8 February 2019
Mr Chris Gower
General Manager
Resolution & Enforcement
Policy and Advice Division
Australian Prudential Regulation Authority
Dear Mr Gower,

Re: Discussion paper: Increasing the loss-absorbing capacity of ADIs to support orderly resolution

I refer to the discussion paper released by APRA on 8 November 2018.

As part of my PhD studies at Macquarie University in Sydney, I am preparing a thesis titled 'Three essays on market discipline in the banking industry', which I am due to submit for examination next month.

One of the empirical studies to be reported in my thesis examines the impact of the Basel III point of non-viability bail-in mechanism on the pricing of tier 2 subordinated debt instruments issued by Australian banks, using secondary market data from January 2013 to December 2017 (see chapter draft attached to this submission).

The study finds that the regulatory discretionary bail-in mechanism is priced by investors when they trade the subordinated debt securities issued by banks. The inclusion of the Basel III point of non-viability bail-in feature is associated with an additional risk premium of approximately 73 basis points per annum and 45 basis points per annum, for fixed rate bonds and floating rate bonds respectively. Furthermore, the study provides evidence that the pricing of subordinated debt securities issued by Australian banks became more sensitive to the risk profile of the bank after the implementation of the Basel III bail-in requirement.

The findings to be reported in my thesis are consistent with the idea that Basel III tier 2 subordinated debt instruments provide additional loss-absorbing capacity to support the resolution of Australian ADIs and minimise taxpayer support.

I would be grateful if you would take my empirical findings into consideration when finalising your policy proposal.

Sincerely,
Yilian Guo
PhD candidate
Macquarie University

Chapter 4

Do the Basel III bail-in rules increase investors' incentives to monitor banking risks? Evidence from the subordinated debt market

4.1 Introduction

The empirical study reported in this chapter examines the impact of the Basel III discretionary point of non-viability trigger mechanism on the pricing of subordinated debt securities issued by Australian banks. Australian banks began to issue bail-in subordinated debt securities with the point of non-viability trigger from May 2013, while the conventional subordinated debt securities that they issued previously continue to trade in the secondary market until they are redeemed and phased-out by January 2023. This transition timetable enables an assessment of whether investors demand an bail-in risk premium when pricing subordinated debt securities issued with the Basel III discretionary point of non-viability trigger compared with the old-style securities without the trigger. This trigger provides a mechanism to help resolve a 'gone-concern' bank when the regulator use its discretion to activates the non-viability trigger and convert to common equity or write off the holdings of tier 2 subordinated debt investors, to absorb the losses of the bank. This study examines the impact of the Basel III gone-concern bail-in mechanism on the pricing of subordinated debt and whether the regulatory discretionary point of non-viability trigger mechanism increases the sensitivity of subordinated debt prices to the risk profile of the issuing bank.

The remainder of this chapter is organised as follows. Section 4.2 describes the Basel III loss absorbency requirements for tier 2 capital instruments. Section 4.3 describes the data and methodology for this study. Section 4.4 reports the empirical results on the impact of the Basel III discretionary point of non-viability trigger mechanism on the pricing of bank-issued subordinated debt securities. The findings of this study are summarised in section 4.5.

4.2 Basel III bail-in rules for bank subordinated debt

To improve the loss-absorbing capacity of non-common equity capital instruments, the Basel III reforms introduced new loss-absorbency requirements for subordinated debt securities to qualify as tier 2 regulatory capital instruments. In the previous versions of the Basel Accord, eligible subordinated debt securities had been allowed to be included as 'gone-concern' tier 2 regulatory capital. However, the 2007-2009 financial crisis highlighted significant shortcomings in the arrangements by which subordinated debt capital would be used to resolve an insolvent bank, as well as moral hazard problems caused by government support for systemically important financial institutions. In many countries, subordinated debt holders were spared from the contractual requirements to absorb bank losses according to the juniority of their claims because governments intervened to recapitalise the banks before they were subject to bankruptcy proceedings. The Basel III loss-absorption mechanism introduced for tier 2 subordinated debt securities requires them to be issued with a loss-absorbency feature, such that the securities are converted to common equity or have their principal values written-down once a point of non-viability trigger is activated. The responsibility to decide whether a bank is non-viable is exercised by the national banking regulator. This bail-in feature represents an additional risk, over and above the risks to which conventional subordinated debt investors are exposed.

