-SIB
National Australia Bank	NAB	Australia	Australia	571.34	D-SIB

Chile (Covered Bond), Lettre de Gages (Covered Bond), Namenspfandbrief (Covered Bond), Obbligazioni Bancaria Garantita (Covered Bond), Obligation Fonciere (Covered Bond), Obligations de Financement de l'Habitat (Covered Bond), Obrigacao Hipotecaria (Covered Bond), Oeffentlicher Namenspfandbrief (Covered Bond), Oeffentlicher Pfandbrief (Covered Bond), Oeffentlicher Pfandbrief Jumbo (Covered Bond), Pfandbrief Anleihe (Covered Bond), Realkreditobligation (Covered Bond (Denmark pre-2008)), Saerligt Daekkede Obligation (Covered Bond), Saerligt Daekkede Realkreditobligation (Covered Bond), and Sakerstallda Obligation (Covered Bond).

3.3.2 Binary Models and Variables

The aim of this study is to evaluate banks' issue of an unsecured structured note rather than a traditional bond and to determine if agency problems with SIBs or regulatory changes impact this choice. Equation 3.11 models in logistic regression the natural logarithm of the probability of a bank choosing to issue a note, where $\Pr(y_{i,t} = 1)$ represents the probability of an unsecured structured note by bank i at time t, and $\Pr(y_{i,t} = 0)$ is the probability of a traditional bond by bank i at time t. For secured covered bonds the probability of bank i at time t choosing to issue an offshore covered bond is $\Pr(y_{i,t} = 1)$ and $\Pr(y_{i,t} = 0)$ is the probability of bank i at time t choosing to issue an onshore covered bond. Modelling follows a similar approach to Gao (2011) and Tawatuntachai and Yaman (2008) who both employ logistic techniques[63]. The independent variables in Equation 3.11 are represented by a vector of bond characteristics $\boldsymbol{X}_{i,t}$ and a vector of bank characteristics to proxy for agency costs, reputation, flotation costs, and a vector for regulation changes for global banks $\boldsymbol{R}_{i,t-1}$. Vector $\boldsymbol{C}_{i,t-1}$ controls for enforcement of contract (Esho et al., 2001), underlying asset volatility, and macro-economic conditions. Epsilon ε is the error term. The vectors $\boldsymbol{X}$, $\boldsymbol{R}$, and $\boldsymbol{C}$ are estimated using maximum likelihood, and the binary regression log likelihoods are used to calculate the probability of an unsecured structured note/offshore covered bond issue. Logistic regression must adhere to the assumptions of model specification, error terms need to be independent, and there must be no multicollinearity from independent variables, and no influential outliers.

Equation 3.11

$$ln\left(\frac{\Pr(y_{i,t}=1)}{\Pr(y_{i,t}=0)}\right) = \beta_0 + \beta_1\boldsymbol{X}_{i,t} + \beta_2\boldsymbol{R}_{i,t-1} + \beta_3\boldsymbol{C}_{i,t-1} + \varepsilon_{0i,t}$$

The empirical model in Equation 3.12 uses bond characteristics including a dummy variable to proxy for issuer call (CALL), which is important for range accrual notes, in addition to proxies for agency costs, reputation, and flotation costs similar to Equation 2.10 from Study

[63] Gao (2011) uses a binary value of 1 for the Yankee Market and a value of 0 for the Non-Yankee market; Tawatuntachai and Yaman (2008) use a binary value of 1 for Global Bonds and a value of 0 for domestic bonds.

1. However, Equation 3.12 seeks to evaluate the propensity for a bank to issue an unsecured structure note (USN) rather than a particular market choice.

Equation 3.12

$$USN_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 TENOR_{i,t} + \beta_3 CALL_{i,t} + \beta_4 IRATING_{i,t-1} + \beta_5 ONSBOND_{i,t-1} + \beta_6 AGE_{i,t-1} + \beta_7 UFE_{i,t-1} + \beta_8 MVBV_{i,t-1} + \beta_9 TA_{i,t-1} + \beta_{10} CCP_{i,t-1} + \beta_{11} TETA_{i,t-1} + \beta_{12} LCR_{i,t} + \beta_{13} ENFORCE_{i,t-1} + \beta_{14} VOL_{i,t-1} + \beta_{15} CPI_{i,t-1} + \varepsilon_{0i,t}$$

Crabbe and Argilagos (1994) emphasise that purchasing from highly rated issuers limits the credit risk of the notes and the market risk of the underlying linked asset(s). Following the GFC, the reliability of credit rating agencies reduced. One could expect that the reliance on a bank's reputation measured by issuer credit rating would be less valuable. Increases in other reputation proxy measures including bank age and onshore bond reputation could overcome incentive problems (Diamond, 1989). It is likely that there are positive relationships with reputation and the issue of unsecured structured notes compared to traditional bonds. Contracting costs are higher for firms with higher investment and growth opportunities (Jensen & Meckling, 1976; Myers, 1977) because shareholder and bondholder conflicts are higher, and these firms select the debt choice that has lower contracting costs. Expectations are that unsecured structured notes have higher contracting costs compared to traditional bonds, so banks will issue unsecured structured notes less than traditional bonds when growth opportunities are higher. The adverse selection problem is due to asymmetric information between the issuer and investor and impacts a bank's funding decision (Myers & Majluf, 1984). Unsecured structured note investors can have less non-private information about a bank than traditional bonds because the focus is on the complexity of the structure, and potentially be at a disadvantage to traditional bond investors. Traditional bond investors can tend to focus on the underlying issuer credit risk. Banks with higher levels of asymmetric information and younger banks expect less issuance of unsecured structured notes. Under the flotation cost hypothesis (Blackwell & Kidwell, 1988), expectations are that larger and more reputable firms are more likely to issue unsecured structured notes due to economies of scale. These theories are tested in Hypotheses 1 and 2 from Equation 3.12.

$\mathbf{H_1}$: Increases in bank age, onshore bond activity, and size of bank as reputation measures have a significant positive relationship with the likelihood of the issue of unsecured structured notes.

$\mathbf{H_2}$: Increases in asymmetric information through unexpected future earnings and increases in investment and growth opportunities in market to book value of bank issuers have significant negative relationships with the likelihood of the issue of unsecured structured notes.

To reduce the notion that banks are Too Big to Fail and ensure the financial system is more resilient to future shocks, regulators implemented derivative, capital, and liquidity regulatory reforms. The growth rate of central counterparty clearing (CCP) for interest rate swaps from December 2008 until December 2019 and CDS from June 2010 to December 2019 are employed to replicate OTC derivative reform through The Dodd-Frank Act. Figure 3.12 in the chapter appendix charts the interest rate CCP growth from 37.1 percent to 76.6 percent and CDS CCP growth from 9.6 percent to 55.9 percent. In contrast, for the same periods the outstanding notional amounts for reportable dealer (RD) counterparty decreased by 30.7 percent and 32.9 percent, respectively (BIS, 2019).

The Liquidity Coverage Ratio (LCR) is given a binary dummy value of one for each bank's parent domiciled country and applied on the adoption of the Basel Regulatory framework listed in Table 3.10 in the chapter appendix. Expectations are that increased regulation, in either derivative central counterparty, and enhancements to liquidity reduce the likelihood of an unsecured structured note over a traditional bond, and this is tested in Hypothesis 3.

$\mathbf{H_3}$: Increases in banking derivative and liquidity regulation following the GFC had a significant negative relationship with the likelihood of a bank to issue unsecured structured notes.

To control for contract enforceability, this study follows a similar approach to Esho et al. (2001) who test the legal and institutional hypothesis, and model the enforceability of a contract if an issuer defaults on its obligations. The bankruptcy of Lehman and the repercussions of the Euro Sovereign Debt Crisis for investors on enforceability makes its inclusion justifiable. The variable ENFORCE calculated in Equation 3.13 averages four categories per bank issuing country including political stability and absence of violence/terrorism, rule of law, government effectiveness, and regulatory quality from the Worldwide Government Indicators from World Bank, on a yearly basis. A larger value indicates a greater likelihood an investor will have greater contract enforcement.

Equation 3.13

$$ENFORCE_{i,t} = \frac{(GOV.EFFECTIVENESS_{i,t} + REG.QUALITY_{i,t} + RULE\ OF\ LAW_{i,t} + POLITICAL\ STAB._{i,t})}{4}$$

To control for and price the market risk of unsecured structured notes, a variable is created to replicate the underlying volatility of each asset class. The annualised volatility σ_T over time horizon T is calculated and included in the model. The annualised volatility (VOL) is measured by the standard deviation for the quarter computed for the 3 preceding monthly returns $\sigma\sqrt{T}$. σ is the standard deviation and T are the number of periods in the time horizon. The returns for each asset class are matched to the closest underlying unsecured structured note referenced asset and include interest rates (10-year United States Treasury mid-rate), equities (the Standard & Poor's 500 composite index), credit (the 5-year credit default swap mid-spread for either North America, Europe, United Kingdom, or Asia region), and commodities (Standard & Poor's GSCI Commodity Total Return). All data is accessed from Datastream, and presents in Figure 3.13 in the chapter appendix. To address undercapitalisation of banks a control proxy to measure increased quality and quantity of capital, namely the financial characteristic of book value of total equity to total assets (TETA), is added.

Overall, it is expected that unsecured structured note regression results may vary due to the complexities and diverse payoffs of unsecured structured notes.

The empirical model in Equation 3.14 tests the likelihood of a bank issuing an offshore covered bond (OFFCB) versus an onshore covered bond. Bank age is included to proxy for reputation as an independent variable. Interactive variables equal to 1 for Australian (AU) and Canadian (CA) jurisdictions, collectively region (REG) with asymmetric information (UFE) and investment and growth opportunities (MVBV) added. Covered bond legislation for jurisdictions like Australia and Canada was introduced following the GFC to permit banks to issue covered bonds. Understanding how incentive problems and adverse selection impacts offshore covered bond issuance for these smaller countries and less researched issuers is important for financial stability. To capture a bank's increase in stable customer deposits following the GFC, a proxy of book value of customer deposits to book value of total assets (DEPTA) is added. Short-term stable deposits and covered bonds are considered more conservative funding avenues than unsecured bonds in times of market stress. Banks with a higher customer deposit funding to total asset ratio are expected to exhaust this cheaper and more stable funding before offshore covered bonds. To proxy for Domestic SIBs, a dummy variable equal to one for D-SIBs (DSIB) is added to the model. Expectations are that D-SIBs, as generally smaller institutions, will access offshore markets more than onshore due to onshore market completeness issues, greater access bond market tenor, and a more diverse investor base that the onshore market does not offer (Black & Munro, 2010). European banks are frequent issuers of covered bonds as per Figure 3.11 in Section 3.3.3, and a dummy variable (EU) is added to improve model fit. VIX (a proxy for market conditions) and GDPPC (a proxy for macro-economic conditions) are both added. Hypotheses 4 and 5 test the expectations discussed above.

Equation 3.14

$$OFFCB_{i,t} = \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 TENOR_{i,t} + \beta_3 AGE_{i,t-1} + \beta_4 UFE_{i,t-1} + \beta_5 UFE_{i,t-1} \times REG + \beta_6 MVBV_{i,t-1} + \beta_7 MVBV_{i,t-1} \times REG + \beta_8 DEPTA_{i,t-1} + \beta_9 DSIB_{i,t} + \beta_{10} EU_{i,t} + \beta_{11} VIX_{i,t} + \beta_{12} GDPPC_{i,t-1} + \varepsilon_{0i,t}$$

$\mathbf{H_4}$**:** An increase in asymmetric information and growth opportunities has a significant negative relationship with the issuance of a bank offshore covered bond.

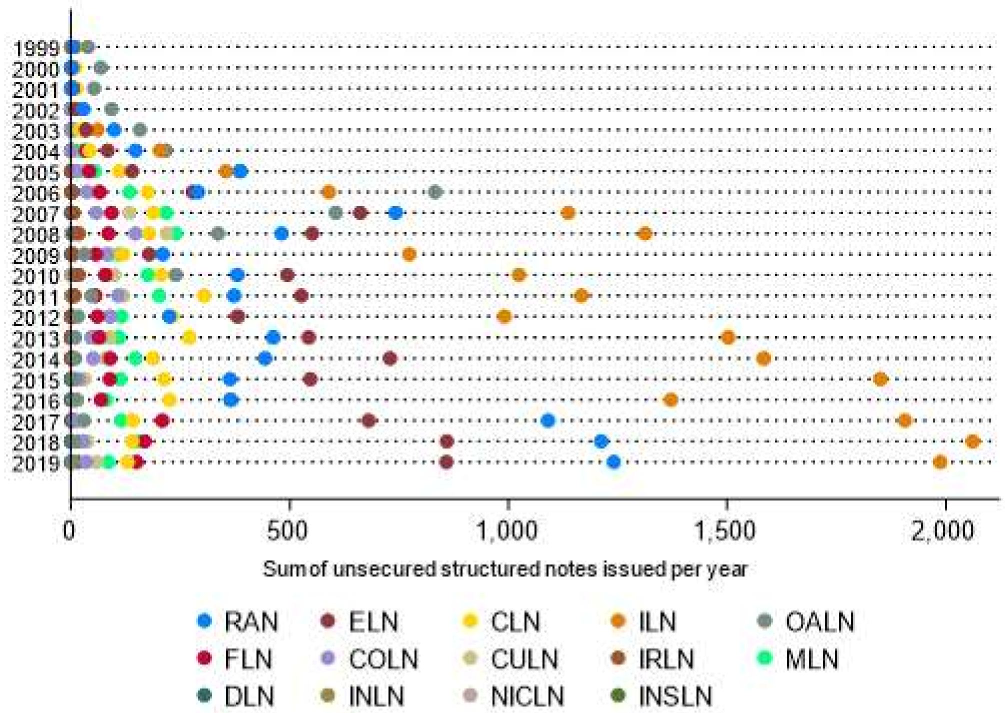
$\mathbf{H_5}$**:** Domestic Systemically Important Banks have a significant positive relationship with the issuance of a bank offshore covered bond.

3.3.3 Summary Statistics

Figure 3.10 charts the quantity of the dependent variable unsecured structured notes issued from 1999 to 2019 inclusive. ILN are the most common and increased following the

GFC. ELN and RAN are the next most popular. CLNs, which had a notable increase in 2007 and 2008, linked to the growth of the CDS markets, and decrease during the Euro Sovereign Debt Crisis. From then after CLNs have remained steady in issuance following the GFC. OALN were prevalent prior to the GFC but have since diminished compared to other choices. MLN, CULN, COLN, and FLN have remained steady since 2009 following the GFC. DLN, NICLN, IRLN, INSLN, and INLN are hard to distinguish due to the comparatively low issuance compared to other unsecured structured notes. The RAN, CLN, ELN, MLN, and COLN were selected to test in Equation 3.12. ILN was not included in the results as it experienced similar relationships and significance to ELN.

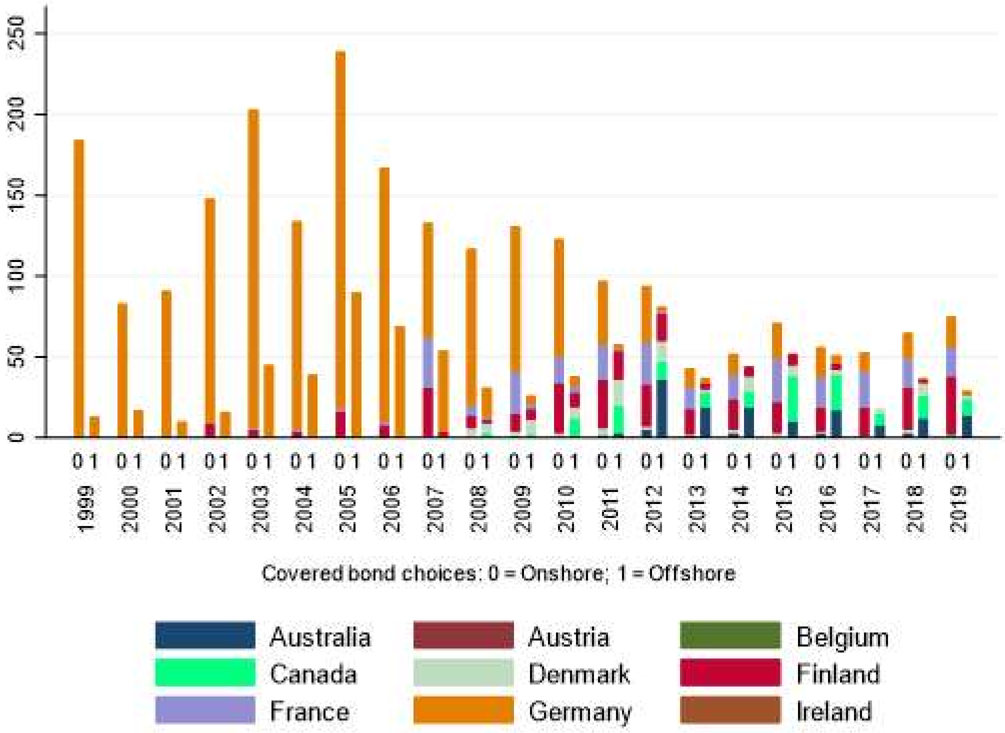
Figure 3.10: The Number of Unsecured Structured Notes Issued from the Sample of Systemically Important Banks (Table 3.4). Source: Stata and Refinitiv.



The figure charts the sum per annum of unsecured structured note issuance from the selected nine Global Systemically Important Banks from Table 3.5 from 1999 to 2019 inclusive. The types of unsecured structured notes in alphabetical order include Commodity-Linked Note (COLN), Credit-Linked Note (CLN), Currency-Linked Note (CULN), Derivative-Linked Note (DLN), Equity-Linked Note (ELN), Fund-Linked Note (FLN), Index-Linked Note (ILN), Inflation-Linked Note (INLN), Insurance-Linked Note (INSLN), Interest Rate-Linked Note (IRLN), Multiple-Linked Note (MLN), Non-Inflationary Currency-Linked Note (NICLN), Other Asset-Linked Note (OALN), and Range Accrual Note (RAN).

The German banks' dominance of covered bond issuance from 1999 to 2006 is evident in Figure 3.11. There were 1,574 covered bond issuances during this period and 87 percent of these were Pfandbriefe[64], a type of German bank issued covered bond. Finland, France, and the United Kingdom issued covered bonds prior to the GFC (2007-2008). In 2011 in Australia and 2012 in Canada, legislation was passed allowing these countries to issue covered bonds under this framework. Following this time, Australian and Canadian banks have issued larger quantities of offshore covered bonds than onshore covered bonds compared to European issuers from Finland, France, and Germany.

Figure 3.11: Covered Bond Choices by Issuer Country Each Calendar Year. Source: Stata, Refinitiv, and Author Calculations.



[64] A specific class of covered bonds corresponds to each of these cover asset classes: Hypothekenpfandbriefe (mortgage lending), Öffentliche Pfandbriefe (public sector lending), Schiffspfandbriefe (ship financing), and Flugzeugpfandbriefe (aircraft financing) (Covered Bond Label, 2023b).

3.4 RESULTS AND DISCUSSION

Table 3.6 presents the regressions results from Equation 3.12 for the selected notes, namely range accrual (RAN), credit-linked (CLN), equity-linked (ELN), multiple-linked (MLN), and commodity-linked (COLN). The models fit with a pseudo R2 of 0.05 to 0.25 with a pseudo R2 mean of 0.17. Bond size has a negative relationship with RAN, CLN, and COLN at the one percent significance level. An increase in bond tenor increases the likelihood of a RAN and decreases the likelihood of an MLN reflecting investor's risk adversity to convex payoff RAN to the concave payoffs of MLNs. The callability of an unsecured structured note (USN) has a positive relationship with RAN, which is consistent with the literature (Crabbe & Argilagos, 1994), and a negative relationship with the other five USNs.

Reputation proxies indicate that bank issuer rating is not significant for any USN, which could suggest investors rely less on the credibility of the credit rating agencies and more on concerns of the underlying performance. Increases in onshore bond reputation increase the likelihood of a bank issuing a MLN and COLN, supporting Hypothesis 1 (namely a positive relationship), and increases in unexpected future earnings decrease the likelihood of issuance of MLN and COLN, supporting a negative relationship with asymmetric information from Hypothesis 2 and the seminal work of Myers and Majluf (1984). This may be due to concerns over greater sensitivities in information from the more complex payoff structures of MLN and COLN compared to the other USN tested. Growth opportunities all exhibit significant negative relationships with the likelihood of issues of RAN, CLN, and ELN proxied through market to book value, supporting Hypothesis 2 and Myers (1977). MLN and COLN are insignificant for growth opportunities, and this result is surprising because these notes are expected to have higher contracting costs.

Analysis of the CLN is important given its popularity and the fact that this instrument was once lauded by market participants and regulators. Further, it was the focus of OTC derivative reform through the Dodd-Frank Act. Increases in reputation measured through age and total assets increase the likelihood of a bank issuing a CLN, supporting Diamond (1989), and SIB issuers with a longer track record have lower incentive problems as adverse selection reduces over time with a good reputation. This supports Hypothesis 1. Interestingly, ELN has a significant negative relationship with age, which could indicate that investors prefer traditional bonds from more reputable banks due to the underlying nature of equities as a growth asset. CLN does not support the asymmetric information in Hypothesis 2, as increases in unexpected future earnings in fact increase the likelihood of a CLN relative to a traditional bond. It is plausible that CLN investors are content to accept higher asymmetric information and rely more on an issuer's age and larger balance sheets proxied by total assets. The predicted probability results for CLN are the largest amongst the other USN, with age and total assets displaying the highest increase in percentage changes, and central counterparty growth in credit derivatives reducing the predicted probability. Figures 3.15 to 3.19 in the chapter appendix graphs the predicted probability CLN changes in these independent variables.

The relationship between increased regulation and the likelihood of a bank to issue unsecured structured notes raises some curious points. The introduction of OTC derivative reform through the Dodd-Frank Act and through a centralised counterparty to increase transparency and reduce systemic risk displays a negative relationship with RAN, CLN, MLN, and COLN, supporting Hypothesis 3. ELN is negative but insignificant, which is expected because equity derivatives were based on an exchange and not OTC prior to the GFC. The introduction of the Basel III liquidity coverage ratio, a measure of a bank's resilience to withstand at least 30 days of market stress, has a negative relationship with RAN, MLN, and COLN as expected, supporting Hypothesis 3 that increases in derivative and liquidity regulation reduce the likelihood of a USN. Increases in equity to total assets in line with Basel III requirements increase the likelihood of MLN and COLN and provide comfort to USN investors regarding additional loss absorption of the SIB issuer.

The control variables for enforceability exhibit a significant positive relationship with CLN, ELN, and MLN, indicating an increased likelihood of a bank to issue unsecured structured notes when political, legal, and government environments are more stable and unsecured structured notes contract enforceability is higher. Volatility has a negative relationship with the four structured notes; however, none are significant. The consumer price index is positively significant for an MLN issue.