In Australia, the domestic prudential regulator, the Australian Prudential Regulation Authority (APRA) began the implementation of the Basel III capital reforms from January 2013. The new loss-absorbency requirements were introduced for tier 2 subordinated debt according to phase-in timeline running from 2013 to 2023. Australian banks were generally in a strong position to meet the Basel III rules and started to issue Basel III bail-in subordinated debt in both domestic and offshore markets from May 2013. Bail-in subordinated debt securities are mostly traded over the counter, except a small number that are listed and traded on public securities exchanges including the Australian Securities Exchange (ASX). Any subordinated debt issued since 1 January 2013 must include a regulatory discretionary point of non-viability trigger to be eligible to be included as part of tier 2 capital under the Basel III regime. There is no specific guidance provided to the market about how the local supervisor, APRA, will assess and decide when a bank is to be declared non-viable. The assessment could potentially be based on a high proportion of non-performing loans, a lack of sufficient liquidity or a weakened capital position. The uncertainty associated with the issuing bank's regulatory standing in relation to the non-viability provisions and the lack of transparency about how the regulator will assess the bank's condition contribute to the risk profile of the bail-in subordinated debt securities. Under the Basel III rules, the pre-defined mechanical 5.125% CET1 capital ratio trigger applies to additional tier 1 capital instruments, but it does not apply to tier 2 capital instruments (including subordinated debt).

Transitional arrangements have been implemented for the old-style subordinate debt securities issued under the Basel I and Basel II regimes. These securities can continue to be counted towards tier 2 regulatory capital, but will be phased out from their first available call date (if any), or as determined by APRA. The proportion of the transitional instruments included in the base amount of tier 2 capital is to be reduced over a ten-year period from 2013 to 2023, with a 10 per cent reduction each year. The regulatory discretionary loss-absorption mechanism only applies to new issues of bail-in subordinated debt from 1 January 2013. If the point of non-viability trigger is activated by the regulator, Basel III bail-in subordinated debt is to be written off or converted to common equity. However, the old-style subordinated debt securities issued under Basel I and Basel II frameworks will not be converted or written off in this case. This, in turn, gives the old-style subordinated debt securities a higher effective ranking in the hierarchy of claims on the bank. During the period that both the old-style and Basel III bail-in subordinated debt securities are trading in the market place, it is expected that the bail-in mechanism will be taken into account by investors when they price the subordinated debt securities issued with the Basel III bail-in feature.

4.3 Data and Methodology

4.3.1 Data and sample

This study focuses on 75 subordinated debt securities issued by 9 Australian banks and traded in the secondary market from January 2013 to December 2017. The sample bonds included in the study comprise 28 old-style subordinated debts (i.e. subordinated debt issued under the Basel I and Basel II regimes) and 47 bail-in subordinated bonds (i.e. Basel III tier 2 subordinate debt) issued since 1 January 2013, that is, the start date of Basel III implementation in Australia. Table 4.1 presents the sample Australian banks, the number of subordinated bonds and number of monthly observations involved in the analysis. Observations for subordinated bonds with less than one year remaining to effective maturity are excluded from the sample data. As can be seen from the table, the sample comprises a reasonably balanced number of observations for subordinated bonds issued with and without the Basel III point of non-viability trigger. Subordinated bonds represents a more junior claim on the bank than senior bonds and are issued with an offer to compensate investors with periodic interest payments, which are relatively higher compared with senior bonds and can be either fixed or floating rate. The higher yields that investors demand can be attributed to the higher risks associated with subordinated bonds, which include interest rate risk and default risk, but also the potential for conversion into common equity or write down for bonds issued under the Basel III rules.

The subordinated bonds in the sample are issued in eight different currency denominations. I collect issue-level information on the subordinate debt securities from Bloomberg, including their issue dates, maturity types, contractual maturity dates, coupon rates, coupon types, coupon frequency, par value, issue amounts, call features and the Basel III loss-absorbency treatment of each individual bond. To determine the effective maturity date of a subordinated bond, I consider both the call schedule and maturity type of the bond. Because the market convention is such that all callable subordinated debts issued by Australian banks are called by the issuing bank at the first call date, I use the first call date as the effective maturity date for all subordinated bonds that are callable bonds. For

Table 4.1: Sample banks with subordinated debt observations

This table presents the sample Australian domestic banks included in the analysis. The sample period is January 2013 to December 2017. This table presents the number of subordinated bonds and month-end observations for the subordinated bonds with the Basel III point of non-viability trigger and without the point of non-viability trigger.