Table 3.6: Unsecured Structured Note (USN) Range Accrual, Credit-Linked, Equity-Linked, Multiple-Linked, Commodity-Linked, And Index-Linked Log Pseudolikelihood Regressions (from Equation 3.12)

Regression	**1**	**2**	**3**	**4**	**5**
Dependent variable	**RAN**	**CLN**	**ELN**	**MLN**	**COLN**
Independent variables					
SIZE	-0.1705**	-0.2046***	-0.0065	0.1064	-0.2927***
	(0.0721)	(0.0446)	(0.0920)	(0.0832)	(0.0820)
TENOR	0.0921***	0.0198		-0.0919*	
	(0.0231)	(0.0127)		(0.0477)	
CALL	2.3306***	-1.8281***	-2.4966***	-1.8212***	-4.0844***
	(0.2330)	(0.2317)	(0.3804)	(0.3819)	(1.1886)
IRATING	0.0500	0.0442	-0.1699	-0.0038	0.1975
	(0.0978)	(0.1302)	(0.1059)	(0.0822)	(0.2236)
ONSBOND	2.6154	2.0365	-1.7964	7.7639***	16.0159***
	(2.0820)	(1.4740)	(2.4952)	(0.8470)	(3.6129)
AGE	-0.0026	0.0138***	-0.0068***	0.0048	0.0028
	(0.0043)	(0.0026)	(0.0022)	(0.0029)	(0.0061)
UFE	0.0002	0.4284***	-0.0703	-0.3077***	-0.5914***
	(0.0510)	(0.0619)	(0.0446)	(0.0949)	(0.1866)
MVBV	-22.6888***	-13.0596*	-8.6790**	-1.0009	9.0099
	(5.0764)	(7.8599)	(4.0048)	(7.9133)	(14.1110)
TA	-0.0390	2.2013***	-0.2806	0.4867	0.6075
	(0.4757)	(0.6212)	(0.3552)	(0.4700)	(0.6354)
CCP	-0.0239*	-0.0365***	-0.0079	-0.0334***	-0.0624***
	(0.0127)	(0.0102)	(0.0084)	(0.0108)	(0.0131)
TETA	11.0876	-4.8180	-7.4542	13.4577*	33.6648**
	(8.6981)	(8.4542)	(6.8786)	(6.9834)	(16.4771)
LCR	-1.0299***	0.3911	-0.1962	-1.0604**	-2.2677***
	(0.2252)	(0.2507)	(0.4249)	(0.4469)	(0.7656)
ENFORCE	-0.0494	0.0322**	0.0401***	0.0664***	0.0181
	(0.0323)	(0.0162)	(0.0126)	(0.0195)	(0.0556)
VOL	-0.3612	-0.2042	0.9739	-0.7100	-2.4474
	(0.6460)	(0.4532)	(1.4500)	(1.6291)	(1.8663)
CPI	0.0845	-0.1288	-0.1687	0.2732*	0.5042
	(0.0681)	(0.1266)	(0.1114)	(0.1494)	(0.4129)
Constant	26.8531**	-21.0776	12.8841	-14.6387	-19.4260
	(13.1568)	(12.8564)	(8.6660)	(13.6630)	(13.8417)
Log pseudolikelihood	-2,617.50	-2,952.24	-3,703.53	-2,228.01	-1,237.14
Pseudo R2	0.2519	0.1741	0.0579	0.1378	0.2436
Observations	13,107	10,725	8,272	12,566	12,270

This table reports the logistic regressions for unsecured structured notes. The dependent variables are binary discrete unsecured structured notes and given a value of 1 and labelled RAN: range accrual note, CLN: credit-linked note, ELN: equity-linked note, MLN: multiple-linked note, and COLN: commodity-linked note. The other outcome is traditional bonds, given a value of 0. The coupon types for the RAN and CLN regressions employed fixed rate and floating rates to capture a meaningful comparison to traditional bonds and the other unsecured structured notes. Traditional bonds employed zero-coupon bonds. SIZE is the logarithm of bond size in USD, and TENOR is the bond tenor in years. CALL is a binary dummy variable for callable bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, CCP is the central counterparty growth of interest rate swaps (used for RAN, ELN, MLN, and COLN) and central counterparty growth of credit default swaps (used for CLN), TETA is the book value of total equity divided by the book value of total assets, LCR is a dummy binary variable for the introduction of the Liquidity Coverage Ratio for each jurisdiction, ENFORCE is the enforceability of the contract, VOL is annual standard deviation of interest rates (RAN), equity (ELN and MLN), commodities (COLN), or credit (CLN), CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3.7: Unsecured Structured Note Predictive Probabilities (from Table 3.6)

	RAN	CLN	ELN	MLN	COLN
SIZE	-4%	-7%	0%	2%	-2%
TENOR	8%	2%	-	-6%	-
CALL	21%	-9%	-18%	-4%	-3%
IRATING	1%	2%	-9%	0%	3%
ONSBOND	1%	2%	-2%	3%	4%
AGE	-2%	13%	-16%	3%	1%
UFE	0%	7%	-2%	-4%	-4%
MVBV	-8%	-8%	-7%	0%	2%
TA	0%	27%	-5%	3%	2%
CCP	-5%	-11%	-3%	-5%	-6%
TETA	4%	-2%	-7%	4%	8%
LCR	-6%	3%	-3%	-5%	-5%
ENFORCE	-5%	5%	12%	7%	1%
VOL	-1%	-1%	2%	0%	-1%
CPI	1%	-2%	-4%	2%	2%

This table reports the predictive probabilities at a confidence interval of 95 percent for the binary outcome of 1 for unsecured structured note and an outcome of 0 for a traditional bond implied by the logisitic regressions from Table 3.6. The change in probability is calculated from the 5^{th} to the 95^{th} percentile of the independent variables. SIZE is the logarithm of bond size in USD, and TENOR is the bond tenor in years. CALL is a binary dummy variable for callable bonds, IRATING is a dummy variable for Moody's long-term issuer credit rating, ONSBOND is the bond onshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TA is the logarithm of the book value of total assets, CCP is the central counterparty growth of interest rate swaps (used for RAN, ELN, MLN, and COLN) and central counterparty growth of credit default swaps (used for CLN), TETA is the book value of total equity divided by the book value of total assets, LCR is a dummy binary variable for the introduction of the Liquidity Coverage Ratio for each jurisdiction, ENFORCE is the enforceability of the contract, VOL is annual standard deviation of interest rates (RAN), equity (ELN and MLN), commodities (COLN), or credit (CLN), and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix.

The covered bond regressions in Table 3.8 model Equation 3.14. A pseudo R2 of 0.23 for the models results in an adequate fit for the 3,373 onshore and offshore covered bonds issued. Bank age is employed to measure reputation. The dual recourse of covered bonds still relies on the issuer credit rating; however, the secured nature of the bonds and triple A rating of the covered notes makes bank reputation less relevant. Bank age has a significant negative relationship with the likelihood of an offshore covered bond choice over an onshore covered bond, as more reputable banks have more developed and liquid covered bond markets. For all banks in the sample, increased asymmetric information results in a decreased likelihood of an offshore covered bond choice and increased growth opportunities result in increased likelihood of an offshore choice, which has mixed support for Hypothesis 4. For Australian covered issuers, increases in asymmetric information and growth opportunities result in decreased likelihoods of offshore covered bonds, supporting Hypothesis 4. Canadian covered issuers are the opposite, with increased likelihoods of offshore covered bonds. A reason for the difference between Canada and Australia may be because Canadian banks have a lower limit on issuance of 4 percent versus the Australian limit of 8 percent, and Canadian banks receive more benefit in accessing offshore covered investors. Canadian bank issuers can overcome increases in asymmetric information (Myers & Majluf, 1984) and agency problems (Myers, 1977), particularly given the dual recourse and triple A rating.

Bond size and bond tenor are insignificant. Control variable deposits to total assets has a negative relationship with offshore choices, as an increase in predominately onshore stable deposits relies less on offshore issuance. D-SIBs spread across Australia, Canada, United Kingdom, Germany, Finland, and Denmark are more likely to issue offshore covered bonds, and European jurisdictional banks are less likely to issue offshore over onshore covered bonds. This supports Hypothesis 5, with a positive relationship between offshore covered bonds and smaller SIBs.

Table 3.9 presents the predictive probabilities of the models in Table 3.8. For Australia, increases in unexpected future earnings as an asymmetric information proxy display the largest economic impact, with a decreased predicted probability of -52 percent of offshore covered bonds. This has a positive impact on financial stability. The Canadian predictive probability of an offshore covered bond issue increases +22 percent as asymmetric information increases, which has a negative impact on financial stability. Although statistically significant, the economic impact of growth opportunities is small with only plus or -1 percent for Australian and Canadian banks.

Table 3.8: Secured Covered Bonds Log Pseudolikelihood Regressions (from Equation 3.14)

Australia	**Regression 6**	**Canada**	**Regression 7**
Dependent variable	**OFFCB**	**Dependent variable**	**OFFCB**
Independent variables		Independent variables	
SIZE	-0.0490	SIZE	-0.0440
	(0.1487)		(0.1470)
TENOR	0.0099	TENOR	0.0091
	(0.0363)		(0.0365)
AGE	-0.0190***	AGE	-0.0185***
	(0.0050)		(0.0050)
UFE	-1.0089***	UFE	-0.9814***
	(0.2204)		(0.2206)
UFEAU	-85.3534***	UFECA	95.0910***
	(29.3403)		(32.2885)
MVBV	23.3739***	MVBV	21.5134***
	(6.7853)		(6.7689)
MVBVAU	-3.9789***	MVBVCA	4.2177***
	(0.8691)		(1.1157)
DEPTA	-2.6841**	DEPTA	-2.4159
	(1.3589)		(1.4938)
DSIB	1.9280***	DSIB	1.8624**
	(0.7258)		(0.7254)
EU	-4.1053***	EU	-0.8763
	(0.7941)		(0.8323)
VIX	-0.0141	VIX	-0.0144
	(0.0149)		(0.0149)
GDPPC	0.0001**	GDPPC	0.0001**
	(0.0000)		(0.0000)
Constant	-21.1068**	Constant	-22.4160**
	(8.8589)		(8.9635)
Log pseudolikelihood	-1,604.20	Log pseudolikelihood	-1,608.06
Pseudo R2	0.2317	Pseudo R2	0.2303
Observations	3,373	Observations	3,373

This table reports the logistic regressions for secured covered bonds. The dependent variables are binary discrete offshore covered bonds and given a value of 1 and labelled OFFCB. The other outcome is an onshore covered bond and given a value of 0. The independent variables include SIZE, the logarithm of bond size in USD and TENOR, the bond tenor in years. AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, UFEAU or UFECA is an interactive variable calculated as the product of unexpected future earnings and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction. MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, MVBVAU or MVBVCA is an interactive variable calculated as the product of market value to book value variable and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction, DEPTA is the ratio of customer deposits to total assets, DSIB is a binary dummy variable of 1 for domestic systemically important banks, 0 for global systemically important banks, EU is a dummy binary variable for the European bank issuers, 0 for other countries, VIX is the Chicago Board Options Exchange's Volatility Index, and GDPPC is gross domestic product per capita of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p< 0.05, * p<0.1.

Table 3.9: Secured Covered Bond Predictive Probabilities (from Table 3.8)

Australia

Dependent variable	**OFFCB**
Independent variables	
SIZE	-4%
TENOR	3%
AGE	-45%
UFE	-1%
UFEAU	-52%
MVBV	30%
MVBVAU	-1%
DEPTA	-9%
DSIB	21%
EU	-67%
VIX	-8%
GDPPC	34%

Canada

Dependent variable	**OFFCB**
Independent variables	
SIZE	-3%
TENOR	3%
AGE	-44%
UFE	-1%
UFECA	22%
MVBV	27%
MVBVCA	1%
DEPTA	-8%
DSIB	21%
EU	-16%
VIX	-9%
GDPPC	32%

This table reports the predictive probabilities at a confidence interval of 95 percent for the binary outcome of 1 for offshore covered bonds and an outcome of 0 for an onshore covered bond implied by the logistic regressions from Table 3.8. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. The independent variables include SIZE, the logarithm of bond size in USD and TENOR, the bond maturity tenor in years. AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, UFE is unexpected future earnings calculated as bank forward earnings per share for next period less earnings per share for next period divided by current bank market share price, UFEAU and UFECA are interactive variables calculated as the product of unexpected future earnings and a dummy binary variable of 1 for the Australian bank or Canadian bank regions. MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, MVBVAU and MVBVCA are interactive variables calculated as the product of market value to book value variable and a dummy binary variable of 1 for the Australian bank or Canadian bank regions, DEPTA is the ratio of customer deposits to total assets, DSIB is a binary dummy variable of 1 for domestic systemically important banks, 0 for global systemically important banks, EU is a dummy binary variable for the European bank issuers, 0 for other countries, VIX is the Chicago Board Options Exchange's Volatility Index, and GDPPC is gross domestic product per capita of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix.

3.5 ROBUSTNESS CHECKS

To ensure the results from Table 3.6 (Equation 3.12) are stable and reliable, the bank selection for the dependent variable is widened and various independent variables are substituted (see the chapter appendix Table 3.11 for full results). Additional banks[65] are selected where the issuers are active in the specific unsecured structured notes being tested.

[65] RAN: added Royal Bank of Canada and Natwest PLC; CLN: Added HSBC and Svenska Handelsbanken AB; ELN: Added HSBC, Natwest PLC, and Svenska Handelsbanken AB; MLN: Added HSBC and Svenska Handelsbanken AB; CULN: Did not add any additional banks from the original regression.

The dependent variable COLN is replaced with the currency-linked note (CULN) as both notes are similarly structured by banks. The robustness models fit adequately with a mean Pseudo R2 of 0.18, which is comparable to the main results (mean Pseudo R2 of 0.17 in Table 3.6). The size sample increased on average due to additional issuer banks, and replacement independent variables that covered longer periods.

The independent variable issuer bank rating is substituted for return on average equity (ROAE) and is insignificant with all dependent variables and consistent with issuer credit rating. Offshore bond reputation (OFFBOND) replaces onshore bond reputation and the expectation for offshore bond reputation is a lower likelihood of issuing an unsecured structured note; the results are consistent with this expectation. An increase in asymmetric information, measured by future abnormal earnings (FAE) (replacing unexpected future earnings) is consistent with UFE and FAE in Study 1 (Table 2.24). Derivatives central counterparty is replaced by reported dealers (RD) and three of the five unsecured structured notes exhibit a positive relationship, indicating these dealers can accommodate tailored contracts unlike central counterparty clearing. Liquidity regulation through LCR and NSFR is significant, with a negative relationship to unsecured structured notes. A dummy variable per jurisdiction adoption for countercyclical buffers (CCB) as per Table 3.10 in the chapter appendix replaces the ratio of total equity to total assets. To substitute for asset volatility a dummy variable is used for "negative" markets events[66] (EVENTS).

OFFCB robustness checks substitute loan loss provisions as a ratio of net interest revenue (LOANLOSS), a measure of asset quality for reputation proxy bank age. The expectation is that increases in loan loss provisions would decrease the likelihood of offshore covered bond issues. However, the results are insignificant. Offshore covered bond investors may not be overly concerned with loan losses because of the dual recourse of overcollateralisation and

[66] This dummy reflects the GFC (Event One) from the Dow Jones Industrial Index from a high on 29 August 2008 of 11,543.55 to a low of 7,062.93 on 27 February 2009, a reduction of 38.8 percent. Regulation then followed; however, in March 2009 Citigroup and Bank of America both announced they were again profitable. Event Two represents the European Sovereign Debt Crisis from October 2009 to March 2012, focuses on Greece austerity measures and was in recession with GDP per capita declining 7.2 percent between 2010 and 2011. 10-year Republic of Greece bond yields increased from 14.9 percent (price 58.7) to 35.5 percent (price 19.6) over this period. Other European regions including Ireland, Portugal, Spain, and Italy suffered sharp appreciations in yields and price decline. Event Three was the announcement in June 2016 that the United Kingdom would exit the European Union (Brexit) on 31 January 2020 due to a British referendum result. The FTSE 100 Index went from 12,770.50 on 27 May 2016 to 11,579.48 on 4 August 2016 with multiple sharp declines and inclines over this period.

pledge of the bank issuer assets. Future abnormal earnings (FAE) replaces unexpected future earnings as per Study 1. Liquid assets as a ratio to total assets (LIQTA) replaces deposits to total assets to reflect greater stability in liquidity. MOVE and CPI replace VIX and GDPPC, respectively. Bond size and bond tenor are unchanged and insignificant as per the original regressions.

Overall, the results of the robustness checks for unsecured structured notes and secured covered bonds from Tables 3.11–3.14 provide confidence that the original regressions and predicted probabilities in Tables 3.6–3.9 are accurate and appropriate conclusions can be drawn.

3.6 CONCLUSION

Financial innovation can improve the stability of the issuing bank, as exemplified in the cross-currency swap between IBM and the World Bank in the early 1980s. Securitisation and CDSs are other examples of how banks transfer credit risk to improve stability. Unfortunately, improper incentives for originators, brokers, and investment bankers; complex and opaque repacking of risk exposures into off-balance sheet structured debt; circumnavigation of capital requirements; and increased bank leverage were key contributors to the GFC and ensuing financial instability.

On-balance sheet unsecured structured notes and secured covered bonds were used in the lead up to the GFC and continue to be used in the present day. Unsecured structured notes are OTC hybrid securities that by all intents and purposes look like a bond but additionally have one or more imbedded derivatives in the structure linked to the performance of alternative assets. Covered bonds are secured structured notes like mortgage-backed securities except for one major factor, namely that covered bondholders have recourse to the assets of the issuer. Due to the pledge over the issuer's assets and strong credit rating, covered bonds are effectively a funding option for issuers when others are shut and a safe haven for investors in times of market stress. Both types of securities enable SIBs to increase funding diversity by accessing an alternative type of investor to traditional bonds, lowering their cost of funds. This study aims to shed more light on the on-balance sheet structured notes and examine the motivational factors regarding corporate finance theories of agency cost, reputation, and flotation costs hypotheses. This study also expands on the impact of financial stability reform from increased transparency in derivative markets via the Dodd-Frank Act and Basel III Capital and Liquidity.

This study employs a cross-section of unsecured and secured structured notes from active SIB issuers. The models include BIS central counterparty statistics for the Dodd-Frank Act reform, and a LCR dummy variable for Basel III Liquidity reforms. The control variables include book value of total equity to total assets for Basel III Capital, enforceability of contract measure, and volatility to match the underlying asset class of the unsecured note as closely as possible. The findings indicate that agency proxies (including those for reputation, asymmetric information, and investment and growth opportunities) do impact the likelihood of a bank issuing a distinct type of structured note. The agency and flotation cost results vary materially, which confirms these issued securities are complex and non-standard. The Dodd-Frank Act decreased the predictive probabilities of structured notes, with credit-linked notes most impacted. The impact of Basel III Capital and Liquidity reform on other unsecured structured notes is less notable. Although these securities have increased market risk and low liquidity (which may have a negative impact on financial stability) and a reduction in the probability of issuance (which may have a positive impact on financial stability), SIBs issuing these structured notes less suffer more from a lack of funding diversity and increased cost of funds, which overall has a negative impact on financial stability. The second model for covered bonds employs fewer reputation proxies, instead proxying for asymmetric information and investment and growth opportunities for Australia and Canada. The results indicate increases in asymmetric information have a large positive impact on financial stability as Australian banks are less likely to issue offshore. However, there is a smaller negative impact on financial stability for Canadian banks. The economic impacts of increases in investment and growth opportunities on financial stability are negligible for Australian and Canadian banks.

The largest limitation of this study is the inability to determine the underlying assets and payoff parameters for unsecured notes from the data. Whilst the assumption is that many of the notes will be concave in payoff, one cannot be 100 percent certain. This certainly does not render the results worthless. For future studies, a novel approach to use the free text field in the bond static description can distinguish between convex and concave notes, until such time Refinitiv creates a flag field to distinguish the two types of payoffs.

Financial innovation should not be discouraged because without innovation the finance profession could not diversify its funding as effectively and support ESG outcomes. In the spirit of Miller (1986) on-balance sheet structured notes have survived but need to grow due to the benefits to funding diversity and lowering cost of funds. The goal following the GFC was to make the global financial system more resilient and reduce the Too Big to Fail notion for large banks. Whilst this may have been achieved holistically, unfortunately, the likelihood of issuance of unsecured structured notes has reduced, which negatively impacts funding diversity and the cost of funds and is an unintended consequence of sweeping global reform. For unsecured structured notes, regulators could provide banks a clearing exemption to meet margin requirements for non-centrally cleared derivatives, where the risk is hedged in a transparent manner. For covered bonds, regulators could implement initiatives in the local covered bond markets to enhance liquidity and depth to reduce offshore issuance. In Australia, a tax incentive for fixed income securities (equities have dividend imputation) would see a reallocation from investors towards onshore bonds. Superannuation in Australia is $3.4 trillion AUD and 11 percent is allocated to onshore fixed income (ASFA, 2023). Covered bonds[67] would be an ideal alternative to triple A rated Australian treasury bonds with the same credit rating.

[67] There are 52 covered bond issues in Australia, totalling $38.2 billion AUD (up to COVID-19 in 2020). 54 percent comprise Australian-owned ADI.

3.7 APPENDIX

Figure 3.12: Outstanding Notional Amount of Interest Rate Derivatives and Credit Default Swaps. Source: BIS OTC Derivative Outstanding Statistics.

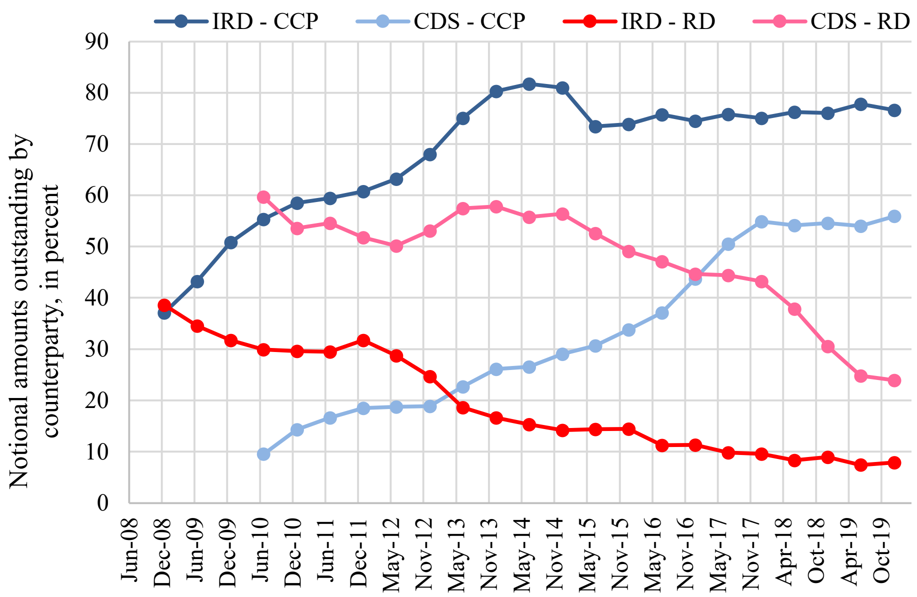


Figure 3.13: World Governance Indicators Enforceability Score. Source: World Bank (2021 Update, 1998 to 2019).

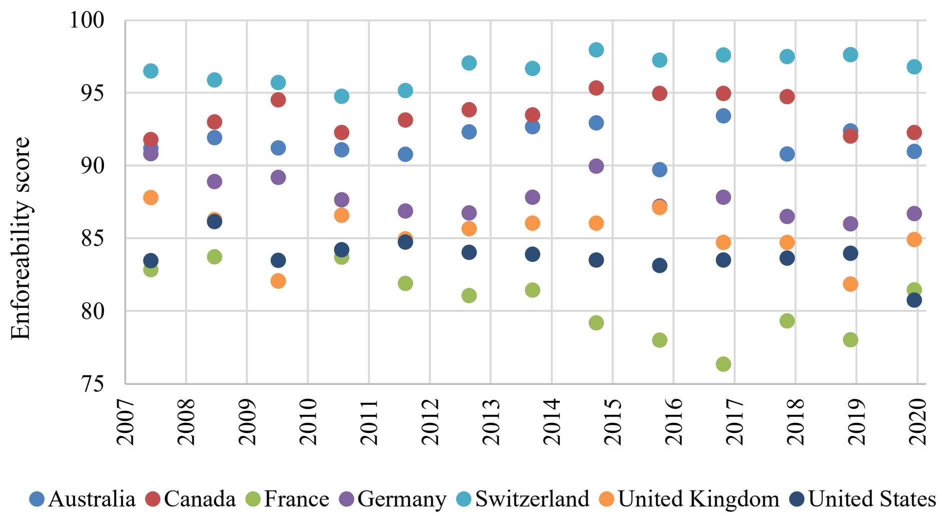


Figure 3.14: Annualised Volatility of Underlying Asset Classes, S&P 500®, US Treasury, Commodity, and Credit Default. Sources: Datastream and Author Elaborations.

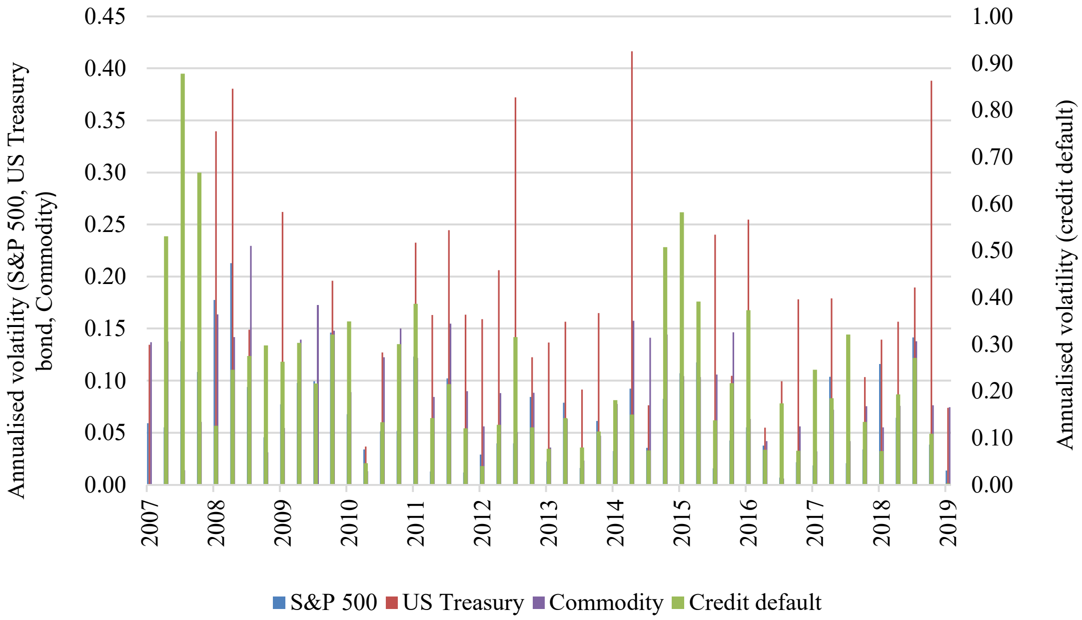
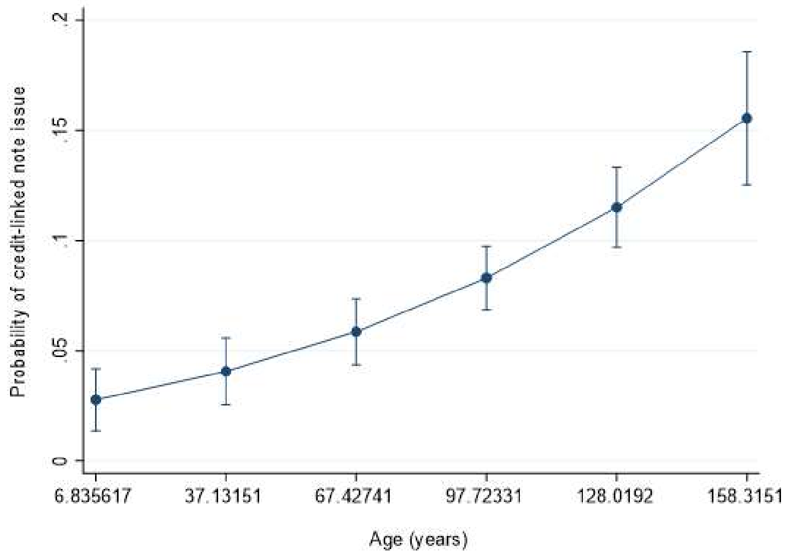
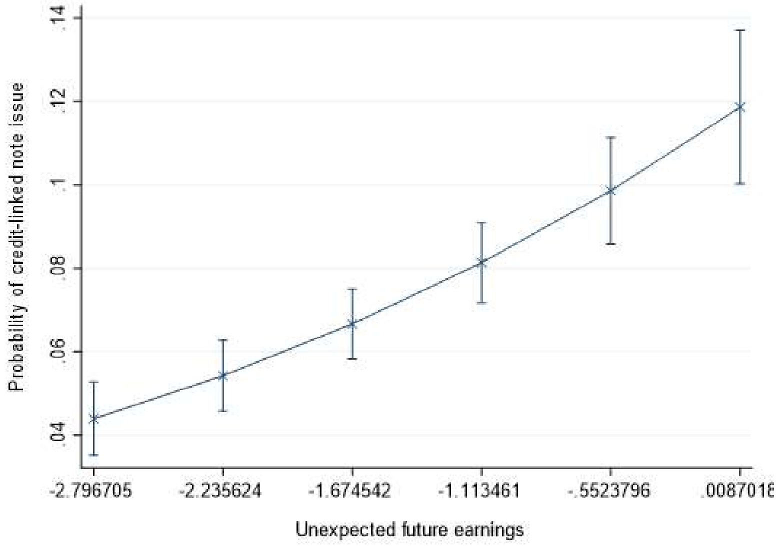


Figure 3.15: Credit-Linked Note Predictive Probabilities – Bank Age (from Table 3.7)



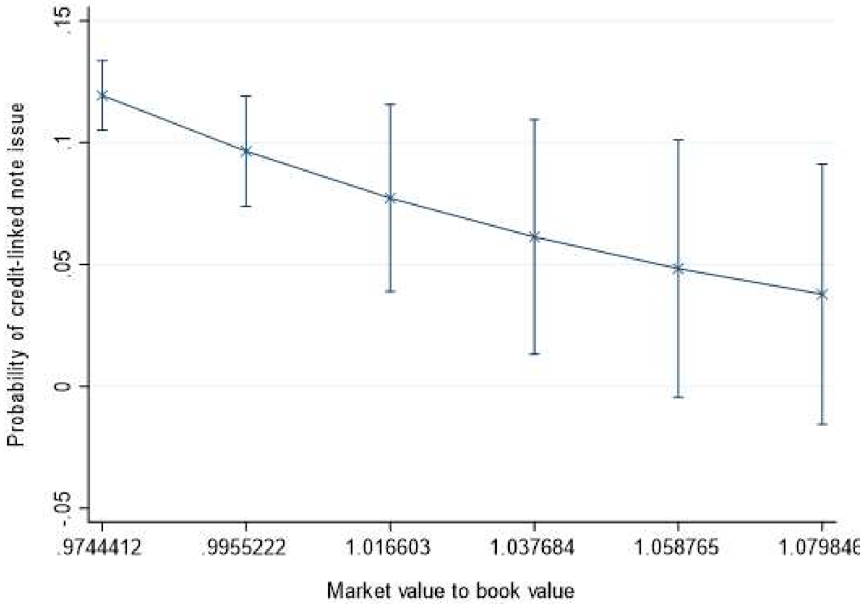
This figure charts the credit-linked note predictive probabilities at a confidence interval of 95 percent for the selection of a credit-liked note over a traditional bond implied by the logistic regression from Table 3.7. The change in probability is calculated from the 5th to the 95th percentile of the independent variable bank age (AGE).

Figure 3.16: Credit-Linked Note Predictive Probabilities – Unexpected Future Earnings (from Table 3.7)



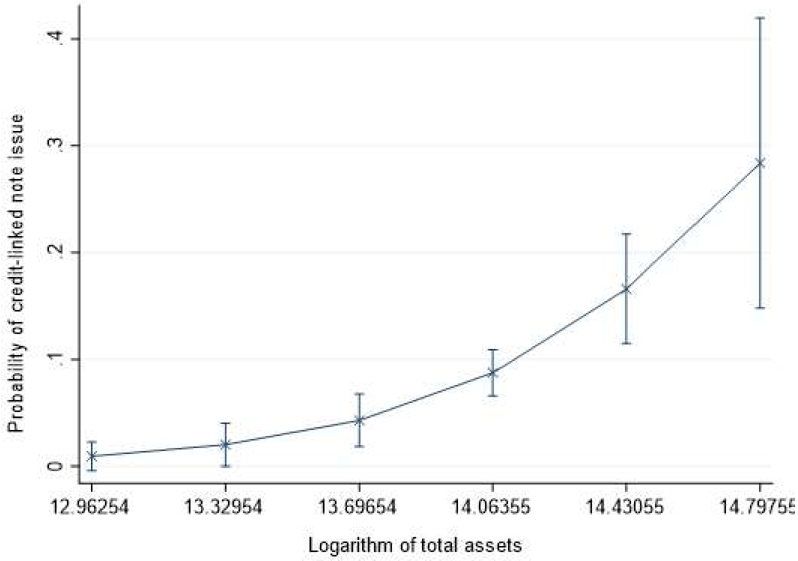
This figure charts the credit-linked note predictive probabilities at a confidence interval of 95 percent for the selection of a credit-liked note over a traditional bond implied by the logistic regression from Table 3.7. The change in probability is calculated from the 5th to the 95th percentile of the independent variable unexpected future earnings (UFE).

Figure 3.17: Credit-Linked Note Predictive Probabilities – Market Value to Book Value (from Table 3.7)



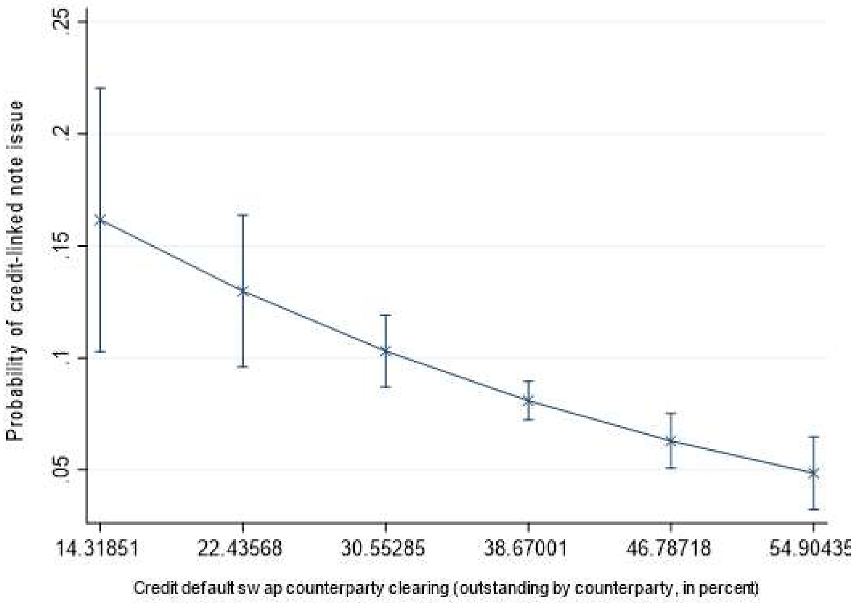
This figure charts the credit-linked note predictive probabilities at a confidence interval of 95 percent for the selection of a credit-liked note over a traditional bond implied by the logistic regression from Table 3.7. The change in probability is calculated from the 5th to the 95th percentile of the independent variable market value to book value (MVBV).

Figure 3.18: Credit-Linked Note Predictive Probabilities – Logarithm of Total Assets (from Table 3.7)



This figure charts the credit-linked note predictive probabilities at a confidence interval of 95 percent for the selection of a credit-liked note over a traditional bond implied by the logistic regression from Table 3.7. The change in probability is calculated from the 5th to the 95th percentile of the independent variable logarithm of total assets (TA).

Figure 3.19: Credit-Linked Note Predictive Probabilities – Credit Default Swap Central Counterparty (from Table 3.7)



This figure charts the credit-linked note predictive probabilities at a confidence interval of 95 percent for the selection of a credit-liked note over a traditional bond implied by the logistic regression from Table 3.7. The change in probability is calculated from the 5th to the 95th percentile of the independent variable credit default swap central counterparty (CCP).

Table 3.10: Extract of Monitoring Reports on Timeliness of the Implementation of the Basel Standards. Source: BCBS.

	Basel Standards	Australia	Canada	European Union*	United States	Switzerland
Capital	Countercyclical capital buffer (CCB)	1 Jan. 2016	31 Jan. 2017	1 Jan. 2016 FRA 1 Feb. 2016	1 Jan. 2019	1 Jul. 2016
Liquidity	Liquidity Coverage Ratio (LCR)	1 Jan. 2015	31 Jan. 2015	6 Feb. 2015 UK 1 Oct. 2015	1 Jan. 2015	1 Jan. 2015
Liquidity	Net Stable Funding Ratio (NSFR)	1 Jan. 2018	1 Jan. 2020 for SIBs.	28 Jun. 2021 UK 1 Jan. 2022	Proposal May 2016. 1 Jan. 2018	1 Jul. 2021

* The European Union covers countries including France, Germany, the Netherlands, and the United Kingdom. Switzerland's timeline is slightly different to the European Union and is thus treated separately. Some countercyclical conservation buffer rates differ for EU member country timelines; however, others do not. Each bond choice reflects the regional adaptation of the requirements.

Table 3.11: Unsecured Structured Note Range Accrual, Credit-Linked, Equity-Linked, Multiple-Linked, and Currency-Linked Log Pseudolikelihood Regressions (Robustness Check)

Regression	**8**	**9**	**10**	**11**	**12**
Dependent variable	**RAN**	**CLN**	**ELN**	**MLN**	**CULN**
Independent variables					
SIZE	-0.3488***	-0.2916***	0.1828**	0.0046	-0.2721*
	(0.1064)	(0.0550)	(0.0732)	(0.0633)	(0.1421)
TENOR	0.0785***	0.0277	-0.1030***		
	(0.0238)	(0.0194)	(0.0268)		
MCGB				4.7405***	
				(0.2765)	
CALL	2.2215***	-1.0768***	-1.5817***	-2.2585***	-2.7815***
	(0.3261)	(0.2065)	(0.2922)	(0.3480)	(0.7882)
ROAE	0.0436***	-0.0218**	0.0345	-0.0025	-0.0042
	(0.0159)	(0.0093)	(0.0238)	(0.0084)	(0.0174)
OFFBOND	4.5448**	-14.1350***	-1.7134	-1.9772	1.1368
	(2.2577)	(4.0399)	(2.7176)	(1.4895)	(2.3597)
AGE	-0.0009	0.0149***	-0.0017	0.0075**	0.0128
	(0.0046)	(0.0044)	(0.0021)	(0.0033)	(0.0102)
FAE	-0.0057	0.1170***	0.0248	0.0911***	-0.1239***
	(0.0230)	(0.0271)	(0.0268)	(0.0189)	(0.0376)
MVBV	-6.9818	-8.7584***	2.6285*	-5.0723***	-6.7039
	(6.8638)	(3.1911)	(1.5344)	(1.8008)	(11.2921)
TE	1.0089*	0.3586	-0.4972	0.8206*	1.7266*
	(0.5799)	(0.4884)	(0.3974)	(0.4400)	(1.0094)
RD	0.0629***	0.0166	0.0151	0.0532***	0.0737**
	(0.0140)	(0.0113)	(0.0143)	(0.0171)	(0.0288)
CCB	0.4988*	0.5047	-0.0275	0.2496	0.6541
	(0.2667)	(0.3643)	(0.2546)	(0.2114)	(0.6129)
LCR	-0.8567***	0.0132			-1.7236
	(0.2873)	(0.3319)			(1.1891)
NSFR			-0.7420***	-0.0704	
			(0.1855)	(0.4234)	
ENFORCE	0.0768***	0.0291	0.0356**	0.0677**	0.0721
	(0.0255)	(0.0344)	(0.0150)	(0.0287)	(0.0785)
EVENTS	-0.2986*	0.3303**	0.5505***	0.3223	0.1492
	(0.1636)	(0.1423)	(0.1301)	(0.2092)	(0.2239)
CPI	-0.2098***	0.0626	-0.0568	0.3130***	0.3607***
	(0.0653)	(0.1493)	(0.0731)	(0.0839)	(0.1309)
Constant	-10.7578	4.5097	-3.8241	-14.7167***	-20.6128
	(12.2222)	(7.5410)	(6.0585)	(5.4984)	(16.3257)
Log pseudolikelihood	-4,632.35	-5,087.31	-4,740.59	-3,006.22	-2,202.48
Pseudo R2	0.2715	0.1169	0.1373	0.1837	0.1896
Observations	18,328	17,474	10,281	16,295	14,833

This table reports the logistic regressions for unsecured structured notes as a robustness check. The dependent variables are binary discrete unsecured structured notes and given a value of 1 and labelled RAN: range accrual note, CLN: credit-linked note, ELN: equity-linked note, MLN: multiple-linked note, and CULN: currency-linked note. The other outcome is traditional bonds and given a value of 0. The coupon types for the RAN and CLN regressions employed fixed rate and floating rates to capture a meaningful comparison to traditional bonds and the other unsecured structured notes. Traditional bonds employed zero-coupon bonds. SIZE is the logarithm of bond size in USD, and TENOR is the bond tenor in years. MCGB is a dummy binary variable for Global Bond market choice, CALL is a binary dummy variable for callable bonds, ROAE is the return on average equity calculated as a bank's net income divided by book value of average total equity, OFFBOND is the bond offshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TE is the logarithm of the book value of total equity, RD is the reported dealer counterparty growth of interest rate swaps (used for RAN, ELN, MLN, and CULN) and reported dealer counterparty growth of credit default swaps (used for CLN), CCB is a binary dummy variable for countercyclical buffer, LCR is a dummy binary variable for the introduction of the Liquidity Coverage Ratio for each jurisdiction, NSFR is a dummy binary variable for the introduction of the Net Stable Funding Ratio for each jurisdiction, ENFORCE is the enforceability of the contract, EVENTS is a dummy variable for exogenous market events including and stemming from the GFC, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3.12: Unsecured Structured Note Predictive Probabilities – from Table 3.11 (Robustness Check)

	RAN	**CLN**	**ELN**	**MLN**	**CULN**
SIZE	-10%	-10%	9%	0%	-3%
TENOR	9%	3%	-28%		
CALL	25%	-7%	-17%	-5%	-4%
MCGB				71%	
ROAE	9%	11%	11%	0%	0%
OFFBOND	8%	-5%	-5%	-2%	1%
AGE	-1%	-4%	-4%	4%	6%
FAE	0%	0%	0%	0%	0%
MVBV	-5%	6%	6%	-3%	-2%
TE	15%	-14%	-14%	9%	19%
RD	18%	8%	8%	11%	12%
CCB	4%	0%	0%	1%	3%
LCR	-6%	-10%	-	-	-5%
NSFR	-	-	-10%	0%	
ENFORCE	12%	11%	11%	7%	6%
EVENTS	-2%	9%	9%	2%	1%
CPI	-3%	-1%	-1%	2%	2%

This table reports the predictive probabilities at a confidence interval of 95 percent for the binary outcome of 1 for unsecured structured notes and an outcome of 0 for a traditional bond implied by the logistic regressions from Table 3.11. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. SIZE is the logarithm of bond size in USD, and TENOR is the bond tenor in years. MCGB is a dummy binary variable for Global Bond market choice, CALL is a binary dummy variable for callable bonds, ROAE is the return on average equity calculated as a bank's net income divided by book value of average total equity, OFFBOND is the bond offshore reputation, AGE is the bank age in years from issue date of the market choice to the incorporation date of the bank issuer, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, TE is the logarithm of the book value of total equity, RD is the reported dealer counterparty growth of interest rate swaps (used for RAN, ELN, MLN, and COLN) and central counterparty growth of credit default swaps (used for CLN), CCB is a binary dummy variable for countercyclical buffer, LCR is a dummy binary variable for the introduction of the Liquidity Coverage Ratio for each jurisdiction, NSFR is a dummy binary variable for the introduction of the Net Stable Funding Ratio for each jurisdiction, ENFORCE is the enforceability of the contract, EVENTS is a dummy variable for exogenous market events including and stemming from the GFC, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix.

Table 3.13: Secured Offshore Covered Bonds, Australian Proxied and Canadian Proxied Log Pseudolikelihood Regressions (Robustness Check)

Australia	**Regression 13**	**Canada**	**Regression 14**
Dependent variable	**OFFCB**	**Dependent variable**	**OFFCB**
Independent variables		Independent variables	
SIZE	0.0051	SIZE	0.0059
	(0.1349)		(0.1350)
TENOR	0.0045	TENOR	0.0045
	(0.0365)		(0.0365)
LOANLOSS	0.0122	LOANLOSS	0.0121
	(0.0090)		(0.0090)
FAE	-0.3253**	FAE	-0.3253**
	(0.1296)		(0.1299)
FAEAU	-23.5742***	FAECA	0.4574
	(8.1409)		(8.1499)
MVBV	13.8834**	MVBV	13.6159**
	(6.0865)		(6.1033)
MVBVAU	-1.9131**	MVBVCA	1.7985**
	(0.8165)		(0.7942)
LIQTA	-0.0310	LIQTA	-0.0305
	(0.0290)		(0.0289)
DSIB	0.1067	DSIB	0.1110
	(0.6195)		(0.6204)
EU	-3.9863***	EU	-2.0665**
	(0.7228)		(0.8701)
MOVE	-0.0081**	MOVE	-0.0080**
	(0.0032)		(0.0032)
CPI	0.7159***	CPI	0.7194***
	(0.1306)		(0.1300)
Constant	-10.1375	Constant	-11.9278
	(8.6447)		(8.7625)
Log pseudolikelihood	-1,546.61	Log pseudolikelihood	-1,548.15
Pseudo R2	0.1820	Pseudo R2	0.1812
Observations	2,951	Observations	2,951

This table reports the logistic regressions for secured covered bonds as a robustness check. The dependent variables are binary discrete offshore covered bonds and given a value of 1 and labelled OFFCB. The other option is an onshore covered bond and given a value of 0. The independent variables include SIZE, the logarithm of bond size in USD and TENOR, the bond tenor in years. LOANLOSS is loan loss provisions as a ratio to net income, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, FAEAU or FAECA is an interactive variable calculated as the product of future abnormal earnings and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction. MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, MVBVAU or MVBVCA is an interactive variable calculated as the product of market value to book value variable and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction, LIQTA is the ratio of liquid assets to total assets, DSIB is a binary dummy variable of 1 for domestic systemically important banks, 0 for global systemically important banks, EU is a dummy binary variable for European bank issuers, 0 for other countries, MOVE is the Merrill Lynch Option Volatility Estimate, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 3.14: Secured Offshore Covered Bond Predictive Probabilities – from Table 3.13 (Robustness Check)

Australia

Dependent variable	**OFFCB**
Independent variables	
SIZE	0%
TENOR	1%
LOANLOSS	8%
FAE	-1%
FAEAU	-19%
MVBV	19%
MVBVAU	-1%
LIQTA	-14%
DSIB	2%
EU	-67%
MOVE	-13%
CPI	18%

Canada

Dependent variable	**OFFCB**
Independent variables	
SIZE	1%
TENOR	1%
LOANLOSS	8%
FAE	-1%
FAECA	0%
MVBV	19%
MVBVCA	1%
LIQTA	-14%
DSIB	2%
EU	-43%
MOVE	-13%
CPI	18%

This table reports the predictive probabilities at a confidence interval of 95 percent as a robustness check for the binary outcome of 1 for offshore covered bonds and an outcome of 0 for an onshore covered bond implied by the logistic regressions from Table 3.13. The change in probability is calculated from the 5th to the 95th percentile of the independent variables. SIZE is the logarithm of bond size in USD, and TENOR is the bond tenor in years. LOANLOSS is loan loss provisions as a ratio to net income, FAE is a bank's earnings per share for next period less bank earnings per share for current period divided by current bank market share price, FAEAU or FAECA is an interactive variable calculated as the product of future abnormal earnings and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction. MVBV is the book value of banks' total assets less book value of total equity plus market value of total equity divided by total assets, MVBVAU or MVBVCA is an interactive variable calculated as the product of market value to book value variable and a dummy binary variable of 1 for the Australian bank or Canadian bank jurisdiction, LIQTA is the ratio of liquid assets to total assets, DSIB is a binary dummy variable of 1 for domestic systemically important banks, 0 for global systemically important banks, EU is a dummy binary variable for European bank issuers, 0 for other countries, MOVE is the Merrill Lynch Option Volatility Estimate, and CPI is the consumer price index of the bank's parent domiciled country. For a more detailed explanation of the variables refer to Table 3.15 in the chapter appendix.