Fixed-rate bonds

Bank name	No. of subordinated bonds		No. of observations	
	Without trigger	With trigger	Without trigger	With triggers
Westpac Banking Corporation	3	10	126	153
Commonwealth Bank of Australia	4	6	208	135
National Australia Bank Limited	3	4	148	74
Australia and New Zealand Banking Group Limited	2	9	85	238
Macquarie Bank Limited	3	2	170	62
All banks	15	31	737	662

Floating-rate bonds

Bank name	No. of subordinated bonds		No. of observations	
	Without trigger	With trigger	Without trigger	With triggers
Westpac Banking Corporation	2	3	81	116
Commonwealth Bank of Australia	0	2	0	57
Australia and New Zealand Banking Group Limited	3	2	136	69
National Australia Bank Limited	3	3	120	60
Bendigo and Adelaide Bank Limited	1	2	25	55
Bank of Queensland Limited	3	1	50	20
MyState Bank Limited	0	1	0	27
Auswide Bank Limited	1	2	22	62
All banks	13	16	434	466

bonds that are not callable, I use the contractual maturity date as the bond's effective maturity date. I collect daily prices for the subordinated bonds from Capital IQ and Bloomberg, then select calendar month-end observations and calculate credit spreads for the subordinate debt securities.[13] For fixed-rate subordinated bonds, I obtain the maturity dates and monthly yields-to-maturity of government bonds in the eight relevant currencies from Bloomberg to be used as the benchmark risk-free interest rates. For floating-rate subordinate bonds, I collect bank bill swap rates from the Australian Financial Markets Association to be used as the benchmark risk-free interest rate.[14]

To construct bank risk measures and control variables that can be used in the analysis to disentangle the effect of the point of non-viability trigger from other possible factors

[13]I use Capital IQ as the first source for pricing data due to better data quality and coverage. For bonds with no pricing data from Capital IQ, I use data from Bloomberg to calculate credit spreads

[14]The floating-rate subordinated bonds in the sample are all Australian dollar-denominated bonds

that may impact the credit spreads of banks' subordinated bonds, I collect data from a variety of sources. I collect daily data on bank equity returns and market capitalisation from Thomson Reuters Datastream. Semi-annual data from banks' financial reports are obtained from Worldscope, including the total assets, total liabilities, shareholders' equity, net income, non-performing loans, total loans, trading assets and cash and liquid assets of the bank. For macroeconomic factors, interest rates on bank accepted bills and the generic Australian Government bonds of different maturities are collected from the Reserve Bank of Australia. Average redemption yields for bonds in the S&P/ASX Australian Corporate Bond Index are obtained from Thomson Reuters Datastream. The values of the S&P/ASX 200 VIX index are collected from Bloomberg.

4.3.2 Point of non-viability trigger, bank risk and control variables

The key variable of interest is the gone-concern loss-absorption feature for a subordinated debt security. Bloomberg reports whether a subordinated debt instrument qualifies as Basel III tier 2 capital, and the trigger type and trigger action under the Basel III rules. Banks are required under APRA's prudential standard APS330, to disclose the main features of instruments included in their regulatory capital. Combining the information from Bloomberg and from banks' disclosure documents, I determine whether a subordinated debt security issued by an Australian bank meets the Basel III loss-absorbency requirements. In the capital disclosure document, the bank specifies if a tier 2 subordinate debt instrument has the regulatory discretionary point of non-viability trigger. Alternatively, if a subordinated debt security is specified as 'Tier 2' capital under 'Post-transitional Basel III rules', the security is designated as a bail-in subordinated debt instrument, i.e., one issued with the Basel III gone-concern loss-absorption feature, otherwise, the security is designated as an old-style subordinated debt instrument, i.e., one issued without the loss-absorption feature.