Table 3.15: Study 2 Variable Definitions

Variable	Name	Definition	Source(s)
Dependent			
CLN	Credit-linked note	Dummy indicator equal to 1 for a credit-linked note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
COLN	Commodity-linked note	Dummy indicator equal to 1 for a commodity-linked note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
OFFCB	Offshore covered bond	Dummy indicator equal to 1 for an offshore covered bond, indicator equal to 0 for an onshore covered bond.	Refinitiv, author calculations
CULN	Currency-linked note	Dummy indicator equal to 1 for a currency-linked note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
ELN	Equity-linked note	Dummy indicator equal to 1 for an equity-linked note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
MLN	Multiple-linked note	Dummy indicator equal to 1 for a multiple-linked note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
RAN	Range accrual note	Dummy indicator equal to 1 for a range accrual note, indicator equal to 0 for traditional bond.	Refinitiv, author calculations
Independent			
AGE	Bank age	Issue date of the bond choice less the incorporation date of the bank legal parent entity.	Refinitiv, Fitch, Author calculations
CALL	Callable bond	Binary dummy indicator equal to 1 for callable notes/bonds, otherwise 0.	Refinitiv
CCB	Countercyclical capital buffer	Binary dummy indicator of 1 for the jurisdictional adoption of countercyclical capital buffer, designed to counter procyclicality in the system when cyclical systemic risk is deemed to be elevated, 0 otherwise.	BIS, author calcualtions
CCP	Interest rate swap and credit default swap central counterparty	Growth of interest rate derivatives or credit default swap central clearing, notional amounts outstanding by counterparty, semi-annually in percent.	BIS statistics, author calculations
CPI	Consumer price index	Inflation measured by consumer price index (CPI) is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households, annual growth rate, quarterly.	Organisation for Economic Co-operation and Development (OECD)
DEPTA	Deposits to total assets	Book value of customer deposits divided by book value of total assets, in USD, annually.	Fitch, author calculations
DSIB	Domestic Systemically Important Bank	Binary dummy indicator equal to 1 for banks classified as Domestic Systemically Important Bank, indicator equal to 0 for banks classified as Global Systemically Important Bank.	FSB, local regulators, author calculations
ENFORCE	Enforceability of contract	The average of political stability and absence of violence/terrorism, rule of law, government effectiveness, and regulatory quality from the Worldwide Government Indicators from World Bank for each country, annually.	World Bank, author calculations
EU	European region dummy	Binary dummy indicator equal to 1 for all European region banks, indicator equal to 0 otherwise.	Refinitiv, author calculations
EVENTS	Market events	Binary dummy indicator equal to 1 for significant market events, indicator equal to 0 otherwise.	Author calculations

Variable	Name	Definition	Source(s)
FAE	Future abnormal earnings	(Bank earnings per share for next period less bank earnings per share for current period) divided by current bank market share price, USD, annually.	Fitch, author calculations
FAEAU / FAECA	Future abnormal earning for Australia or Canada	Interactive dummy binary variable of 1 for future abnormal earnings multiplied by region dummy (REG) for Australia or Canada of 1, variable of 0 otherwise.	Fitch, author calculations
GDPPC	Gross domestic product per capita	Gross domestic product per capita on an international comparison programme, in USD.	World Bank
IRATING	Issuer long-term credit rating	Moody's bank parent long-term credit rating discrete choice converted to sequential continuous variable. Aaa equal to 22 / Baa3 equal to 13.	Fitch, author calculations
LCR	Liquidity coverage ratio	Binary interactive dummy indicator of 1 for the jurisdictional adoption of liquidity coverage ratio, defined as banks holding a sufficient reserve of high-quality liquid assets (HQLA) to allow them to survive a period of significant liquidity stress lasting 30 calendar days, 0 otherwise.	BIS, author calculations
LIQTA	Liquid assets to total assets	Banks' liquid assets divided by book value of total assets, in USD, annually.	Fitch
LOANLOSS	Loan loss to net interest revenue	Bank's loan impairment charge divided by net interest income, in USD, annually.	Fitch
MCGB	Market Choice Global Bond	Interactive binary dummy variable of 1 for structured note market choice Global Bond, indicator of 0 otherwise.	Refinitiv, author calculations
MOVE	Merrill Lynch Option Volatility Estimate	Merrill Lynch Option Volatility Estimate, end of month.	Datastream
MVBV	Market value to book value	(Book value of banks' total assets less book value of total equity plus market value of total equity) divided by book value of total assets, in USD, annually.	Fitch, Datastream
MVBVAU / MVBVCA	Market value to book value for Australia or Canada	Interactive dummy binary variable of 1 for market value to book value multiplied by region dummy (REG) for Australia or Canada of 1, variable of 0 otherwise.	Fitch, Datastream
NSFR	Net stable funding ratio	Binary interactive dummy variable of 1 for the jurisdictional adoption of the net stable funding ratio, defined as the proportion of long-term assets funded by stable funding, 0 otherwise.	BIS, author calculations
OFFBOND	Offshore bond reputation	The outstanding offshore bonds each month by bank and bond seniority in USD millions are divided by Fitch's Total Liabilities excluding Preference Shares & Debt Hybrid Capital, monthly, with one lag period.	Refinitiv, Stata, author calculations
ONSBOND	Onshore bond reputation	The outstanding onshore bonds each month by bank and bond seniority in USD millions are divided by Fitch's Total Liabilities excluding Preference Shares & Debt Hybrid Capital, monthly, with one lag period.	Refinitiv, Stata, author calculations
RD	Interest rate swap and credit default swap reported dealers	Growth of interest rate derivatives and credit default swap reported dealers, notional amounts outstanding by counterparty, semi-annually in percent.	BIS statistics, author calculations
ROAE	Return on average equity	Banks' net income divided by book value of average total equity in USD, annually.	Fitch
SIZE	Logarithm of bond size	Logarithm of bond size, in USD.	Refinitiv

Variable	Name	Definition	Source(s)
TA	Logarithm of total assets	Logarithm of book value of bank total assets, in USD, annually.	Fitch, Stata
TE	Logarithm of total equity	Logarithm of book value of bank total equity, in USD, annually.	Fitch, Stata
TENOR	Bond maturity tenor	(Maturity date less issue date) divided by 365, in years.	Refinitiv, author calculations
TETA	Total equity to total assets	Book value of total equity divided by book value of total assets, in USD, annually.	Fitch, Stata
UFE	Unexpected future earnings	(Bank forward earnings per share for next period less earnings per share for next period) divided by current bank market share price, in USD, annually.	Fitch, Datastream, author calculations
UFEAU / UFECA	Unexpected future earnings for Australia or Canada	Interactive dummy binary indicator of 1 for unexpected future earnings multiplied by dummy for Australia or Canada of 1, indicator of 0 otherwise.	Fitch,
VIX	Chicago Board Options Exchange's Volatility Index	Chicago Board Options Exchange's Volatility Index, daily.	Datastream
VOL	Market and asset volatility	Annual standard deviation of interest rates, foreign exchange, equity, commodities, or credit.	Refinitiv, author calculations

Chapter 4: Market Discipline of Bond Issuance: An Australian Banking Experience (Study 3)

4.1 INTRODUCTION

Security holders and regulators monitor banks through market discipline to ensure these banks do not take disproportionate risk in their business. Failure to exercise appropriate market discipline can result in banks being classified as Too Big to Fail in times of market crises, which is harmful to financial stability. Empirical studies on bond spreads (Avery et al., 1988; Flannery & Sorescu, 1996; Krishnan et al., 2005; Morgan & Stiroh, 2001; Sironi, 2013) test the relationship of subordinated notes and debenture spreads to bank risk characteristics, finding weak market discipline for firms. Acharya et al. (2013) and Balasubramnian and Cyree (2014) test the implementation of Dodd-Frank Act reforms, with Acharya et al. (2013) finding support for market discipline and Balasubramnian and Cyree (2014) failing to find support for market discipline. These studies focus primarily on the United States market. In their study of the Australian market, Cummings and Guo (2020) assess the Major Banks compared to other Australian-owned banks. By examining unsecured issue spreads, they reveal that the implicit subsidy enjoyed by the Major Banks reduced after the introduction of Basel III Capital reforms, indicating that the borrowing cost advantage of the D-SIB Major Banks decreased.

This study focuses on the subsidy funding cost advantage in the primary bond markets of the domestic systemically important banks (D-SIB) Major Banks, similar to Cummings and Guo (2020). The present study differs from Cummings and Guo (2020) in several respects. Firstly, the selection of Foreign Banks in lieu of Australian-owned banks targets an alternative competitor than second tier Australian-owned banks. Secondly, the selection of independent interactive dummy variables for Australian bank regulatory conditions (including deposit insurance, competition measures, responsible lending, and enforcement actions) rather than Basel III Capital provides insight into market discipline from bond investors. The aim of the present study is to isolate changes in Australian bank regulatory conditions on the Major Banks and determine if the funding cost advantage, known as the "issue spread subsidy", over Foreign Banks in fact reduces. This would indicate market discipline. The implications of market discipline, or weak market discipline, have a bearing on the concept of Too Big to Fail and financial stability, and more broadly, competition within the Australian banking system. The study will answer Research Question 3: Is there adequate market discipline of the Major Banks in the Australian bond market compared to Foreign Banks, indicating the Major Banks are not Too Big to Fail?

This chapter proceeds as follows. Section 4.2 provides a background on banking conditions in Australia, detailing how periods of deregulation and regulation shape the environment. This section also provides a timeline of Australian banking regulation since the GFC. Section 4.3 provides a literature review of market discipline of bond pricing. Section 4.4 presents the data and methodology, detailing the computation of the dependent variable issue spreads in floating and fixed rate bonds samples, independent variables from bond characteristics, bank conditions, control variables, hypotheses, and descriptive statistics. Section 4.5 presents and discusses the results, Section 4.6 details the robustness checks, and Section 4.7 concludes the chapter. Section 4.8 provides the chapter-specific appendix.

4.2 BACKGROUND ON BANKING CONDITIONS

This section sets the scene for the current banking environment in Australia. Periods of deregulation, financial services inquiries, the GFC, and a financial services Royal Commission have shaped the banking conditions and the position of the Major Banks in the present day.

The 1970s and 1980s witnessed deregulation in the Australian financial system. Ric Battelino, the then Deputy Governor of the RBA, discusses key initiatives that occurred in Australia's deregulation (RBA, 2007). One of these initiatives in 1992, was the reduction of barriers to entry for foreign banks seeking a banking licence in Australia. Overall, all these initiatives improved banking competition and efficiencies with financial markets. The initiatives also complemented the establishment of the 4-pillar policy in 1990 by the then Federal Treasurer, Paul Keating, to ensure the Major Banks could not merge or acquire another Major Bank.

Following the recession in Australia in the early 1990s, the Financial Services "Wallis Inquiry" handed down a report in 1997. This report included 115 recommendations tabled to the Australian parliament (Treasury, 1997). One of the most significant recommendations was the establishment of a new prudential regulator in 1998, now known as APRA. The RBA's responsibilities were focused on monetary policy, and ASIC was established for market conduct and consumer protection. The Council of Financial Regulators, a council with no formal power, but a collaboration of the RBA, APRA, ASIC, and the Australian Treasury, was formed. The RBA, as central bank, is responsible for financial stability and co-manages this responsibility with other members of the Council of Financial Regulators[68]. The Wallis Inquiry report also discussed the merits of deposit insurance in promoting a safe and stable financial system. However, explicit deposit insurance was not recommended as it would have undermined an institution's obligation to exercise due care for its depositors' funds. The report did give merit to deposit insurance schemes, where institutions pay a premium dependent on the risk profile. Deposit insurance had a capped account balance and foreign banks could participate, allowing them to compete more with local banks (Treasury, 1997).

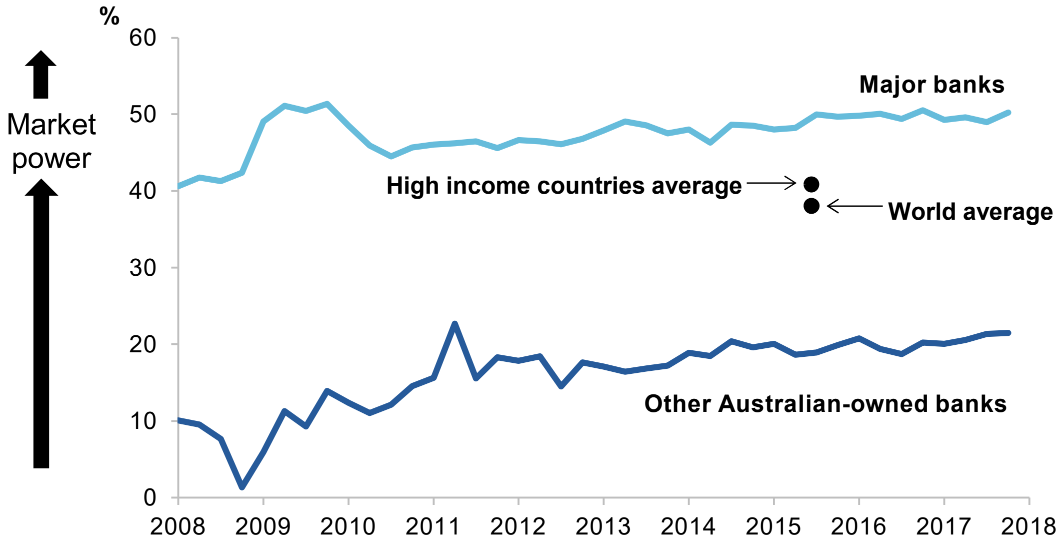
The collective efforts of the Council of Financial Regulators some ten years later would be required to respond to the GFC. In October 2008, a month after the collapse of Lehman, the government introduced temporary retail deposit protection up to $1,000,000[69]. The capped amount was reduced to $250,000 from February 2012 and made permanent. Foreign subsidiary banks, which are separate legal entities incorporated in Australia and independently capitalised in Australia, had their retail deposits insured unlike foreign branch banks. Deposit insurance reduces the likelihood of bank runs. The government also announced it would guarantee new wholesale bond funding triple A for ADIs to ensure banks could refinance maturing debt and fund credit in the Australian banking system (Treasury, 2009). These measures were undertaken to restore stability and confidence in the Australian financial system.

Despite competition initiatives, the Major Banks dominate the Australian banking system by market share, and as at the end of 2019, the Major Banks hold more than 80 percent of the total Authorised Deposit-Taking Institution (ADI) housing loans (APRA, 2022), and aggregated total assets of USD 2.7 trillion (Fitch, 2020). Compared to other developed countries, Australia Major Bank market share ranks second largest to Canada. U-Din et al. (2022) measure market concentration from the Herfindahl-Hirschman Index (HHI)[70], reporting

[68] The Australian Competition and Consumer Commission (ACCC) is not on the Council.
[69] Foreign bank branches had different guarantee rules in Australia. Short-term wholesale liabilities were guaranteed.
[70] The calculation of the HHI $= s_1^2 + s_2^2 + s_3^2 + \dots s_n^2$ where s_i is the market share for each bank. A HHI less than 1,500 can represent a competitive environment; 1,500 to 2,500 represents moderate competition; and greater than 2,500 represents a highly concentrated environment.

a peak index level HHI (reflecting lower competition) of 1,247 from 2003 to 2017 to 1,269 from 2013 to 2015 from a low of 818 in 2003. Coccorese (2014) notes that HHI can be too simplistic and argues that if there exists contestability then markets can still be "quite competitive". An alternative measure of competition is the Lerner Index, which measures the degree of monopolistic power[71]. The Productivity Commission Inquiry Report, released in June 2018, concluded that banking competition in the Australian financial system following the GFC remained constrained. It noted that the Major Banks' market power (charted in Figure 4.1) had allowed the four largest banks to remain profitable to the detriment of small competitors and consumer outcomes. U-Din et al. (2022) confirm this market trend. Using the Boone Indicator[72] as a third measure of competition, U-Din et al. (2022) indicate that from 2003 to 2017, banking competition in Australia was highest in 2005 and that by 2017 the level of the competition had lessened.

Figure 4.1: Lerner Index for Australian Major Banks and Other Australian Owned Banks. Source: Productivity (2018).



[71] A competitive environment is equal to 0, and greater than 0 indicates the presence of market power (Lerner, 1934).

[72] First applied to the banking market (van Leuvensteijn et al., 2011), the Boone Indicator postulates that inefficient firms profit and that market share is reduced as competition improves the efficiency of firms. This addresses the concerns raised by Spierdijk and Zaourasa (2018) that the Lerner Index does not consider economies of scale.

A probable reason for the decrease in competition following the GFC was a significant priority of the Council of Regulators to restore stability and confidence in the system. The relationship between financial stability and competition is a point of discussion in the literature. Keeley (1990) introduced the "competition-fragility" hypothesis, acknowledging that increased competition may induce bank risk-taking behaviour in asset composition, lowering capital levels and reducing bank[73] charter value. This is a plausible explanation for Australian and global banks prior to the GFC. Allen and Gale (2003) discuss the unique negative relationship between bank competition and financial stability. This could help explain the continued dominance of the Major Banks in market share and market power following the GFC. Boyd and De Nicolo (2005) are unconvinced that there is any theoretical link between banking stability and changes in competition levels. U-Din et al. (2022) find that larger banks have lower risk and higher efficiencies. They suggest that regulators provide suitable initiatives, such as supporting financial technology firms. In hindsight, reducing the barriers to entry for fintech banks has had limited success in Australia with the APRA restricted banking licence. Australian fintech banks Volt Bank, Xinja, and 86 400 were all granted these licences in 2018 and 2019; however, Volt and Xinja handed back their ADI licences a few years later citing difficulties and 86 400 was acquired by a Major Bank in 2021.

The Financial Services Inquiry, led by David Murray on the Australian financial system in 2014, contained 44 recommendations in a report tabled with the Government (Treasury, 2014). One recommendation was to build resilience amongst banks, defined as "strengthen the economy by making the financial system resilient" (Treasury, 2014, p. 13). This theme supported work already started by Basel III and APRA, who the year prior had identified the Major Banks as D-SIBs, requiring these institutions to increase the level of capital and the quality of capital to make institutions "unquestionably strong"[74] and "minimise taxpayer support"[75] for Too Big to Fail institutions. The report recommended the adoption of the leverage ratio[76] in line with global peers, and the continued use of the ex post Financial Claims Scheme[77] for deposit protection. Another recommendation was increased average internal ratings-based mortgage risk weights[78] to reduce the difference between standardised-based and

[73] Study of 85 large United States banks from 1970 to 1986.
[74] Recommendation #1.
[75] Recommendation #3.
[76] Recommendation #7.
[77] Recommendation #6.
[78] Recommendation #2.

internal ratings-based models for ADIs. APRA advised ADIs in late 2014 that it would be reinforcing sound lending practices. APRA identified annual investor mortgage credit growth above 10 percent as an indicator of elevated risk. They advised that from the first quarter of 2015 they would be reviewing these types of risk indicator and serviceability policies (APRA, 2014). In July 2015, APRA advised an increase in Australian residential mortgage risk weights to an average of at least 25 percent for internal ratings-based models (APRA, 2015). This impacted the Major Banks and Macquarie Bank[79]. The FSI report recommended more transparency on competition[80] discussions between regulators and to report how this is balanced against other regulator priorities. To level the playing field, a bank levy of 1.50 basis points on a bank's liabilities[81] was introduced in July 2017. The banks impacted were the Major Banks and Macquarie Bank (APH, 2017).

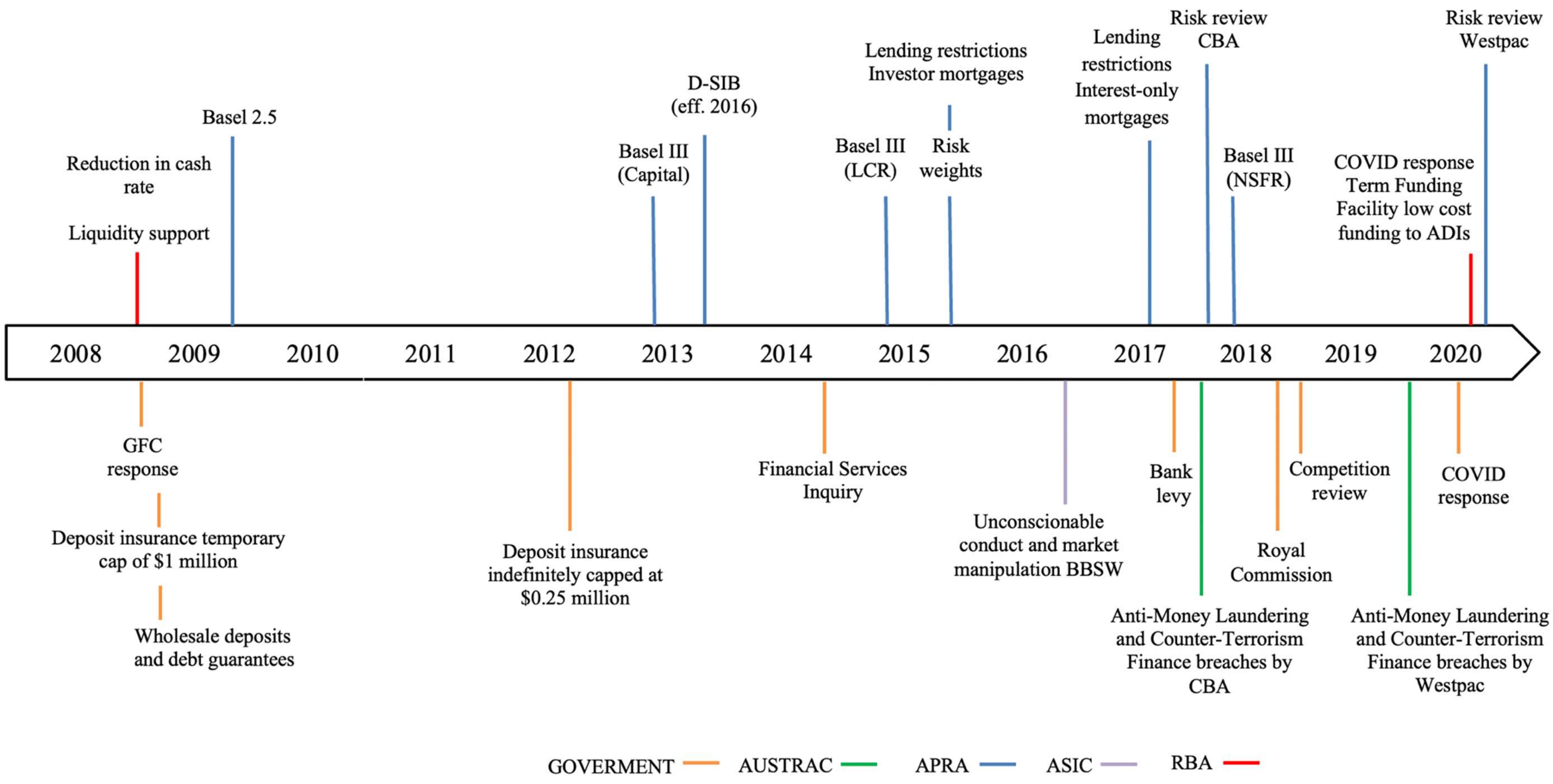
Housing risks in the Australian financial system have been a topic of discussion for many years. Australian banks have the second highest level of residential mortgage loans to total loans, second only to China (CGFS, 2018). In its 2019 Financial Stability Report, the IMF noted Australia's elevated level of household debt to disposable income (relative to other countries). The IMF report also confirmed the BCBS findings on the large exposures the Major Banks have to residential lending. From the first quarter of 2013 to the second quarter 2018, Sydney, Australia's largest city by population, experienced the third highest average annual real house price growth in all advanced economies. It was higher than cities in Canada, Europe, and the United States. In a speech in October 2022, Wayne Byres, the Chair at the time of APRA, outlined that APRA's "interest in housing stems from our job to protect bank depositors" (APRA, 2022, p. 3). Funds are used to lend to households, so APRA has a personal stake to ensure each ADI remains constrained in lending as excessive risk-taking in housing by ADIs could impact depositors, and negatively impact financial stability. It remains a by-product of deposit protection. The IMF report noted that policy action from APRA to restrict mortgage lending had reduced systemic risk to the financial system.