Table 4.2 lists the bank risk measures, subordinated debt security characteristics, bank-level characteristics and macroeconomic variables and the anticipated effects on credit spread levels. I employ five alternative proxies to measure bank default risk. Following Hillegeist et al. (2004), Duffie et al. (2007) and Acharya, Anginer & Warburton (2016), the

Table 4.2: List of risk measures, subordinated-debt characteristics, bank-characteristics and macroeconomic variables

	Proxy for	**Expected effect on credit spreads**
Panel A: Bank risk variables		
Negative Merton distance-to-default (-MertonDD)	Bank default risk	Positive
Common equity volatility (Equity volatility)	Bank equity risk	Positive
Common equity idiosyncratic volatility (Idiosyncratic volatility)	Bank idiosyncratic equity risk	Positive
Non-performing loan/Toal loans (NPL)	Bank asset risk	Positive
Trading assets/Total assets (Trading Assets)	Bank asset risk	Positive
Panel B: Subordinated bond characteristics		
Logarithm of issue size (Log issue size)	Counterparty availability	Negative
Logarithm of time-to-maturity (Log TTM)	Interest rate risk	Positive
Callable feature (Callable)	Bond callable by issuer	Positive
Panel C: Other bank-level variables		
Return on assets (ROA)	Profitability/Operational efficiency	Negative
Common equity to total assets ratio (Common equity ratio)	Bank solvency position	Negative
Cash holdings to total assets ratio (Cash holdings)	Bank liquidity position	Negative
Panel D: Macro variables		
10 year government bond yield - 90-day bank bill rate (Term premium)	Term premium	Positive
S&P/ASX corporate bond index yield spread (Default premium)	Default premium	Positive
S&P/ASX 200 VIX (VIX)	Equity market volatility	Positive

first risk variable used is the distance-to-default value calculated using the Merton (1974) structural default model. The Merton distance-to-default is shown in previous studies to have significant explanatory power in generating a term structure of bank default probabilities (Duffie et al. 2007). The Merton model is an application of option pricing theory, which treats a firm's equity as a European call option on the firm's assets, where the value of the firm's liabilities represents the strike price. The number of standard deviations away from the default point, i.e., the point at which the assets of the bank are just equal to its liabilities, is the distance-to-default value estimated for the bank. If the estimated market value of the bank's total assets falls below the book value of its total liabilities, the call option is out of the money and will be left unexercised. The insolvent bank will be passed over to its debt holders (Hillegeist et al. 2004). To enhance the readability of the regression results, I use the negative value of the Merton distance-to-default as the risk measure (following Gropp et al. 2006). In this way, a higher value of the negative Merton distance-to-default indicates a the bank with a higher default risk.

As Campbell et al. (2008) identifies limitations of the Merton distance-to-default measure in predicting bank default risk, I use two additional market-based risk measures, common equity volatility and idiosyncratic common equity volatility. Atkeson et al. (2017) demonstrate theoretically that one can estimate a firm's distance-to-default using data on the inverse of the volatility of that firm's equity returns. Following Acharya, Anginer & Warburton (2016), I use equity return volatility ($Equity\ volatility$) as a risk measure, This measure transcends the assumptions underpinning the Merton structural model. Equity volatility is computed using daily stock return data over the past 12 months. Also, as substitute risk measure, I use idiosyncratic equity volatility (following Balasubramnian & Cyree, 2011 and Balasubramnian & Cyree, 2014). It is documented by Campbell & Taksler (2003) that idiosyncratic equity volatility has a direct relationship with the credit spreads on corporate bonds. Using their method, idiosyncratic equity volatility ($Idiosyncratic\ volatility$) is calculated as the residual standard error obtained by estimating a rolling market index model, that is, by regressing excess returns on the bank's common equity against excess returns on the market index over the past 130 trading days. I use the S&P ASX 200 total return index and the 90-day bank bill swap rate as the equity market index and the risk-free rate respectively.

To the extent that investors anticipate government support for distressed firms in the banking industry, the distance-to-default and other equity market-based measures of bank risk may understate the risks inherent in their business models (Gandhi & Lustig 2015, Kelly et al. 2016). To address this concern, I use two accounting-based risk measures to test the robustness of my results. Following previous studies examining banks' bond spreads, including Sironi (2003), Brewer & Jagtiani (2013) and Balasubramnian & Cyree (2014), I use non-performing loans (*NPL*) as a risk measure. Morgan & Stiroh (2001) find evidence that bond investors price the risks implicit in banks' trading assets. Thus, I use the relative size of a bank's trading book (*Trading assets*) as an additional risk measure.