Enforcement from Australian regulators increased after a subdued period prior to the GFC. Major Banks ANZ, Westpac, and NAB had been accused by ASIC of unconscionable

[79] ING Bank effective April 2018 was approved by APRA with advanced accreditation although there was no bond issues from this period onwards in the sample.
[80] Recommendation #30.
[81] Liabilities excluded deposits covered by the Financial Claims Scheme, some of the banks' high-quality prudential capital, and the exchange settlement accounts held with the RBA.

conduct and market manipulation of the bank bill swap rate between 2010 and 2012 and action was brought against them in 2016. In August 2017, AUSTRAC claimed that CBA had not met its legal obligations under the Anti-Money Laundering and Counter-Terrorism Finance Act 2006 (Cth). Shortly after, APRA launched a prudential inquiry into the risk governance of CBA. In December 2017, the Royal Commission into Misconduct in the Banking, Superannuation and Financial Services Industry (hereafter "Royal Commission") was established. Public hearings with senior executives of the impacted financial institutions concluded in November 2018 and a final report with 76 recommendations was tabled in February 2019 (Royal Commission, 2019). The Major Banks suffered substantial reputational damage in the public hearings of 2018 with "Fees for No Service" and poor financial advice for customers resulting in significant remediation. In November 2019 AUSTRAC launched civil proceedings against Westpac Bank for contraventions of the Act. In December 2020, Westpac entered an enforceable undertaking with APRA on risk governance remediation. CBA settled for $700 million AUD, and Westpac settled for $1.3 billion AUD plus legals with AUSTRAC. The remediation costs of the Major Banks are detailed in Figure 4.6 in the chapter appendix. Figure 4.2 below provides a timeline of Australian bank regulation and oversight in the wake of the GFC.

Figure 4.2: Timeline of Australian Bank Regulation and Oversight Following the GFC. Source: Author Elaborations.



4.3 LITERATURE REVIEW

This section provides an overview of the literature on market monitoring and market influence (Section 4.3.1) and market discipline in practice (Section 4.3.2). Section 4.3.3 examines the empirical research to date, revealing a lack of research in the Australian setting regarding market discipline for bond pricing.

4.3.1 Market Monitoring and Market Influence

Market discipline is the process whereby investors' decisions influence the level of risk incurred by a firm's activities. Flannery and Bliss (2018, p. 3) outline that security holders (namely equity or debtholders) are "the market agents involved in disciplining the firm"; furthermore, "the goal of market discipline is to avoid or remediate excessive risk taking by banks and other financial firms". In Australia, the practical application of Pillar 3 of the Basel Accords requires Australian banks to release disclosures covering capital levels and other key risk metrics each quarter[82]. It is therefore believed that this additional disclosure, outside of full and interim financial reports, allows market participants to make an objective decision as to the financial health of each bank and determine the appropriate bond default risk.

Flannery (2001) states that regulatory supervision should be accompanied by market discipline. A deficit in investor and regulatory market discipline could have catastrophic outcomes. This was evident in the failure of prominent institutions during the GFC. Figure 4.3 outlines how market participants and regulators use market discipline to change firm behaviour. Lehman reported on 10 September 2008 a preliminary third quarter loss of $3.93 billion USD. Equity investors sold off the Lehman common equity and the price reduced by 42 percent, and Lehman 5-year CDS widened 135 basis points, leading to a higher cost to buy protection on a Lehman default (Siew, 2008). This represents Market Monitoring in part A Figure 4.3 (Flannery, 2001), and subsequent Indirect influence by regulators as Part G and Market Influence as Part B and Direct influence by investors as Part E for Lehman to announce strategic initiatives to spin off commercial assets and cut its dividend. As new information to regulators became apparent in Part D the United States government invited the largest United States banks and Barclays Bank to broker a private solution to Lehman's woes, concerned with

[82] For example, CBA as at 31 December 2021: capital, leverage ratio, risk weighted assets, credit risk, equity risk, market risk (traded and non-traded), operational risk, and liquidity risk (LCR and NSFR).

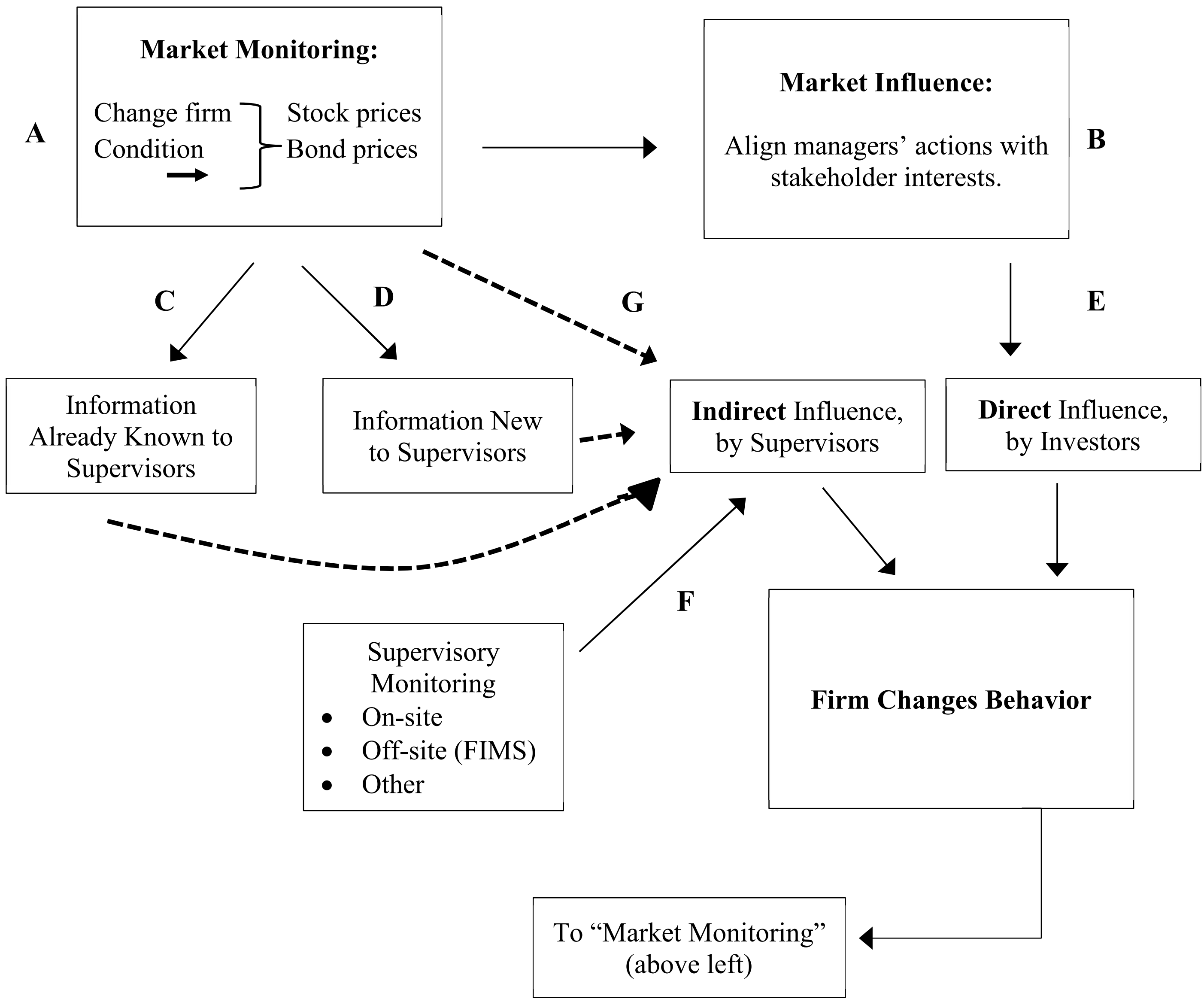
the declining share price. This process was unsuccessful, and Lehman filed for Chapter 11 bankruptcy on 15 September, 2008.

The 2023 events of the United States bank collapses and the Credit Suisse failure[83], although different in causes and outcomes, confirm the scepticism of Flannery (1998) who doubts whether market participants adequately determine bank risk. Flannery (1998) suggests that market participants (namely equity and bond investors and retail depositors) behave rationally and react in a similar fashion to government supervision from a timing perspective.

The events and ultimate collapse of Lehman highlighted the moral hazard of taxpayer funded bailouts. Lehman, the USD 691 billion investment bank, was not bailed out and yet insurer AIG with USD 1,060 billion in total assets was bailed out. In hindsight it is still unclear whether Lehman should have been left to fail given the market turmoil that ensued. The moral hazard of bank bailouts is not a new concept to United States regulators. The Too Big to Fail concept was introduced in 1984 due to the failing United States Continental Illinois Bank, which had suffered loan losses and a subsequent loss of confidence in the bank, resulting in depositor bank runs. Over concerns of financial stability within the national banking system, the Office of the Comptroller of the Currency bailed out Continental Illinois Bank. This action guaranteed depositors and bond holders in the holding company all their invested capital back (Acharya et al., 2013; Flannery, 1998; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Morgan & Stiroh, 2005; Santos, 2014; Sironi, 2003). Later during a Congressional hearing into the matter, it was noted "that the federal government won't currently allow any of the nation's 11 largest banks to fail" (Flannery & Sorescu, 1996, p. 1352). Concerned with Too Big to Fail perceptions, United States regulators implemented the Federal Deposit Insurance Corporation Improvement Act Congress in 1991. The presence of Too Big to Fail institutions indicates weak market discipline. Some years later, a shared objective of the Dodd-Frank Act and Basel III was to end financial institutions being deemed Too Big to Fail.

[83] United States Silicon Valley Bank (SVB), the second largest bank by total assets in United States history, collapsed on 10 March 2023. Credit Suisse had experienced net losses over recent years and suffered withdrawal of client funds and share prices declines. The SVB collapse impacted investor confidence in Credit Suisse as its 5-year CDS widened from +421 basis points on 10 March 2023 to +1,266 basis points by 15 March 2023. The Credit Suisse share price declined 25 percent from 10 March 2023 to 17 March 2023 (Refinitiv, 2023).

Figure 4.3: The Anatomy of Market Discipline. Source: Flannery (2001).



4.3.2 Market Discipline in Practice

The BCBS under Basel II discusses how subordinated debt (SND) can signal a bank's financial condition as the bank is prepared to borrow at an inflated cost of funds. Direct market discipline results from the increased cost of new funding to constrain the risk-taking of a bank, and indirect market discipline, through secondary market prices of outstanding equity and debt, should reflect the financial health of the bank (BCBS, 2003). Empirical studies (Avery et al., 1988; Flannery & Sorescu, 1996; Krishnan et al., 2005; Morgan & Stiroh, 2001; Sironi, 2013) test the market discipline of SND to bank holding companies. Avery et al. (1988) test the relationship of SND from 1983 to 1984 in response to bank financial accounting risk metrics. They find weak market discipline for bank debt risk premiums, which are not aligned to the regulator's valuation of bank risk. Flannery and Sorescu (1996) study the relationship between United States bank SND market prices at month end to the financial information of holding banks. The analysis from data over the period 1983 to 1991 highlights market discipline for bank risk. Although finding market discipline is important, the evidence suggests that market discipline alone cannot price bank risk, and government supervision is also required. The results of Sironi (2003) confirm that SND sample spreads are sensitive to bank risk stand-alone ratings. Combined with a softening in the Too Big to Fail approach in the second half of the 1990s, this is indicative of market discipline from bond investors. Morgan and Stiroh (2001) assess whether bond investors look beyond bond characteristics, for example credit ratings and firm performance, to determine whether there is a relationship between bond spread and firm asset composition. The results identify that market discipline is present, with higher bond spreads identified when banks moved to riskier assets. Morgan and Stiroh (2005) find weak market discipline as bond spreads indicate support for Too Big to Fail banks post regulation. In order to test risk monitoring in firms, Krishnan et al. (2005) study credit spread curves from primary bond trades to understand the relationship with quarterly firm financial information. The results indicate that the level of credit spread reflects bank risk; however, changes in the quarterly spread do not reflect bank risk. Instead, changes are impacted more by "noisy" market variables.

Acharya et al. (2013) find evidence from 1999 to 2011 that bond spreads have a relationship with firm characteristics; however, large firms have weak market discipline and expect government bailouts. The introduction of the Dodd-Frank Act to limit the Too Big to Fail notion did little to alter this situation. Balasubramnian and Cyree (2014) use secondary market transactions for fixed rate bonds in USD from June 2009 to December 2011. The authors find that following the introduction of the Dodd-Frank Act, the discount on Too Big to Fail banks reduced, which is indicative of market discipline. Santos (2014) assesses the Too Big to Fail hypothesis, confirming the United States largest banks are more likely afflicted with the Too Big to Fail concept than the largest non-banks and the largest non-financial corporations. Banks by comparison trade at a larger discount from a sample from 1985 to 2009. Kroszner (2016) summarises research on large versus small bank funding cost differentials across different industries to assess government support for large banks. Kroszner (2016) recommends adjustment for size when comparing to the banking industry regarding the Too Big to Fail dilemma.

4.3.3 Gaps in the Empirical Research

The empirical literature on market discipline focuses on the United States market for subordinated debt and debentures, particularly the period following the failure of United States Continental Illinois Bank and periods following the introduction of the Federal Deposit Insurance Corporation Improvement Act. The impacts of the Too Big to Fail subsidy following the introduction of the Dodd-Frank Act are also the focus of much research. Empirical studies (Balasubramnian & Cyree, 2014; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Sironi, 2003) reveal that the Too Big to Fail subsidy did in fact reduce, meaning less likelihood of government support when banks are in financial trouble. However, other studies do not identify a reduction, indicating weak market discipline (Acharya et al., 2013; Avery et al., 1988; Morgan & Stiroh, 2005). Santos (2014) reveals that larger banks still support the Too Big to Fail mantra. Apart from Cummings and Guo (2020), the Australian market has received little empirical attention with regard to market discipline for bond pricing. Furthermore, to the best of the author's knowledge, there is no existing empirical study of issue spread subsidy between Foreign Banks and Major Banks.

This study addresses the scarcity of literature in Australia by examining the market discipline of large Australian banks to Foreign Banks. Despite Major Banks being labelled as D-SIBs following the Basel III reforms, is the Major Banks' issue spread subsidy to Foreign Banks representative of banks that are Too Big to Fail? The study analyses periods of banking regulatory condition change following the GFC, with the expectation that the issue spread subsidy reduces for the Major Banks, and they are therefore not Too Big to Fail and this does not add to financial instability. The findings also have implications for competition in the Australian banking industry.

4.4 DATA AND METHODOLOGY

4.4.1 Issue Spreads

This study examines primary issue spreads from traditional bonds in the banking sector from the Australian debt capital markets. A cross-section of bank bond data is obtained from an advanced corporate bond search in Refinitiv. The Refinitiv fields as per Table 4.5 from the chapter appendix are used to select the relevant fields. To isolate traditional bonds, bonds with callable, putable, and convertible bonds are excluded as per Table 4.6 from the chapter appendix, and is consistent with Acharya et al. (2013). Bond issue spreads are sourced from primary issue date in line with Morgan and Stiroh (2001), Sironi (2003), Morgan and Stiroh (2005), Santos (2014), and Cummings and Guo (2020). Morgan and Stiroh (2001) and Cummings and Guo (2020) specifically comment that primary issue spreads are preferable because spreads are based on real transactions rather than secondary market spreads. Senior unsecured and unsecured bonds are sourced from the Refinitiv *Seniority* field. Cummings and Guo (2020) use senior unsecured bonds only; however, as unsecured bonds were a more common seniority prior to the GFC, they are included in the study.

As the selection of floating rate notes is in the primary market, only the discount margin is required. This study follows the same approach as Cummings and Guo (2020, p. 8), who define the discount margin as "the difference between the internal rate of return on the bond cash flows and the reference rate". As Cummings and Guo (2020) note, the equation assumes the reference rate (BBSW)[84] does not change from the issue date until maturity date. For information purposes only, Equation 4.1 calculates the discount margin, which for this study is the Issue Spread (IS). Refinitiv, like Bloomberg, provides this value in the *Margin* field from the coupon type known as *Fixed Margin Over Index*. The market convention for floating rate notes is to use the margin field and multiply by 100 to obtain the market accepted issue spread in basis points. The sample of dependent variable data in this study, in contrast to Cummings and Guo (2020), does not include Australian-owned non-D-SIBs. Instead, the study selects Foreign ADI and Foreign non-ADI Banks in addition to the Major Banks. The Foreign non-ADI are more frequent issuers of fixed rate bonds compared to Australian-owned non-D-SIBs.

Equation 4.1

$$IS_{i,t} = (IRR_{i,t} - BBSW_{i,t}) \times 100$$

[84] The bank bill swap rate (BBSW) "is characterised as an interest rate which includes a credit premium representing the market assessment of the premium payable by the Prime Banks, relative to a comparable risk-free interest rate" (ASX, 2023, p. 1).

In Australia, it is common for fixed rate bonds to be expressed in yields. Empirical studies employ a range of techniques to calculate spreads for fixed rate bonds. The approach adopted in this study is to calculate the spread from the bond issue yield less the treasury bond yield (Acharya et al., 2013; Avery et al., 1988; Cummings & Guo, 2020; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Morgan & Stiroh, 2005; Santos, 2014; Sironi, 2013). The same process used to extract a sample of floating rate notes is used to construct the sample of fixed rate bonds (as per Tables 4.4, 4.5, and 4.6 in the chapter appendix) except the Refinitiv *Coupon Type* selected is *Plain Vanilla Fixed Coupon* and *Issuer* includes Foreign non-ADI and excludes Australian owned non-Major Banks. As per Equation 4.2, Issue Spread (IS) is equal to the *Yield* field from Bloomberg (BY) of bank i and time of issue date t less the end of day Australian Treasury yield (TY). The tenor of the bank fixed rate bond is matched to the Australian Treasury bond tenor. The result is multiplied by 100 to convert to basis points.

Equation 4.2

$$IS_{i,t} = (BY_{i,t} - TY_{i,t}) \times 100$$

The use of this technique to calculate issue spread for fixed rate bonds does have a minor limitation. When the primary issue bond yield is paired with the prevailing swap (or treasury) rate[85], this method can be less precise because historical end of day swap rates can vary same day to the setting of the issued bond yields. Despite this, it is not expected this will materially impact the regression results for fixed rate bonds.

4.4.2 Descriptive Statistics

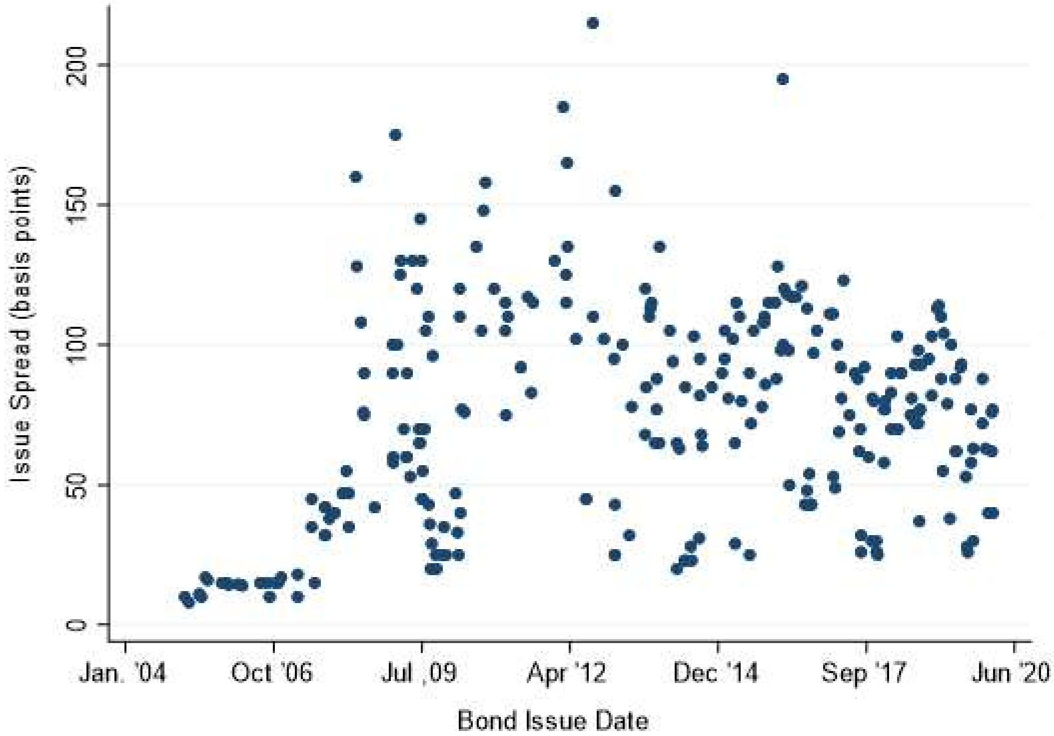
From an original sample of 1,642 fixed and floating rate corporate bond issues from Refinitiv, the sample was reduced to 268 dependent variable issue spreads for traditional floating rate notes. Non-traditional features like perpetual, callable, putable, and green bonds were excluded. Tables 4.5 to 4.7 in the chapter appendix outline the selection parameters.

Australian-owned Major Banks account for 46 percent of the floating rate note issues and Foreign ADI Banks the remaining 54 percent, as per Table 4.10 from the chapter appendix.

[85] The swap rate at time of the bond issue date matches the bond maturity tenor. This caters for any term effects. The daily swap rates are retrieved from Datastream.

Excluding Australia, the Foreign ADI Banks' parent bank is domiciled in 11 countries. Major Banks account for 56 percent of the fixed rate bond issues, and Foreign non-ADI Banks account for the remaining 44 percent (Table 4.11). To limit the risk that the data contain spurious outliers, scatter plots[86] present the floating rate issue spread (Figure 4.4) and the fixed rate issue spread (Figure 4.5) for the samples, and the independent variables are winsorised to the 5th and 95th percentiles. Cummings and Guo (2020) do not use a fixed rate in their main regressions, but do so in the robustness check as a balanced approach. However, the percentages in this study justify the fixed rate bond inclusion. Table 4.1 lists the independent variables for the floating rate note regressions in Table 4.3.

Figure 4.4: Issue Spread for Floating Rate Notes. Source: Stata and Refinitiv.



The chart reports the primary issue spread on issue date for floating rate senior unsecured and unsecured bonds issued by Australian Major Banks and Foreign ADI Banks in the Australian debt capital markets. The sample data period is from 2005 until early 2020 prior to the onset of COVID-19.