To allow for other factors that could potentially impact on the pricing of subordinated debt securities, I control for specific characteristics of the securities, bank profitability and financial strength, and macroeconomic factors. As debt securities with larger issue sizes and shorter maturities can be expected to be more liquid and have lower yield spreads, I compute the logarithm of the amount issued of the bond in constant 2017 dollar terms (*Log issue size*), i.e., adjusted using the historical consumer price index, and the logarithm of term-to-maturity of the bond (*Log TTM*) to assess the influence of these factors on the pricing of subordinated bonds. I also use a zero-one dummy variable to identify callable bonds. A subordinated bond is callable if the issuer has the option to call the security on one or more pre-defined dates. This option is valuable to the issuer and can be expected to result in higher yield spreads on the securities. Following Acharya, Anginer and Warburton (2016), I consider variables relating to the financial strength and profitability of the bank when it issues a bond: the common equity to total assets ratio (*Common equity ratio*), cash holdings to total assets ratio (*Cash holdings*) and the return on assets (*ROA*). A bank with a higher common equity ratio, and a higher level of cash holdings is a bank that is financially sounder and is expected to be associated with lower credit spreads. A bank with a higher return on assets is one that operates more efficiently and is expected to be associated with lower credit spreads. I include three macroeconomic variables in the analysis. *Term Spread* is calculated as the yield spread between 10-year Australian Government bonds and 90-day bank bills. *Default Premium* is the yield spread between bonds in the S&P/ASX corporate bond index and Australian Government bonds with the nearest average time to maturity, and is used as a proxy for default risk. The S &P/ASX 200 VIX index (*VIX*) is used to measure the aggregate uncertainty in the securities market, which is calculated by the index provider using the 30-day implied volatilities of S&P/ASX 200 put and call options. As the S&P/ASX 200 VIX is only available from January 2008, I use the average of the implied volatilities on closest maturity S&P/ASX 200 put and call options prior to this date.

4.4 Results and discussions

4.4.1 Descriptive statistics

Table 4.3 reports descriptive statistics of key variables for the sample subordinated bond monthly observations used in the analysis.[15] Descriptive statistics for characteristics of the fixed-rate bonds and floating-rate bonds are reported respectively. The average credit spreads in the secondary market are 178 bps and 196 bps for fixed-rate and floating-rate bonds respectively from January 2013 to December 2017. The average term to effective maturity for the sample subordinated bonds trading in the secondary market is around 5 years for fixed-rate bonds and 3 years for floating-rate bonds. The average issue size of the sample subordinated bonds is around 720 million and 640 million Australian dollars for fixed-rate and floating-rate bonds respectively.

Figures 4.1 and 4.2 illustrate the average credit spreads and total amount outstanding of subordinated debt securities issued by Australian banks quarter-by-quarter over the sample period, displayed for fixed-rate bonds (Panel A) and floating rate bonds (Panel B). The grey bars represent the old-style subordinated debt issued under the Basel I and Basel II regimes (without the point of non-viability trigger), while the gold bars represent bail-in subordinated debt issued under the Basel III regime (with the point of non-viability trigger). Regarding the average credit spreads in figure 4.1, except in the September and December quarter of 2017 when most of the old-style floating-rate subordinated debt securities have been redeemed, in every quarter for which comparable data are available, there is a higher credit spread on bail-in subordinate debt issued with the point of non-viability trigger than on the old-style

[15]For the bank-level and macroeconomic variables, the description statistics are based on the fixed-rate bond monthly observations. The descriptive statistics based on the floating-rate bond monthly observations are similar and are omitted for brevity.

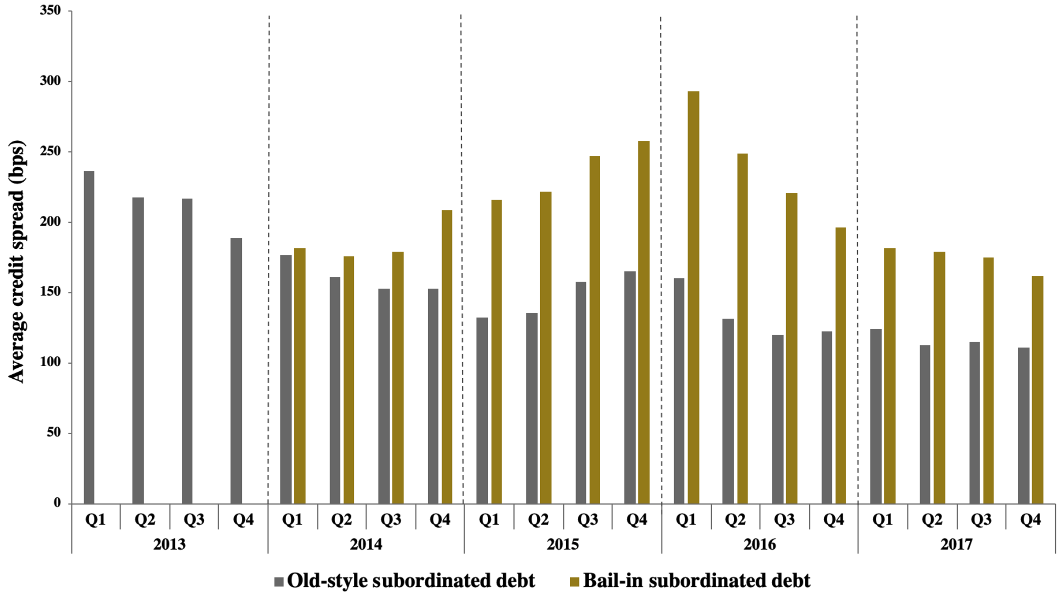
Table 4.3: Descriptive statistics for bank subordinated debt observations

This table presents summary statistics for bank subordinated debt observations. The sample period is from January 2013 to December 2017. *Issue size* is the issue size of the subordinated debt security in constant 2017 dollars. *Time-to-maturity* is the the time-to-effective maturity of subordinated debt security. For fixed-rate securities, *Credit Spread* is the difference in yields between the subordinated debt security and the nearest maturity government bond. For floating-rate securities, *Credit Spread* is the discount margin, which is the difference between the internal rate of return on the subordinated debt cash flows and the reference bank bill swap rate, assuming that the reference rate does not change over the life of the security. *Merton distance-to-default* is the distance-to-default calculated using the Merton model. *Equity volatility* is the standard deviation of daily equity returns over the past twelve months. *Idiosyncratic volatility* is the residual standard error estimated for the bank's common equity using a rolling market index model over the past 130 trading days. *Non-performing loans* is non-performing loans divided by total loans. *Trading assets* is the bank's trading book to total assets ratio. *Total Assets* is the book value of total assets. *Common equity ratio* is the book value of common equity divided by the book value of assets. *Cash holdings* is cash holdings divided by total assets. *Return on assets* is the return on assets, computed as net income divided by average assets. *Term spread* is the term structure premium, measured by the yield spread between 10-year Australian Government bonds and 90-day bank accepted bills. *Default premium* is the default risk premium, measured by the yield spread between bonds in the S&P/ASX corporate bond index and Australian Government bonds with nearest average time-to-maturity. *S&P ASX 200 VIX* is the level of the S&P/ASX 200 VIX index.