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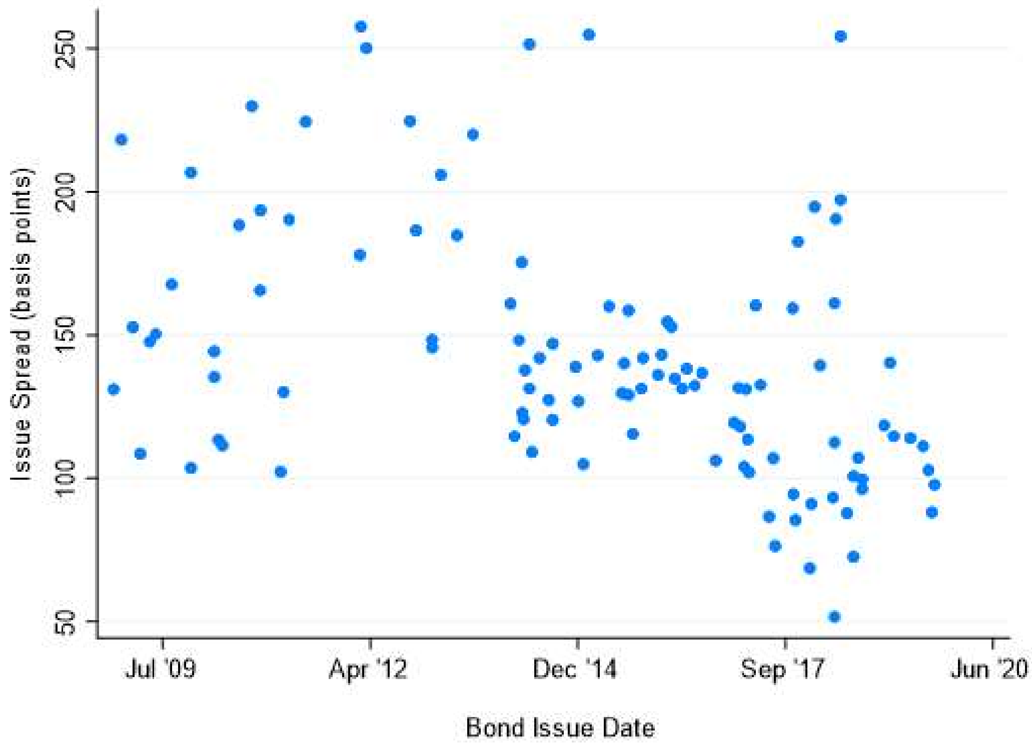
[86] Early analysis of the 990 floating rate notes of the original sample data identified one IS of 9325 basis points, which was clearly a static data error from the mean of 74.5 basis points. More probable is that the margin was 93.25 basis points from a bond credit rating Triple A secured covered bond. A correction of the error had not fed back into Refinitiv data and users override this type of obviously incorrect economic information. These steps ensured that the variables were a true representation of the bond activity, and that violations of the normality of residuals assumption were minimised.

Figure 4.5: Issue Spread for Fixed Rate Bonds. Source: Stata and Refinitiv.



The chart reports the primary issue spread on issue date for fixed rate senior unsecured and unsecured bonds issued by Australian Major Banks and Foreign Banks (non-ADI) in the Australian debt capital markets. The sample data period is from 2008 until early 2020 prior to the onset of COVID-19.

Table 4.1: Study 3 Independent Variable Descriptive Statistics (Floating Rate Regressions)

Variable	N	Mean	Std. Dev.	Min	Max
IS	268	74.48694	38.78975	8.00000	215.00000
BRATING	268	20.00373	1.290989	16.00000	22.00000
TENOR	268	1.121607	0.5631879	0.00000	1.94669
SIZE	268	6.548331	0.8241157	3.23702	7.41645
SENIOR	268	0.8059701	0.3961918	0.00000	1.00000
TERM	268	-45.43112	70.65026	-164.00000	83.20000
DEF3YRA	268	124.7183	48.9165	64.45000	221.02000
GDPPC	268	0.9289892	0.7552586	-0.46384	3.03384

The table reports descriptive statistics for the dependent and independent variables for a sample of 268 floating rate senior unsecured and unsecured notes. The dependent variable IS is a primary issue spread calculated from the Refinitiv fixed margin over the bank bill swap index. SIZE is the logarithm of bond size in Australian dollars, TENOR is the logarithm of bond tenor, BRATING is a dummy variable for Moody's long-term bond credit rating, SENIOR is the binary dummy variable of 1 for Senior notes, TERM is term market spread, DEF3YRA is the 3-year default spread over Australian Commonwealth Government 3-year bond, GDPPC is the gross domestic product for Australia. All variables are in Australian dollars. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix. The independent variables are winsorised at 5 percent and 95 percent levels.

4.4.3 Banking Conditions

Empirical studies measure bank risk using accounting financial characteristics of banks (Acharya et al., 2013; Avery et al., 1988; Cummings & Guo, 2020; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Sironi, 2003). This study adopts the approach of Morgan and Stiroh (2005) and Santos (2014) and does not use accounting financial characteristics to proxy for bank condition risk. Instead, this study uses a unique method to proxy for bank regulatory conditions following the GFC. The variable $CONDITION_{i,t}$ in Equations 4.4 and 4.5 is defined in Equation 4.3 as:

Equation 4.3

$$CONDITION_{i,t} = 1$$

If the issuer i is a Major Bank and one of the bank regulatory conditions is in place in the time period t, based on this logic, there will be six different definitions for $CONDITION_{i,t}$ for different bank regulation periods defined in Table 4.2. The effect of these different regulation changes will be modelled in six different regressions.

Table 4.2: Types of Bank Regulatory Conditions and Description

No.	Variable	Description and period
1.	DEPINS	Introduction of permanent deposit insurance under the Financial Claims Scheme from February 2012.
2.	RISKWEI	APRA adjustment for Major Banks minimum of 25 percent mortgage risk weights from July 2015.
3.	LEVY	Introduction of the bank levy of 1.5 basis points per annum on the Major Banks from July 2017.
4.	LENDINV	Restrictions on investor mortgage lending from July 2015 to June 2018.
5.	LENDIO	Restrictions on interest-only mortgage lending from April 2017 to December 2018.
6.	REPUT	Reputational deterioration from the Royal Commission, APRA, and AUSTRAC inquiries and regulator enforcement from January 2018 to April 2020.

There are Foreign Bank subsidiary banks incorporated and covered by the Financial Claims Scheme, although these bond issues were prior to 2012. In the sample, permanent deposit insurance covers only the Major Banks.

4.4.4 Bond Characteristics and Control Variables

The Moody's long-term bond credit rating (BRATING) is retrieved at the issue date at the bond transaction level from Datastream. A numeric system from 22 to 13 to code Aaa to Baa3 is employed consistent with Acharya et al. (2013). As discussed in Study 1, rating agencies have different methodologies, so for consistency, the Moody's long-term bond issue rating is adopted in this study. Moody's also has the highest historical retrieval of the three credit rating agencies. A material amount of Moody's bond ratings are missing because the bond rating can be withdrawn after the bond maturity. A historical record of the original bond rating is retrieved where it was not withdrawn from Refinitiv through a manual process. Table 4.8 in the chapter appendix outlines bond credit ratings by jurisdiction. Australian Major Banks have the strongest credit ratings with 86 percent Aa1 to Aa3 (S&P equivalent AA+ to AA-) versus Asia 81 percent, Europe 56 percent, and North America 64 percent. Other empirical studies use an average rating between S&P and Moody's (Morgan & Stiroh, 2001; Morgan & Stiroh, 2005), while Flannery and Sorescu (1996) use Moody's weighted average of all outstanding fixed-rate debentures.

The bond characteristic time to maturity in years from issue date is used by Sironi (2003), Morgan and Stiroh (2005), Acharya et al. (2013), and Santos (2014). This study adopts the approach of Cummings and Guo (2020) and employs the logarithm of time to maturity from issue date (TENOR). The logarithm of Australia dollar bond size (SIZE) consistent with Sironi (2003), Santos (2014), and Cummings and Guo (2020) is used as a proxy for the liquidity of the bonds, as per Morgan and Stiroh (2005).

As per Cummings and Guo (2020), the study includes a term market spread (TERM). This is calculated by subtracting the end of month risk-free 10-year Commonwealth Government bond bid yield from the end of month 3-month bank bill swap rate, expressed in basis points. Both yields are accessed from Datastream. The short-term swap rate reflects the credit quality of interbank price makers. Liquidity, market supply, and demand can influence the spread. For the default spread (DEF3YRA), instead of calculating the difference between the yields on S&P/ASX 200 corporate bond index and Australian government bonds (Cummings & Guo, 2020), the Australian end of month non-financial corporate A rated bonds 3-year target tenor spread over the Australian Commonwealth Government bond is employed from Bloomberg (RBA website). It is expressed in basis points from 31 January 2005 until 31 December 2019 (RBA, 2021). The mean of the IS sample is 3.45 years and credit rating numeric score of 20.0 (equivalent Aa2) resulting in the 3-year corporate bond spread selection. A 5-year tenor is used for the fixed rate bonds. To reflect macro-economic conditions in Australia, year-end real GDP per capita (GDPPC) as a percentage of growth, seasonally adjusted on a quarterly basis, is sourced from the Australian Bureau of Statistics. A binary dummy variable (GFC) is added to identify the default environment prior to the Lehman collapse as pre-2009. Overall, the sample data period for floating rate notes is from 2005 to 2020. This period covers prior and post GFC capturing banking condition changes until COVID-19. The fixed rate bond sample period is from 2008 until 2020, and shorter than the floating rate period due to bond yield availability restrictions.

4.4.5 Modelling of Issue Spread

The dependent variable of interest is the continuous variable issue spread (IS) in the primary Australian bond market issued by bank i at time of issue t. Equation 4.4 models a sample of Major Banks and Foreign ADI Banks senior unsecured and unsecured floating rate notes. Equation 4.4 includes independent variables discussed in Sections 4.4.3 and 4.4.4 and tests the relationship to issue spread. Bond characteristics include bond long-term credit rating (BRATING), bond tenor (TENOR), bond size (SIZE), and senior dummy variable (SENIOR). Following Acharya et al. (2013) who model the subsidy for each year, this study uses a similar approach, although the periods reflecting changes in banking conditions with government regulation change. Each *CONDITION* variable is modelled separately: introduction of the permanent deposit insurance under the Financial Claims Scheme (DEPINS); minimum risk weightings for mortgages (RISKWEI); bank levy (LEVY); lending restrictions in investor mortgages (LENDINV) and interest-only mortgages (LENDIO); and a reputation proxy for government and regulatory enforcement (REPUT). The control variables are term market spread (TERM), default spread for 3-year spread over government bond (DEF3YRA), macro-economic conditions (GDPPC), year of bond issue to capture variations specific to bond markets (YEAR), and post Lehman collapse GFC indicator (GFC).

Equation 4.4

$$IS_{i,t} = \delta_0 + \delta_1 BRATING_{i,t} + \delta_2 TENOR_{i,t} + \delta_3 SIZE_{i,t} + \delta_4 SENIOR_{i,t} + \delta_5 CONDITION_{i,t} + \delta_6 TERM_{i,t-1} + \delta_7 DEF3YRA_{i,t-1} + \delta_8 GDPPC_{i,t-1} + \delta_9 YEAR_{i,t} + \delta_{10} GFC_t + \varepsilon_{0i,t}$$

Equation 4.4 tests Hypotheses 1 to 3 for changes in bank regulatory conditions. The six conditions are bundled into three hypotheses. The first hypothesis tests initiatives to improve banking competition, the second hypothesis tests restrictions in investor and interest-only mortgage lending, and the third hypothesis tests reputational damage following the Royal Commission and enforcement actions from regulators. Expectations in all three hypotheses are for a negative relationship between the issue spread subsidy and the bank regulatory condition, and a reduction in the issue spread as each regulatory initiative is implemented.

$\mathbf{H_1}$**:** Initiatives by government regulators to increase local competition reduce the subsidy between Major Bank and Foreign ADI Bank bond issue spreads.

$\mathbf{H_2}$**:** Initiatives by government regulators to target increased risk in mortgage lending reduce the subsidy between Major Bank and Foreign ADI Bank bond issue spreads.

$\mathbf{H_3}$**:** Increases in regulatory enforcement and deteriorations in the reputation of Major Banks reduce the subsidy between Major Bank and Foreign ADI Bank bond issue spreads.

Equation 4.5 is employed for the fixed rate bond sample and models Major Banks and Foreign non-ADI Banks relationship to issuer spread subsidy and *CONDITION* variables. The 5-year default spread (DEF5YRA) substitutes for DEF3YRA as the fixed rate bonds in the sample are a longer bond tenor, and closer to 5 years than 3 years. Equation 4.5 tests two additional hypotheses. Hypothesis 4 expects that Foreign non-ADI Banks will trade at a larger issue spread subsidy than Foreign ADI Banks because the non-ADI banks are not locally regulated. Hypothesis 5 expects that changes in reputational banking conditions have the largest issue spread subsidy compared to competition and lending restriction conditions because Foreign non-ADI Banks do not compete in the local Australian market with the Major Banks.

Equation 4.5

$$IS_{i,t} = \delta_0 + \delta_1 BRATING_{i,t} + \delta_2 TENOR_{i,t} + \delta_3 SIZE_{i,t} + \delta_4 SENIOR_{i,t} + \delta_5 CONDITION_{i,t} + \delta_6 TERM_{i,t-1} + \delta_7 DEF5YRA_{i,t-1} + \delta_8 GDPPC_{i,t-1} + \delta_9 YEAR_{i,t} + \delta_{10} GFC_t + \varepsilon_{0i,t}$$

$\mathbf{H_4}$**:** The subsidy in bond issue spreads for Foreign non-ADI to Foreign ADI Banks is larger because Foreign non-ADI are not locally regulated entities.

$\mathbf{H_5}$**:** The subsidy in bond issue spreads between competition and reputational bank regulatory conditions is smaller for Foreign non-ADI compared to Foreign ADI Banks.

4.5 RESULTS AND DISCUSSION

The first set of results are based on Equation 4.4 and report the floating rate notes for Major Banks and Foreign ADI Banks in Table 4.3. The regressions from Table 4.3 are run separately due to strong positive correlation in the *CONDITION* variables (see Table 4.9 in the chapter appendix). The bond characteristic results are as expected. Issue spread has a significant negative relationship with bond credit rating and is consistent with Santos (2014). Issue spread is significantly positive with the logarithm of bond tenor, consistent with empirical studies (Acharya et al., 2013; Avery et al., 1988; Cummings & Guo, 2020; Morgan & Stiroh, 2001; Morgan & Stiroh, 2005; Santos, 2014; Sironi, 2003). The logarithm of bond size is negative as expected; however, all coefficients are insignificant with issue spread, consistent with Avery et al. (1988), Morgan and Stiroh (2001), Morgan and Stiroh (2005), and Santos (2014). The dummy variable for Senior bonds is positively significant for five of the seven regressions.

The control variables in Equation 4.4, namely term market spread and default spread, are both positively significant at the 1 to 5 percent levels in all regression results, as per Table 4.3, and support Acharya et al. (2013) and Cummings and Guo (2020). The GFC dummy and the GDP per capita, a barometer for macro-economic conditions, are both positively significant at the 1 percent level. The GFC dummy indicates a +42 to +48 basis point premium for the repricing of default risk following the GFC, confirming weak market discipline prior to the GFC. The Year dummy variable is positively significant. The model assumptions for ordinary least squares are tested[87] and the regressions in Table 4.3 (and all other regressions in this chapter) are corrected for heteroscedasticity with robust standard errors clustered at the bank level (Acharya et al., 2013; Cummings & Guo, 2020; Santos, 2014). The regression models fit well with an R2 of 0.77 to 0.78. The *CONDITION* variables are represented by a dummy variable for Major Banks multiplied by a dummy variable for the banking condition period.

The results in Table 4.3 regarding Regression 1 indicate that the introduction of the permanent deposit insurance issue spread subsidy is 11.0 basis points. The announcement in July 2015 by APRA to increase the risk weights for Major Banks to a minimum 25 percent in Regression 2 results in a 11.9 basis point issue spread subsidy, an increase compared to the introduction of deposit insurance, which does not support Hypothesis 1. Comparatively, the bank levy to increase competition introduced two years later narrows the subsidy to 8.7 basis points and supports Hypothesis 1. Intuitively, this makes sense as the bank levy represents a tax of 1.5 basis points per annum on Major Banks, and therefore the levy serves as a competition initiative. The lending restrictions introduced from July 2015 to June 2018 (investor loans) result in an issue spread subsidy of 7.1 basis points, supporting Hypothesis 2 and the presence of market discipline, supporting empirical studies (Balasubramnian & Cyree, 2014; Flannery & Sorescu, 1996; Morgan & Stiroh, 2001; Sironi, 2003). From April 2017 to December 2018 (interest-only loans), the subsidy narrows further to 4.3 basis points, although this result is insignificant. Interestingly, the issue spread subsidy of 8.2 basis points for reputation following APRA, Royal Commission, and AUSTRAC enforcement from 2018 does not support Hypothesis 3 in terms of a further issue spread subsidy reduction. The findings support Avery et al. (1988), Morgan and Stiroh (2005), Acharya et al. (2013), and Santos (2014) who identify weak market discipline and banks impacted by Too Big to Fail.

[87] Linearity of the function form of the model (via a Ramsey RESET); no perfect or strong correlation (a variance inflation factor less than 5 to confirm no multicollinearity); exogenous independent variables that are uncorrelated with the random error; to ensure a normality of distribution (via a Shapiro-Wilk test) trades with a standardised residual greater than ± 2.00 were excluded (these included 11 bonds with 2 low and 9 high IS to the mean IS); homoscedasticity of the residual error terms (Breusch-Pagan/Cook-Weisberg test to identify for heteroscedasticity), the presence of serial correlation (Durbin-Watson test); and a Cook's distance test to ensure no influential observations.

The economic value of the subsidy the Major Banks receive is large. For example, an issue spread subsidy of 8 basis points represents a benefit[88] of $16,166,988 AUD per annum, on average, for each Major Bank. A reduction of 1 basis point reduces the benefit by $2,020,874 AUD per annum, on average, for each Major Bank. It should be noted that this represents a simple example on the liability side of the balance sheet, and does not include the fact that Major Banks can issue in offshore markets, and fund in the deposit and wholesale short-term markets to offset increases in cost of funds.

The results in Table 4.4 from Equation 4.5 test the fixed rate bond issue spread as the dependent variable for Major Banks to Foreign non-ADI Banks. A Foreign non-ADI Bank is not regulated locally by APRA, unlike Foreign ADI Banks, and Foreign non-ADI bonds issued in Australia are known as Kangaroo bonds. The smaller sample size reflects a lower issuance of bank fixed rate securities in the Australian market as the sample issuance started[89] from 2008. Regressions 7 to 10 in Table 4.4 fit adequately (R2 0.71) and are comparable to the results in Table 4.3. Bond characteristics are as expected, including bond size, and are significant at the 1 to 10 percent level. As expected, Foreign non-ADI Banks issue at a wider issue spread subsidy in Table 4.4 than Foreign ADI Banks in Table 4.3, which supports Hypothesis 4. The Foreign non-ADI banking condition bank levy is -15.0 basis points (versus Foreign ADI -8.7 basis points), and reputation is -13.0 basis points (versus Foreign ADI -8.2 basis points). Foreign non-ADI Banks do experience a reduction in issue spread subsidy for the reputation condition compared to the bank levy of 2 basis points (versus Foreign ADI -0.5 basis points) however this is larger than Foreign ADI Banks, and therefore does not support Hypothesis 5. The control variables, term market spread and default premium 5-year benchmark (which is substituted for the 3-year benchmark) and GDP per capita are as expected.

Overall, the results of the *CONDITION* variables indicate that the issue spread subsidy is lowest for restrictions on riskier mortgage investor lending than proxies for increased competition and a proxy for reputation deterioration following government enforcement and fines. One could argue that bond holders did not function as agents to discipline the Major Banks as Flannery and Bliss (2018) suggest. For example, reputation bond investors did not adequately discipline the Major Banks when enforcement action was being taken, as the

88 The Major Banks have combined $80,834,940,771 AUD in onshore outstanding bonds as of 2019 at an average of $20,208,735,193 AUD (Source: Refinitiv and author calculations).
89 Due to availability of bond *Yield* in Bloomberg lab at QUT.

subsidy of -8.2 basis points was not as large as the investor lending restriction of -7.1 basis points. Flannery (2001) indicates that APRA and AUSTRAC use their influence as supervisors although bond investors have not necessarily done this through bond pricing.

A possibility for weak market discipline regarding the deterioration in Major Bank reputation is the expectation that the Major Banks have a material competitive advantage over Foreign Banks in the Australian market. While Major Banks increased provisions to cater for fines and regulatory costs (Figure 4.6 in chapter appendix) to resolve enforcement and breaches of law imposed by the regulators, bond investors believe these financial losses can be absorbed and offset. Major Banks can achieve this by charging mortgage customers more, paying deposit customers less, and/or increasing fees on banking products due to its market share and market power. This line of thinking is interesting, because opting not to pass on variable rate changes on mortgages to customers when the central bank cuts the official cash rate or delaying passing on the cuts can have negative social welfare outcomes, and further reputation issues. Cummings and Guo (2020) note that Australia was an early adopter of Basel III capital requirements, which should place downward pressure on the issue spread subsidy, this may be impacting the results however it is not clear in the results. This may confirm Flannery (1998) who believes market participants cannot understand bank risk as evidenced by misconduct through the Royal Commission findings, APRA, and AUSTRAC enforcement actions.

Table 4.3: Issuer Spread Floating Rate Regressions (Equation 4.4) – Major Banks and Foreign ADI Banks

	1	**2**	**3**	**4**	**5**	**6**
Dependent variable	IS	IS	IS	IS	IS	IS
CONDITION variables	**DEPINS**	**RISKWEI**	**LEVY**	**LENDINV**	**LENDIO**	**REPUT**
Independent variables						
BRATING	-8.5412***	-8.5712***	-8.5896***	-8.3772***	-8.4367***	-8.4738***
	(2.0188)	(2.0661)	(2.1048)	(2.1102)	(2.1384)	(2.1021)
TENOR	38.2824***	38.6876***	38.4516***	38.3437***	38.2377***	38.5770***
	(3.4129)	(3.3985)	(3.3991)	(3.5742)	(3.5159)	(3.3092)
SIZE	-0.7520	-0.8379	-2.0893	-2.3096	-2.8315	-2.3649
	(2.8142)	(2.8316)	(2.5305)	(2.4454)	(2.3737)	(2.4182)
SENIOR	9.3538	9.6264	10.2314*	10.3690*	10.6522*	10.2807*
	(5.5304)	(5.7819)	(5.5526)	(5.7376)	(5.6300)	(5.5561)
CONDITION	**-11.0334*** **	**-11.9437*** **	**-8.6602*** **	**-7.1229*** **	**-4.3409**	**-8.1855*** **
	(3.3126)	**(3.1951)**	**(2.4788)**	**(2.2036)**	**(2.5842)**	**(2.3620)**
TERM	0.0929***	0.0836**	0.0866**	0.0834**	0.0845**	0.0903***
	(0.0323)	(0.0330)	(0.0321)	(0.0338)	(0.0340)	(0.0315)
DEF3YRA	0.5223***	0.5295***	0.5099***	0.5230***	0.5125***	0.5108***
	(0.0359)	(0.0389)	(0.0382)	(0.0387)	(0.0391)	(0.0386)
GDPPC	7.9429***	7.1131***	6.1278***	7.3114***	6.8044***	6.1571***
	(1.8417)	(1.7954)	(1.8167)	(1.8572)	(1.8890)	(1.8438)
YEAR	1.6170**	1.9486**	1.4862**	1.3541**	1.1819*	1.4133*
	(0.6201)	(0.7654)	(0.7072)	(0.6057)	(0.6156)	(0.6988)
GFC	47.6013***	42.3730***	43.9693***	45.3914***	45.7697***	44.7833***
	(7.8981)	(9.1840)	(9.1521)	(8.5021)	(8.6643)	(8.9407)
Constant	70.6026*	69.2329	85.2214*	80.2563*	88.2117*	84.7181*
	(40.9464)	(42.3362)	(42.7649)	(43.2786)	(43.6176)	(43.1843)
Observations	268	268	268	268	268	268
R-squared	0.7818	0.7805	0.7750	0.7746	0.7721	0.7743

This table reports the ordinary least squares regressions for senior unsecured and unsecured floating rate notes issued by Australian Major Banks and Foreign ADI Banks. The dependent variable (IS) is a primary issue spread calculated from the Refinitiv fixed margin over the bank bill swap index. SIZE is the logarithm of bond size in Australian dollars, TENOR is the logarithm of bond tenor, BRATING is a dummy variable for Moody's long-term bond credit rating, SENIOR is the binary dummy variable of 1 for Senior notes, CONDITION is a value of 1 for Major Banks (MAJOR) bond issue subsidy spread in one of six condition periods (CONDITION PERIOD): 1) the introduction of permanent deposit insurance under the Financial Claims Scheme from February 2012 (DEPINS); 2) APRA adjustment for Major Banks minimum of 25 percent mortgage risk weights (RISKWEI); 3) bank levy (LEVY) is the introduction of a 1.5 basis point fee per annum on the Major Banks from July 2017; 4) restrictions on investor mortgage lending (LENDINV) from July 2015 to June 2018; 5) interest-only mortgage lending (LENDIO) from April 2017 to December 2018; and 6) reputational deterioration (REPUT) from January 2018 to April 2020. TERM is term market spread, DEF3YRA is the 3-year default spread over Australian Commonwealth Government 3-Year bond, GDPPC is the gross domestic product for Australia, YEAR is a dummy variable corresponding to the year of the bond issue spread, and GFC is a dummy binary variable for the period following January 2009 (the end of the GFC). All variables are in Australian dollars. Table 4.9 in the chapter appendix displays the correlation matrix for the independent variables in these regressions. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4.4: Issuer Spread Fixed Rate Regressions (Equation 4.5) – Major Banks and Foreign Non-ADI Banks

	7	**8**	**9**	**10**
Dependent variables	IS	IS	IS	IS
CONDITION variables	**LEVY**	**LENDINV**	**LENDIO**	**REPUT**
Independent variables				
BRATING	-14.9808***	-15.3317***	-14.9818***	-15.1968***
	(2.4331)	(2.5496)	(2.4308)	(2.4567)
TENOR	38.7851***	42.3593***	39.0147***	40.5843***
	(8.2873)	(9.0233)	(9.3361)	(8.8001)
SIZE	9.0526*	7.7437*	7.9964*	9.3642**
	(4.5226)	(4.4170)	(4.2543)	(4.4321)
SENIOR	12.4809**	13.5653**	13.0408**	12.1053*
	(5.9195)	(6.3913)	(5.9175)	(5.9146)
CONDITION	**-14.9896*** **	**-3.7630**	**-17.0286*** **	**-13.0294*** **
	(5.2243)	**(3.7441)**	**(4.9757)**	**(4.4513)**
TERM	0.1611***	0.1542***	0.1426***	0.1680***
	(0.0418)	(0.0433)	(0.0422)	(0.0428)
DEF5YRA	0.3672***	0.3946***	0.3655***	0.3771***
	(0.0824)	(0.0866)	(0.0858)	(0.0841)
GDPPC	12.3671***	13.2722***	13.8438***	12.9707***
	(4.3160)	(4.3315)	(4.4336)	(4.0326)
YEAR	-5.8816***	-6.6857***	-6.2547***	-6.1609***
	(1.4632)	(1.3841)	(1.3090)	(1.4132)
GFC	-10.3382	-9.7242	-12.1226	-9.5166
	(8.3835)	(8.2877)	(8.2881)	(8.4485)
Constant	359.9790***	373.6239***	370.6179***	361.2036***
	(69.3083)	(67.9049)	(66.6228)	(68.9308)
Observations	109	109	109	109
R-squared	0.7169	0.7079	0.7196	0.7131

This table reports the ordinary least squares regressions for senior unsecured and unsecured fixed rate bonds issued by Australian Major Banks and Foreign non-ADI Banks. The dependent variable (IS) is a primary issue spread calculated from the Refinitiv yield of the bond on issue date (from Bloomberg) less the end of day Australian Commonwealth Government bond yield in percent on the issue date using the same maturity tenors, as per Equation 4.1. SIZE is the logarithm of bond size in Australian dollars, TENOR is the logarithm of bond tenor, BRATING is a dummy variable for Moody's long-term bond credit rating, SENIOR is the binary dummy variable of 1 for Senior notes, CONDITION is a value of 1 for Major Banks (MAJOR) bond issue subsidy spread in one of four condition periods (CONDITION PERIOD): 1) bank levy (LEVY) is the introduction of a 1.5 basis point fee per annum on the Major Banks from July 2017; 2) restrictions on investor mortgage lending (LENDINV) from July 2015 to June 2018; 3) interest-only mortgage lending (LENDIO) from April 2017 to December 2018; and 4) reputational deterioration (REPUT) from January 2018 to April 2020. TERM is term market spread, DEF5YRA is the 5-year default spread over Australian Commonwealth Government 5-year bond, GDPPC is the gross domestic product for Australia, YEAR is a dummy variable corresponding to the year of the bond issue spread, and GFC is a dummy binary variable for the period following January 2009 (the end of the GFC). All variables are in Australian dollars. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix. Robust standard errors are clustered at the bank level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

4.6 ROBUSTNESS CHECKS

Two robustness checks are performed for the floating rate (Table 4.3) and fixed rate (Table 4.4) regressions. The robustness results for the floating rate notes are displayed in Table 4.12, based on Equation 4.4. The logarithm of bond size is replaced by a dummy variable for a benchmark issue equal to 1 for $500 million AUD and greater (BMARK). This reflects a market standard for large benchmark issues. The benchmark variable is insignificant as per the original regressions for bond size in Table 4.3. The most frequent Foreign ADI Bank issuers in the floating rate sample are European banks (67 of the 268 observations). To ensure offshore bank conditions are considered, a dummy variable for the Euro Sovereign Debt Crisis of 2010 to 2012 (EURO) is added. The results indicate a positive relationship (as expected) as bond investors charge a +14.8 to +18.8 basis points premium for European Foreign Banks during this period, although this result is not statistically significant. The default premium spread over the Australian Commonwealth Government curve is replaced by the corporate spread over the swap rate (DEF3YRS). This exhibits a positive relationship with IS at the 1 percent level and is consistent with the previous model. This shows that the results are not sensitive to the risk free asset. Senior bond proxy variable is excluded and the model fit R2 ranges from 0.73 to 0.74, indicating a good fit, similar to the original regressions in Table 4.3. The banking condition variables tested are directionally consistent and all significant.

The second robustness test in Table 4.13 uses data for fixed rate bonds for Major Banks and Foreign non-ADI Banks. Like the floating rate robustness check, the swap rate corporate spread for 5-year bonds (DEF5YRS) replaces the 5-year Australian Commonwealth Government spread, and the direction and significance are as expected. The senior bond proxy and the term spread are excluded from the original regressions. The Goldman Sachs Australian financial conditions index (FCI) sourced from Bloomberg is substituted for GDP per capita, year dummies, and the GFC dummy from Equation 4.5. The FCI is positive and significant, as is the GDP per capita. Index[90] levels above one hundred imply accommodative financial conditions, and levels below one hundred imply tighter financial conditions. Investor lending and reputation both exhibit negative relationships with IS, although they are not significant. Directions and significance are otherwise as expected. Overall, the robustness checks provide

[90] Figure 4.8 in the chapter appendix charts the FCI. The Australian index, whilst capturing Australian conditions, also incorporates the interconnected global markets. The chart reflects economic cycles including the bust from the Dot-Com bubble and appreciation until the GFC of 2007-2008 and issues from the Euro Sovereign Debt Crisis.

confidence that the original regressions in Tables 4.3 and 4.4 are accurate and appropriate inferences can be made.

4.7 CONCLUSION

Market discipline from investors, coupled with supervision, is important to ensure institutions are profitable and have appropriate risk management practices. Poor market discipline from bond investors in pricing default risk and regulators too lax to use enforcement powers can result in banks being Too Big to Fail, and this is referred to as weak market discipline. This outcome has negative impacts on financial stability.

The Major Banks dominate the Australian banking system in market share and market power, and this increased following the GFC. This was confirmed by competition measures utilising the HHI, Lerner Index, and Boone Indicator in the Australian Productivity Commission report from 2018. Non-Major Banks and Foreign Banks compete with the Major Banks in the Australian market, and all these banks rely on bond funding in the Australian marketplace to finance asset portfolios. The Major Banks experience an issue spread subsidy compared to Foreign Banks for bonds issued in Australia. The aim of the study is to determine whether the subsidy the Major Banks receive over Foreign Banks decreased as banking conditions and regulation targeted at the Major Banks took effect following the GFC.

The study contributes to the literature in several ways. Firstly, empirical studies on market discipline focus on the United States and overlook Australia, with the exception of Cummings and Guo (2020). Secondly, the selection of the Major Banks and a comparison to Foreign ADI and non-ADI Banks expands on Cummings and Guo (2020), who compare Major Banks as D-SIBs and other Australian-owned banks as non-D-SIBs. These two contributions advance our understanding of the primary issuance of the Australian bond market in an international context. Thirdly, rather than look at how the subsidy in issue spread for Major Banks was impacted by the implementation of Basel III capital rules (Cummings & Guo, 2020), or use financial characteristics to determine bank risk (Avery et al., 1988; Flannery & Sorescu, 1996; Krishnan et al., 2005; Morgan & Stiroh, 2001; Sironi, 2013), this study uses novel interactive dummies to represent periods of banking regulatory condition change. The banking conditions incorporate important developments in the Australian banking landscape: the safeguard of bank depositors with the introduction of a permanent deposit insurance; increased competition through a rise in the minimum mortgage risk weights and the introduction of the bank levy; responsible lending intervention to alleviate risks in housing; the financial services Royal Commission; and enforcement from regulators for poor bank customer outcomes and inadequate risk practices.

The findings indicate restrictions placed by APRA on bank investor mortgage lending from mid-2015 until mid-2018 narrowed the issue spread subsidy for Major Banks compared to Foreign ADI Banks, reported as -7.1 basis points. This suggests the initiatives to increase competition, including the bank levy (-8.7 basis points), change in minimum risk weights for mortgages (-11.9 basis points), and reputational damage and remediation costs from 2018 (-8.2 basis points) were not as effective in reducing the issue spread subsidy. Although some of the regulatory initiatives are more permanent in nature and quantifiable, investors believe these can be overcome by the Major Banks through their sheer market size and market power because they are Too Big to Fail. Conversely, the Major Banks to Foreign non-ADI issue spread subsidy is narrowest during the period when Major Banks suffered reputational damage and remediation costs. This is because the market share and power of Major Banks does not impact Foreign non-ADIs because they do not compete in traditional banking products with the Major Banks in Australia.

It would appear government and regulator attempts to increase competition and address poor customer outcomes through bank remediation have not levelled the playing field, at least in terms of bond market discipline. The government could increase the bank levy cost for Major Banks and/or further increase the minimum risk weighting for mortgages for Major Banks to a point where costs could not adequately be passed on without impacting Major Banks' mortgage or deposit market share. This could decrease the Major Banks' market power and make the Australian banking system more competitive. For bond funders like the Foreign Banks, and in turn other Australian-owned ADIs, this could reduce the issue spread premium they pay relative to Major Banks.

There are, of course, limitations to the research. The study has attempted to capture all pertinent variables in the models; however, as always there could be other unobservable factors that might be relevant, such as idiosyncratic factors relating to banks. Liquidity of issuer bonds may impact the price. Specifically, the difference between issuance of floating and fixed rate bonds in Australia. It is expected the variables bond size and term spread will capture any considerable expected liquidity disparities. Bond pricing is one area that Major Banks have a competitive advantage. Other liability products like deposits could be researched in the future and compared to Foreign ADI subsidiaries that compete with the Major Banks. It would be beneficial to test the recent banking fragilities of 2023 and how these offshore conditions impact the discount Major Banks experience relative to Foreign Banks. This is particularly relevant with the issues surrounding Credit Suisse (a Foreign Bank ADI issuer) that is included in the sample. While testing local conditions, there may be offshore bank conditions separate to the Euro Sovereign Debt Crisis that offset adequate market discipline of the Major Banks relative to Foreign Banks. If the conditions are severe enough it is expected bond credit ratings would reflect these conditions, and the models adequately cater for this.

4.8 APPENDIX

Figure 4.6: Provisions for Customer Remediation, Litigation, Operational Risk Issues, and Non-Lending Losses. Source: ASX and Major Bank Annual Reports.

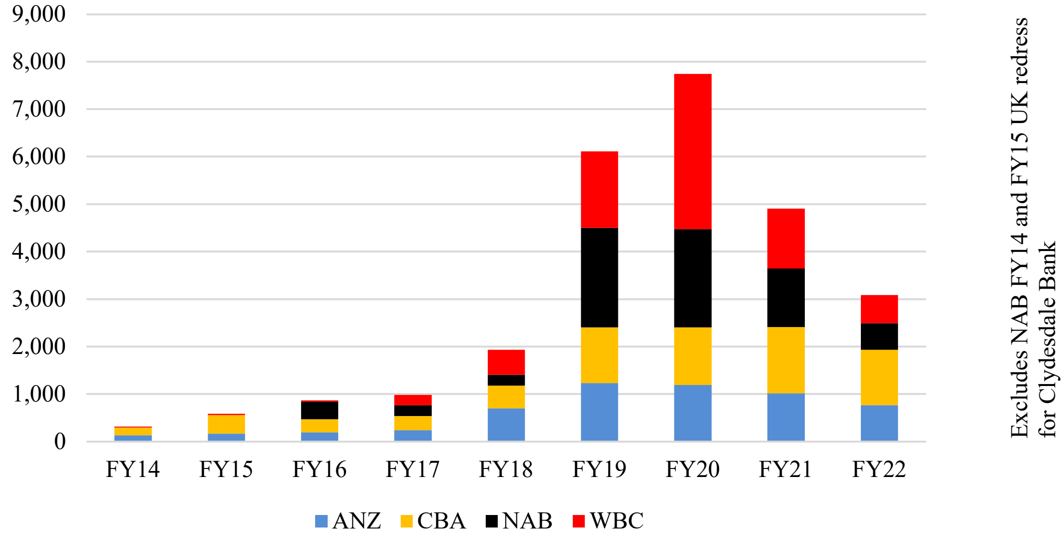
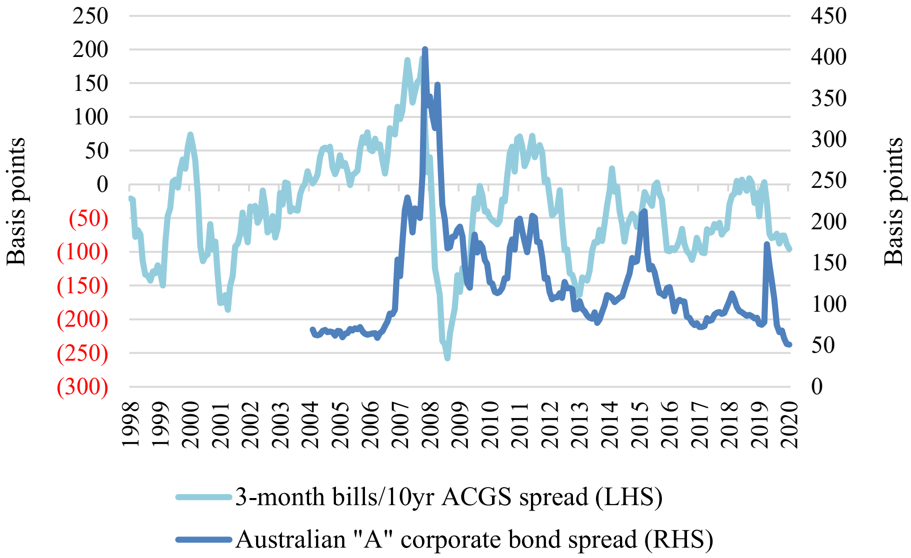


Figure 4.7: Term Spreads and Default Premiums



This chart reports the Australian financial market control variables from Equation 4.4, namely short-term market term spread (TERM) and 3-year default spread (DEF3YRA).

Figure 4.8: Goldman Sachs Australia Financial Conditions Index. Source: Bloomberg.

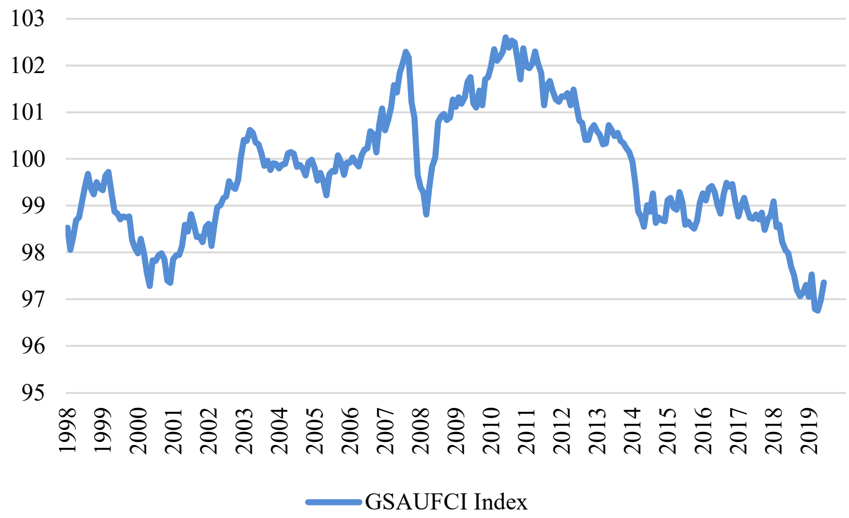


Table 4.5: Issuer Spread Advanced Corporate Bond Search from Refinitiv

Search category	**Description**	**Sample size**
Issuer Type Bond Type Status Sukuks Convertibles	Corporate Bonds Active, Inactive Exclude Include	4,200,148
Principal Currency	Include Australian Dollar	571,723
Issue Date	Between 01/01/1999 and 31/12/2020	45,168
Country of Issue	Include Asia Pacific ex Japan	28,848
Sector	Include Banks	24,160
Instrument Type	Exclude Negotiable Certificates of Deposit	1,645
Amount Issued AUD	Include Greater than zero	1,642
Initial sample size		**1,642**

Table 4.6: Manual Exclusions from Refinitiv Search (using Stata)

Search category	**Description**	**Sample size**
Maturity	Exclude less than 0.995	1,631
Coupon Type	Exclude all except Fixed Margin Over Index	990
Seniority	Exclude all except Senior Unsecured and Unsecured	826
Bond trades	Exclude Greater than 6 April 2020	804
Bond types	Exclude callable, perpetual, putable, extendible	793
Coupon frequency	Exclude all coupon frequency except Quarterly	768
Issuer	Exclude Foreign non-ADI and Australian owned non-Major Banks	443
Refinitiv Long-Term Bond Rating by ISIN	Include Moody's Long-Term Issue Credit Rating	307
Revised sample size		**307**

Table 4.7: Stata Exclusions from Revised Sample Size (using Stata)

Search category	**Description**	**Sample size**
AU non-financial corporate spreads	Start date 1 January 2005 not 1999	279
Standardised residuals	Exclude greater than or equal to ± 2.00	268
Regression final sample size (N)		**268**

Table 4.8: Bond Credit Rating by Jurisdiction. Sources: Moody's, Refinitiv, and Stata.

Bond Rating	Asia	Australia	Europe	North America	United Arab Emirates	Total
A3	0%	1%	0%	0%	0%	**1**
A2	0%	0%	10%	0%	0%	**7**
A1	19%	1%	13%	23%	0%	**22**
Aa3	11%	31%	4%	32%	0%	**57**
Aa2	0%	37%	36%	32%	0%	**90**
Aa1	70%	17%	15%	0%	0%	**62**
Aaa	0%	13%	21%	14%	100%	**31**
Number of bonds	**37**	**141**	**67**	**22**	**1**	**268**

The table reports the Moody's bond long-term credit rating at issue date for AU dollar senior unsecured and unsecured bonds issued by Australian Major Banks and Foreign ADI Banks in the Australian debt capital markets by jurisdiction.

Table 4.9: Correlation Matrix of Independent Variables (from Floating Regressions in Table 4.3)

(Obs. = 268)

	BRATING	TENOR	SIZE	SENIOR	TERM	DEF3YRA	GDPPC	DEPINS	RISKWEI	LEVY	LENDINV	LENDIO	REPUT	YEAR	GFC
BRATING	1.0000														
TENOR	-0.1474	1.0000													
SIZE	0.0245	0.3171	1.0000												
SENIOR	-0.0718	0.0555	0.3600	1.0000											
TERM	-0.1453	0.1016	-0.1467	-0.2202	1.0000										
DEF3YRA	0.5254	-0.0697	0.0479	0.0093	-0.0790	1.0000									
GDPPC	-0.2487	0.0694	-0.1159	-0.2246	0.5811	-0.3508	1.0000								
DEPINS	-0.2234	0.0862	0.3881	0.1757	-0.0109	-0.1466	0.1147	1.0000							
RISKWEI	-0.2447	0.1274	0.4120	0.2183	-0.0304	-0.1661	0.0331	0.8233	1.0000						
LEVY	-0.3019	0.1232	0.3209	0.1902	-0.0582	-0.2875	-0.0432	0.5941	0.7216	1.0000					
LENDINV	-0.1091	0.0751	0.2969	0.1453	-0.0697	-0.0447	0.0701	0.6231	0.7568	0.2551	1.0000				
LENDIO	-0.2271	0.0734	0.2336	0.1431	-0.1432	-0.2367	0.0564	0.4470	0.5429	0.7523	0.3989	1.0000			
REPUT	-0.2661	0.1415	0.2852	0.1676	-0.0042	-0.2499	-0.0312	0.5236	0.6360	0.8813	0.0710	0.5359	1.0000		
YEAR	-0.3848	-0.1077	0.1155	0.3635	-0.2093	-0.3521	-0.0952	0.4697	0.5155	0.4596	0.3103	0.3037	0.4306	1.0000	
GFC	-0.0529	-0.1381	0.1523	0.3602	-0.6313	0.0869	-0.4308	0.2930	0.2413	0.1741	0.1826	0.1310	0.1534	0.6768	1.0000

This table reports the correlation matrix of independent variables for the floating rate ordinary least squares regression. BRATING is a dummy variable for Moody's long-term bond credit rating, TENOR is the logarithm of bond maturity tenor, SIZE is the logarithm of bond size in Australian dollars, SENIOR is the binary dummy variable of 1 for Senior notes, TERM is term market spread, DEF3YRA is the 3-year default spread over Australian Commonwealth Government 3-Year bond, GDPPC is the gross domestic product per capita for Australia, DEPINS is an interactive binary dummy variable to represent the introduction of deposit insurance under the Financial Claims Scheme from February 2012 for Major Banks, RISKWEI is an interactive binary dummy variable for the APRA adjustment for Major Banks minimum of 25 percent mortgage risk weights from July 2015; LEVY is an interactive binary dummy variable for the bank levy of 1.5 basis point fee per annum on the Major Banks introduced from July 2017; LENDINV is an interactive binary dummy variable to reflect APRA restrictions on mortgage investor lending from July 2015 to June 2018 for Major Banks, LENDIO is an interactive binary dummy variable to reflect APRA restrictions on mortgage interest-only lending from April 2017 to December 2018 for Major Banks, REPUT is an interactive binary dummy variable to reflect reputational deterioration of Major Banks from the Royal Commission, APRA, and AUSTRAC inquiries from January 2018 to April 2020, YEAR is binary dummy variable corresponding to the year of the bond issue spread, and GFC is a binary dummy variable for period following January 2009 (the end of the GFC). The independent variables are winsorised at 5 percent and 95 percent levels. All variables are in Australian dollars. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix.

Table 4.10: Issuer of Floating Rate Notes by Major Banks and Foreign ADI Banks

Issuer legal name	Foreign	Local	Total	Percentage
Arab Bank Australia	1	0	1	0.4%
Australia and New Zealand Banking Group	0	25	25	9.3%
Bank of America NA (Sydney Branch)	1	0	1	0.4%
Bank of China Ltd (Sydney Branch)	3	0	3	1.1%
Bank of Nova Scotia (Sydney Branch)	3	0	3	1.1%
Bank of Scotland PLC (Sydney Branch)	9	0	9	3.4%
Bnp Paribas (Sydney Branch)	7	0	7	2.6%
Boq Specialist (Aust) Pty Ltd†	4	0	4	1.5%
Canadian Imperial Bank of Commerce (Sydney Branch)	3	0	3	1.1%
China Construction Bank Corp (Sydney Branch)	1	0	1	0.4%
Citibank NA (Sydney Branch)	2	0	2	0.7%
Citigroup Pty Ltd	3	0	3	1.1%
Commonwealth Bank of Australia	0	20	20	7.5%
Cooperatieve Rabobank UA (Sydney Branch)	23	0	23	8.6%
Credit Suisse (Australia) Ltd	2	0	2	0.7%
Credit Suisse AG (Sydney Branch)	5	0	5	1.9%
DBS Bank Ltd (Sydney Branch)	4	0	4	1.5%
Deutsche Bank AG (Sydney)	1	0	1	0.4%
HSBC Bank Australia	1	0	1	0.4%
Hongkong and Shangai Banking Corporation	3	0	3	1.1%
ING Bank (Australia) Ltd	12	0	12	4.5%
ING Bank NV (Sydney Branch)	3	0	3	1.1%
MUFG Bank Ltd (Sydney Branch)	3	0	3	1.1%
National Australia Bank Ltd	0	39	39	14.6%
Natwest Markets PLC (Sydney Branch)‡	5	0	5	1.9%
Oversea-Chinese Banking Corporation Ltd	15	0	15	5.6%
Portigon AG (Sydney Branch)	1	0	1	0.4%
Royal Bank of Canada (Sydney Branch)	10	0	10	3.7%
Royal Bank of Scotland NV (Sydney Branch)‡	3	0	3	1.1%
Sumitomo Mitsui Banking Corp (Sydney Branch)	4	0	4	1.5%
UBS AG (Sydney Branch)	5	0	5	1.9%
United Overseas Bank Ltd (Sydney Branch)	7	0	7	2.6%
Westpac Banking Corp	0	40	40	14.9%
Total	**144**	**124**	**268**	**100.0%**

This table reports the frequency of floating rate senior unsecured and unsecured note issuance by Major Banks and Foreign ADI Banks in the Australian debt capital markets.

† Investec Bank (Foreign ADI) was acquired in 2015 by Bank of Queensland Ltd (Local ADI).

‡ In 2000 Natwest joined the Royal Bank of Scotland Group. In 2020 The Royal Bank of Scotland was renamed to NatWest Group.

Table 4.11: Issuer of Fixed Rate Bonds by Major Banks and Foreign Non-ADI Banks

Issuer legal name	Foreign	Local	Total	Percentage
ABN Amro Bank NV	1	0	1	1%
Australia and New Zealand Banking Group	0	8	8	7.3%
Bank of America Corp	2	0	2	1.8%
Bank of Montreal	2	0	2	1.8%
Barclays Bank PLC	1	0	1	0.9%
Barclays PLC	2	0	2	1.8%
Bpce SA	2	0	2	1.8%
Commonwealth Bank of Australia	0	10	10	9.2%
Credit Agricole SA	1	0	1	0.9%
Emirates NBD Bank P	3	0	3	2.8%
First Abu Dhabi Bank	3	0	3	2.8%
Goldman Sachs Group	5	0	5	4.6%
HSBC Bank PLC	1	0	1	0.9%
JP Morgan Chase & Co	2	0	2	1.8%
Kiwibank Ltd	1	0	1	0.9%
Lloyds Bank PLC	4	0	4	3.7%
Lloyds Banking Group	3	0	3	2.8%
Morgan Stanley	1	0	1	0.9%
National Australia Bank	0	23	23	21.1%
Shinhan Bank	2	0	2	1.8%
Societe Generale SA	1	0	1	0.9%
Svenska Handelsbank	3	0	3	2.8%
Swedbank AB	2	0	2	1.8%
Toronto-Dominion Bank	3	0	3	2.8%
Wells Fargo & Co	3	0	3	2.8%
Westpac Banking Corp	0	20	20	18.3%
Total	**48**	**61**	**109**	**100.0%**

This table reports the frequency of fixed rate senior unsecured and unsecured bond issuance by Major Banks and Foreign non-ADI Banks in the Australian debt capital markets.

Table 4.12: Issuer Spread Floating Rate Regressions (Equation 4.3) – Major Banks and Foreign ADI Banks (Robustness Check from Table 4.3)

	11	**12**	**13**	**14**	**15**	**16**
Dependent variable	IS	IS	IS	IS	IS	IS
CONDITION variables	**DEPINS**	**RISKWEI**	**LEVY**	**LENDINV**	**LENDIO**	**REPUT**
Independent variables						
BRATING	-8.0172***	-8.1685***	-8.1990***	-7.9613***	-8.0290***	-8.0719***
	(2.2116)	(2.2143)	(2.2675)	(2.3019)	(2.3390)	(2.2778)
TENOR	36.4870***	36.9955***	36.2901***	36.1321***	35.7848***	36.3768***
	(3.5116)	(3.5204)	(3.5361)	(3.7139)	(3.6749)	(3.4709)
BMARK	0.8665	1.4163	0.0543	-0.5283	-1.0523	-0.3838
	(3.9665)	(3.9017)	(3.8810)	(3.9628)	(4.0081)	(3.8252)
CONDITION	**-10.0446*** **	**-13.6829*** **	**-10.5302*** **	**-8.3950*** **	**-5.1361* **	**-10.3080*** **
	(2.6522)	**(3.2460)**	**(2.1989)**	**(2.2517)**	**(2.8336)**	**(2.0957)**
EURO	14.8630	17.2830	18.8003	17.1594	18.1340	18.6418
	(11.2466)	(11.1582)	(11.2101)	(11.2292)	(11.2972)	(11.1912)
TERM	0.1492***	0.1372***	0.1401***	0.1388***	0.1396***	0.1452***
	(0.0368)	(0.0369)	(0.0358)	(0.0373)	(0.0375)	(0.0357)
DEF3YRS	0.5515***	0.5711***	0.5385***	0.5600***	0.5424***	0.5400***
	(0.0432)	(0.0457)	(0.0424)	(0.0443)	(0.0433)	(0.0428)
GDPPC	8.3288***	7.8069***	6.1841***	7.8179***	6.9768***	6.2018***
	(1.7766)	(1.7406)	(1.5139)	(1.7344)	(1.6264)	(1.5363)
YEAR	0.0404	0.5995	0.1910	-0.0671	-0.2142	0.1067
	(0.4914)	(0.6067)	(0.4859)	(0.4504)	(0.4400)	(0.4912)
GFC	48.8384***	41.6405***	43.1806***	45.4127***	45.7292***	44.1357***
	(6.8079)	(7.2924)	(6.9586)	(6.7313)	(6.7227)	(6.8959)
Constant	102.0919**	99.6967**	109.9349**	104.1681**	109.8927**	107.8852**
	(45.4242)	(45.9542)	(46.7143)	(47.7194)	(48.2950)	(47.0708)
Observations	268	268	268	268	268	268
R-squared	0.7387	0.7425	0.7351	0.7341	0.7305	0.7342

This table reports the ordinary least squares regressions as a robustness check for senior unsecured and unsecured floating rate notes issued by Australian Major Banks and Foreign ADI Banks. The dependent variable (IS) is a primary issue spread calculated from the Refinitiv fixed margin over the bank bill swap index, as per Equation 4.1. SIZE is the logarithm of bond size in Australian dollars, TENOR is the logarithm of bond tenor, BRATING is a dummy variable for Moody's long-term bond credit rating, CONDITION is a value of 1 for Major Banks (MAJOR) bond issue spread subsidy in one of six condition periods (CONDITION PERIOD): 1) the introduction of permanent deposit insurance under the Financial Claims Scheme from February 2012 (DEPINS); 2) APRA adjustment for Major Banks minimum of 25 percent mortgage risk weights (RISKWEI); 3) bank levy (LEVY) is the introduction of a 1.5 basis point fee per annum on the Major Banks from July 2017; 4) restrictions on investor mortgage lending (LENDINV) from July 2015 to June 2018; 5) interest-only mortgage lending (LENDIO) from April 2017 to December 2018; and 6) reputational deterioration (REPUT) from January 2018 to April 2020. EURO is a dummy variable from 2010 to 2012 to represent the Euro Sovereign Debt Crisis, TERM is term market spread, DEF3YRS is the 3-year default spread over Australian swap curve, GDPPC is the gross domestic product for Australia, YEAR is a dummy variable corresponding to the year of the bond issue spread, and GFC is a dummy binary variable for period following January 2009 (the end of the GFC). All variables are in Australian dollars. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix. Robust standard errors are clustered at bank ticker level in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4.13: Issuer Spread Fixed Rate Regressions (Equation 4.5) – Major Banks and Foreign Non-ADI Banks (Robustness Check from Table 4.4)

	17	**18**	**19**	**20**
Dependent variable	IS	IS	IS	IS
CONDITION variables	**LEVY**	**LENDINV**	**LENDIO**	**REPUT**
Independent variables				
BRATING	-15.8071***	-16.0461***	-15.5911***	-16.3636***
	(2.6360)	(2.7553)	(2.6621)	(2.6839)
TENOR	28.8257***	33.4420***	29.3974***	31.8747***
	(8.2586)	(8.5341)	(8.7335)	(9.4286)
BMARK	4.3133	3.8869	4.6067	4.8397
	(7.3756)	(7.4950)	(7.3272)	(7.5324)
CONDITION	**-17.5282*** **	**-5.9411**	**-22.1787*** **	**-9.3176**
	(4.7415)	**(3.8351)**	**(4.1419)**	**(5.9620)**
DEF5YRS	0.6439***	0.7027***	0.6249***	0.6943***
	(0.0993)	(0.1032)	(0.1057)	(0.1155)
FCI	15.3216***	16.7072***	15.8107***	16.3393***
	(2.5047)	(2.3521)	(2.3071)	(2.7061)
Constant	-1,194.4101***	-1,342.8157***	-1,246.4773***	-1,297.1795***
	(253.6167)	(233.1505)	(231.9682)	(276.0159)
Observations (N)	109	109	109	109
R-squared	0.6365	0.6235	0.6433	0.6246

This table reports the ordinary least squares regressions as a robustness check for senior unsecured and unsecured fixed rate bonds issued by Australian Major Banks and Foreign non-ADI Banks. The dependent variable (IS) is a primary issue spread calculated from the yield of the fixed rate bond on issue date (from Bloomberg) less the end of day Australian Commonwealth Government bond yield in percent on the issue date using the same maturity tenors, as per Equation 4.2. TENOR is the logarithm of bond tenor, BRATING is a dummy variable for Moody's long-term bond credit rating, BMARK is binary dummy variable of 1 for bonds issued in size greater than or equal to Australian dollars 500 million, CONDITION is a value of 1 for Major Banks (MAJOR) bond issue spread subsidy in one of four condition periods (CONDITION PERIOD): 1) bank levy (LEVY) is the introduction of a 1.5 basis point fee per annum on the Major Banks from July 2017; 2) restrictions on investor mortgage lending (LENDINV) from July 2015 to June 2018; 3) interest-only mortgage lending (LENDIO) from April 2017 to December 2018; and 4) reputational deterioration (REPUT) from January 2018 to April 2020. DEF5YRS is the 5-year default spread over Australian swap 5-year curve, and FCI is the Goldman Sachs Financial Conditions Index for Australia. All variables are in Australian dollars. For a more detailed explanation of the variables refer to Table 4.14 in the chapter appendix. Robust standard errors are clustered at bank ticker level in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4.14: Study 3 Variable Definitions

Variable	Name	Definition	Source(s)
Dependent			
IS	Bond issue spread (floating rate)	Discount margin calculated as the internal rate of return of the bond cash flows less the reference rate. Margin field from the floating rate note coupon type (known as Refinitiv Fixed Margin Over Index). The margin is multiplied by 100 to obtain the issue spread, in basis points.	Refinitiv, author calculations
IS	Bond issue spread (fixed rate)	Yield less 10-year Australian Commonwealth Government bond yield Margin field from the fixed rate bond coupon type (known as Refinitiv Plain Vanilla Fixed Coupon). The yield is multiplied by 100 to obtain the issue spread, in basis points.	Refinitiv, Bloomberg, Datastream, author calculations
Independent			
BMARK	Benchmark bond issue	Binary dummy indicator of 1 for bond size amount greater than or equal to Australian dollars 500 million, 0 otherwise.	Refinitiv, author calculations
BRATING	Bond long-term credit rating	Moody's bond long-term credit rating discrete choice converted to sequential continuous variable by ISIN. Aaa equal to 22 / Baa3 equal to 13 at the issue date of the bond.	Moody's, Refinitiv, author calculations
CONDITION	Bank regulatory condition	Dummy variable of 1 for Major Banks (MAJOR) in bank regulatory condition period (CONDITION PERIOD).	Financial Claims Scheme, APRA, Australian Government, author calculations
CONDITION PERIOD	Bank regulatory condition period	Condition period for observed adoption of regulatory initiative.	Author calculation
DEF3YRA	Default premia	End of month non-financial corporate A rated bonds 3-year target tenor spread to Australian Commonwealth Government bond, in basis points.	RBA
DEF3YRS	Default premia	End of month non-financial corporate A rated bonds 3-year target tenor spread to Australian swap rate, in basis points.	RBA
DEF5YRA	Default premia	End of month non-financial corporate A rated bonds 5-year target tenor spread to Australian Commonwealth Government bond, in basis points.	RBA
DEF5YRS	Default premia	End of month non-financial corporate A rated bonds 5-year target tenor spread to Australian swap rate, in basis points.	RBA
DEPINS	Permanent deposit insurance under the Financial Claims Scheme	Binary interactive dummy indicator equal to 1 for Major Banks from the period 1 February 2012 for the introduction of the permanent cap on deposits for incorporated ADIs, indicator equal to 0 otherwise.	Author calculations
EURO	Euro Sovereign Debt Crisis dummy	Binary interactive dummy indicator of 1 for the European banks in the period 2010 to 2012, 0 otherwise.	Author calculations
FCI	Goldman Sachs Australian Financial Conditions Index	An Australian weighted average of riskless interest rates, the exchange rate, equity valuations, and credit spreads, with weights that correspond to the direct impact of each variable on GDP to form an index, monthly.	Bloomberg

Variable	Name	Definition	Source(s)
GDPCC	Gross domestic product per capita	Year-end real GDP per capita growth, year-end change (in per cent), seasonally adjusted, in AU dollars, quarterly.	RBA, Australian Bureau of Statistics
GFC	Post-Global Financial Crisis for ADI	Dummy indicator equal to 1 for notes/bonds issued by an ADI on or after 1 January 2009, indicator equal to 0 otherwise.	Author calculations
LENDINV	Bank lending restrictions on investor mortgages	Binary interactive dummy indicator equal to 1 for Major Banks between the period 1 July 2015 to 30 June 2018, indicator equal to 0 otherwise.	APRA, Author calculations
LENDIO	Bank lending restrictions on interest only mortgages	Binary interactive dummy indicator equal to 1 for Major Banks between the period 1 April 2017 to 31 December 2018, indicator equal to 0 otherwise.	APRA, Author calculations
LEVY	Bank levy	Binary interactive dummy indicator equal to 1 for Major Banks for the period from 1 July 2017, indicator equal to 0 otherwise.	Australian government, Author calculations
MAJOR	Major Bank dummy	Binary dummy indicator equal to 1 for a Major Bank, indicator equal to 0 otherwise.	Author calculations
REPUT	Bank reputation	Binary interactive dummy indicator equal to 1 for Major Banks for the period from 1 January 2018, indicator equal to 0 otherwise.	Author calculations
RISKWEI	Average mortgage risk weight target of minimum 25 percent	Interactive binary dummy indicator equal to 1 for Major Banks that increased average mortgage risk weight target of minimum 25 percent on Australian residential mortgages using internal models from 1 July 2015, indicator equal to 0 otherwise.	APRA, Author calculations
SENIOR	Senior notes/bonds	Dummy indicator of 1 for senior unsecured bonds, indicator equal to 0 otherwise.	Refinitiv, author calculations
SIZE	Logarithm of bond size	Logarithm of bond size, in USD.	Refinitiv, Stata
TENOR	Logarithm of bond maturity tenor	Logarithm of bond maturity tenor calculated as the (maturity date less issue date) divided by 365.	Refinitiv, Stata
TERM	Term market spread	End of month 3-month bank bill swap rate less the end of month risk-free 10-year Commonwealth Government bond bid yield, in basis points.	Datastream, author calculations
YEAR	Year of issue	Dummy variable for calendar year.	Author calculations

Chapter 5: Conclusions

5.1 CHAPTER OVERVIEW

This research, comprising three studies, seeks to answer research problems originating from Systemically Important Bank (SIB) bond funding and the impact on financial stability. The first study identifies the motivational factors in the choice of a SIB to issue bonds in either one of four offshore bond markets rather than the onshore market, known as the market choice, and the impact of hypotheses for agency costs, reputation, and flotation costs on these choices. Offshore issuance can contribute negatively to financial stability. The second study focuses on similar corporate debt theories from Study 1 to understand the influencing factors for SIBs to issue unsecured structured notes rather than traditional debt bonds and secured offshore covered bonds rather than onshore covered bonds. These non-traditional bond funding channels enable banks to diversify funding and lower the cost of funds, and are different to off-balance sheet securitisation that contributed to the GFC. The third study addresses the market discipline of primary bond issuance in the Australian market for Major Banks and Foreign Banks through issue spread subsidy. Weak market discipline can indicate financial instability.

This chapter proceeds as follows. Section 5.2 provides a summary of the key findings and contributions of this research, and Section 5.3 discusses limitations and directions for future research.

5.2 SUMMARY AND CONTRIBUTIONS

This thesis posited three research questions to answer the three research problems. Research Question 1 aimed to understand the motivations for bank market choices by SIBs, as discussed in Study 1. The dependent variables for market choices were Onshore Bonds, Eurobonds, Foreign Bonds, Yankee Bonds, and Global Bonds. Research Question 2 examined the motivations of SIB issuers in selecting structured notes, either unsecured or secured, as detailed in Study 2. Issued unsecured structured notes were un-rated over the counter (OTC) notes and range accrual, credit-linked, equity-linked, multiple-linked, and commodity-linked notes were selected for sampling. These notes have diverse risk payoffs and the likelihood of issuance was compared to traditional bonds. Secured covered bonds selected for sampling were standardised, highly rated securities that have a pledge to an issuer's on-balance sheet assets. Study 2 investigated a SIB's likelihood of choice of an offshore versus an onshore covered bond. Studies 1 and 2 modelled bond characteristics and financial characteristics to test corporate finance hypotheses on agency costs, reputation, and flotation costs. In addition, Study 2 tested the impacts of the Dodd-Frank Act and Basel III regulation on the issuance of unsecured structured notes. Study 1 controlled for macro-economic conditions and market conditions. Study 2 controlled for underlying asset volatility and contract enforcement. Research Question 3 asked whether this was adequate market discipline, and if the Major Banks are Too Big to Fail? The dependent variable in Study 3 was the continuous primary issue spread for banks in the Australian bond markets. The model employed bond characteristics and controlled for yield curve and bond default conditions. The study tested an interactive dummy proxy to measure the subsidy Major Banks receive in periods of bank regulatory change compared to Foreign Banks. The periods included the introduction of permanent deposit insurance, competition, restrictions on mortgage lending, and enforcement on banks for poor conduct and customer outcomes.

The market choice results from Study 1 add to the empirical research on agency cost, reputation, and flotation cost that has previously focused on the United States, emerging markets, and Asian firms. This study provides a detailed analysis of the Australian context in addition to Systemically Important Banks across multiple jurisdictions. During the period prior to the GFC, SIBs used Global Bonds less, supporting the flotation cost hypothesis. In terms of economic significance, the flotation cost hypothesis had the largest positive impact on financial stability for Australian and Canadian banks with increases in bond size indicating a greater likelihood to issue an Onshore Bond. Increases in bond maturity tenor, a positive influence on financial stability, tend to be at the expense of Onshore Bonds, and therefore a negative influence on financial stability, as most jurisdictions increase the likelihood of offshore Eurobonds. Local regulators from these jurisdictions can implement onshore market initiatives to reduce the likelihood banks are required to fund offshore. For the United States, consideration should be given to their onshore market as increases in onshore bond reputation are predicted to decrease Onshore Bonds and increase Global Bonds.

The results from OTC unsecured structured notes indicate that SIBs with higher asymmetric information and higher growth opportunities are less likely to issue unsecured structured notes, and those banks with greater reputation are more likely to issue unsecured structured notes. However, the results were not uniform; they were impacted by the distinct types of notes with different payoff structures. Derivative regulation has decreased the likelihood of unsecured structured note issuance following the GFC. Liquidity reforms have decreased the likelihood of unsecured structured note issuance, although this does not appear to have the same economic impact as derivative regulation. This indicates that sweeping global reforms to build resilience into the banking sector have in fact reduced an important funding avenue for SIBs that increases funding diversity and minimises cost of funds. Covered bonds indicate an increase in asymmetric information decreases the likelihood of Australian banks issuing offshore covered bonds, and the opposite is true for Canadian banks. This may be due to different total issuance limits in covered bonds for these jurisdictions. A Domestic Systemically Important Bank (D-SIB) is more likely to issue offshore covered bonds than a Global Systemically Important Bank (G-SIB), and as stable deposit funding increases, banks are less likely to issue offshore covered bonds over onshore covered bonds. Regulators can provide subsidies to compensate for more costly OTC derivative clearing for unsecured structured notes and provide infrastructure changes or incentives to increase onshore covered bonds, this includes ensuring deposit and secured funding markets remain viable.

Issue spreads for floating notes and fixed rate bonds between Major Banks and Foreign Banks for Study 3 indicate the Major Banks are afforded a subsidy relative to Foreign Banks. For Foreign ADIs, the Major Banks receive a lower subsidy compared to Foreign non-ADIs, which is expected because Foreign non-ADIs are not regulated by APRA. The implementation of banking regulatory change initiatives since the GFC was expected to decrease the subsidy that Major Banks receive relative to Foreign Banks. However, the issue spread subsidy does not materially reduce until the bank levy and restrictions to residential mortgage lending take place, which should exert a negative influence on the Major Banks. The subsidy widens from restrictions on interest-only mortgage lending when regulatory enforcement occurs and the reputation of the Major Banks deteriorates. Overall, this could indicate periods of adequate and periods of inadequate and therefore weak market discipline. Weak market discipline may indicate that bond investors perceive the Major Banks as Too Big to Fail. A larger subsidy has implications for financial stability, and also affords the Major Banks with a competitive advantage over Foreign Banks. Regulators can implement more initiatives to decrease the market power of the Major Banks and address the Too Big to Fail perception.

5.3 LIMITATIONS AND FUTURE RESEARCH

While the economic static bond data retrieved from Refinitiv is accurate, other data can be less accurate. Values are often missing in fields such as market of issue, underwriter(s), Asset-Linked Security, and bond credit ratings. While this should not materially alter the regression results, nor the conclusions drawn, the limitation should be noted.

The bank selections for Study 1 and Study 2 and the review of Australia only in Study 3 could be argued to be too narrow. For future research it could be beneficial to include developing countries that fall under the purview of SIB. This includes China, which has nineteen of the one hundred largest banks by total assets. China is a late entrant to the global bond markets with little activity prior to the GFC. Other developing countries to consider are India, Brazil, and Qatar. Empirical results in Study 1 would provide the Financial Stability Board (FSB) and developing country regulators insights into how market choices impact financial stability. The definition of active issuers could be adjusted, and the data is replicable for future modelling.

The limitations of retrieving the underlying linked asset data for unsecured structured notes in Study 2 could give rise to developing better techniques to understand the convex or concave payoff profiles of these notes. This may be done with algorithms to retrieve common free text from the bond static description field to identify certain payoff profiles. This could provide more insight and improved modelling in the future, which could be particularly relevant for the next changes in global banking regulation.

Observing other local markets in addition to Australia, in Study 3, might provide regulators with more insight on Too Big to Fail subsidies in onshore markets. Efforts could focus on the onshore bond markets of France, Netherlands, Sweden, Canada, and Brazil that have high market concentrations, with the five largest banks in these markets holding more than 75 percent of system assets (BIS, 2018). This could identify common themes or outline specific results due to the proximity of these local markets. If the issue spread subsidy is wide enough, competition initiatives by regulators may include funding levies, either on wholesale debt or retail deposits covered by insurance, or an adjustment in minimum risk weights for mortgages.

The recent global bank fragilities might warrant extending the sample period to the present day. Credit Suisse bond data was used in all three studies. It would be interesting to observe if deteriorations in reputation of Credit Suisse as a G-SIB impacts market choices, or if increased volatility in underlying assets impacts negatively on SIB and the issue of structured securities. It is likely that regulation globally will be further tightened, either through supervision or prudential standards to ensure the destabilising events of 2023 do not reoccur. Re-running the models to include this data in the study chapters may yield some interesting results and further contributions to the existing literature.

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