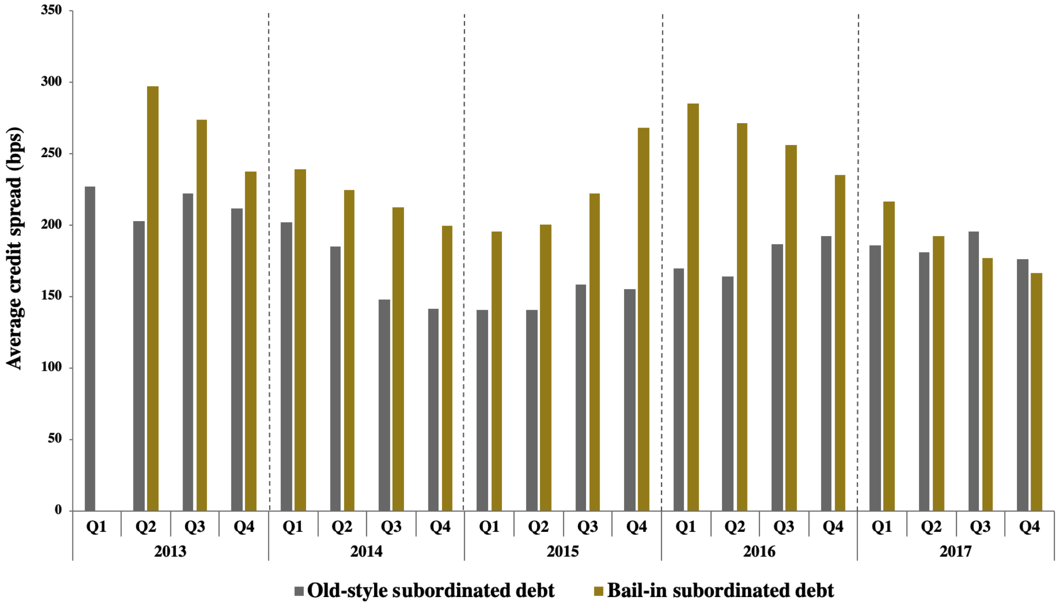
Data item	**Mean**	**Standard deviation**	**Lower quartile**	**Median**	**Upper quartile**
Subordinated bond characteristics					
– Fixed rate bonds					
Issue size $mil	720.4	436.0	355.1	777.0	1034.1
Time to maturity years	5.3	2.3	3.6	5.0	6.9
Credit spread bps	178	62	136	174	213
– Floating rate bonds					
Issue size $mil	641.4	476.4	256.3	566.8	887.1
Time to maturity years	3.2	1.2	2.2	3.2	4.1
Credit spread bps	196	72	143	180	229
Bank risk variables					
Merton distance-to-default	4.9	1.3	3.8	5.0	5.9
Equity volatility % pa	19.3	5.2	15.3	17.8	23.4
Idiosyncratic volatility % pa	12.3	7.5	9.4	10.8	12.8
Non-performing loans %	1.71	1.00	0.71	2.05	2.60
Trading assets %	7.6	3.9	4.9	6.0	10.4
Other bank-level variables					
Total assets $bil	764.3	264.9	788.8	856.1	923.3
Common equity ratio %	6.5	0.7	6.1	6.5	6.9
Cash holdings %	6.1	3.9	3.1	5.2	8.2
Return on assets % pa	1.3	0.2	1.1	1.4	1.5
Macro variables					
Term spread bps	66	40	36	66	94
Default premium bps	107	23	86	111	121
S&P ASX 200 VIX %	13.3	3.4	10.9	12.3	15.1

Figure 4.1: Average credit spreads for old-style and bail-in subordinated debt

Panel A: Fixed-rate bonds

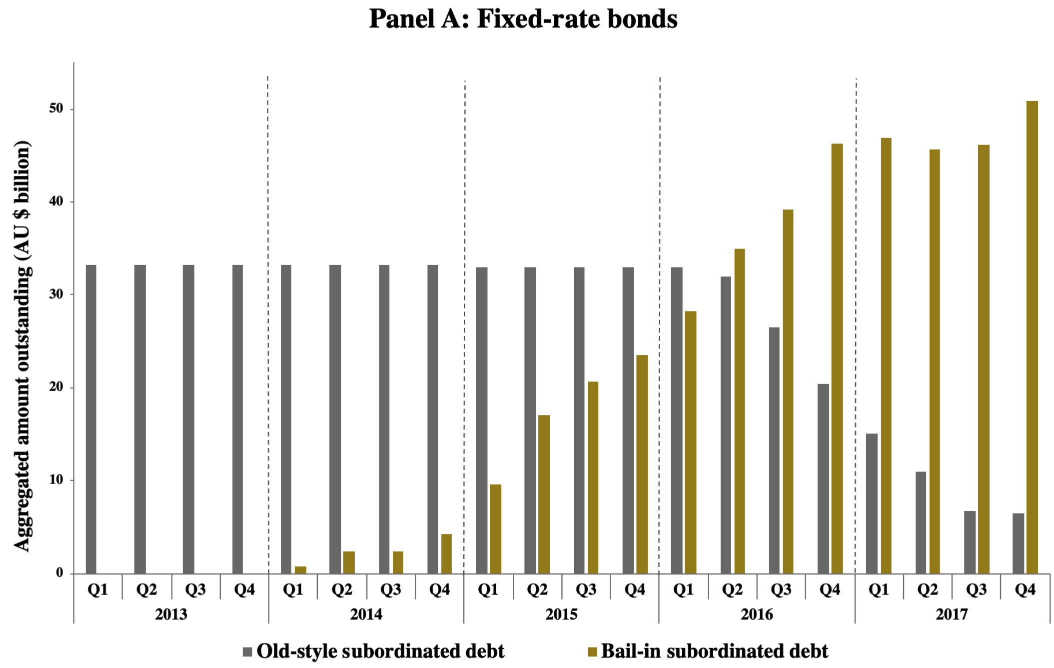


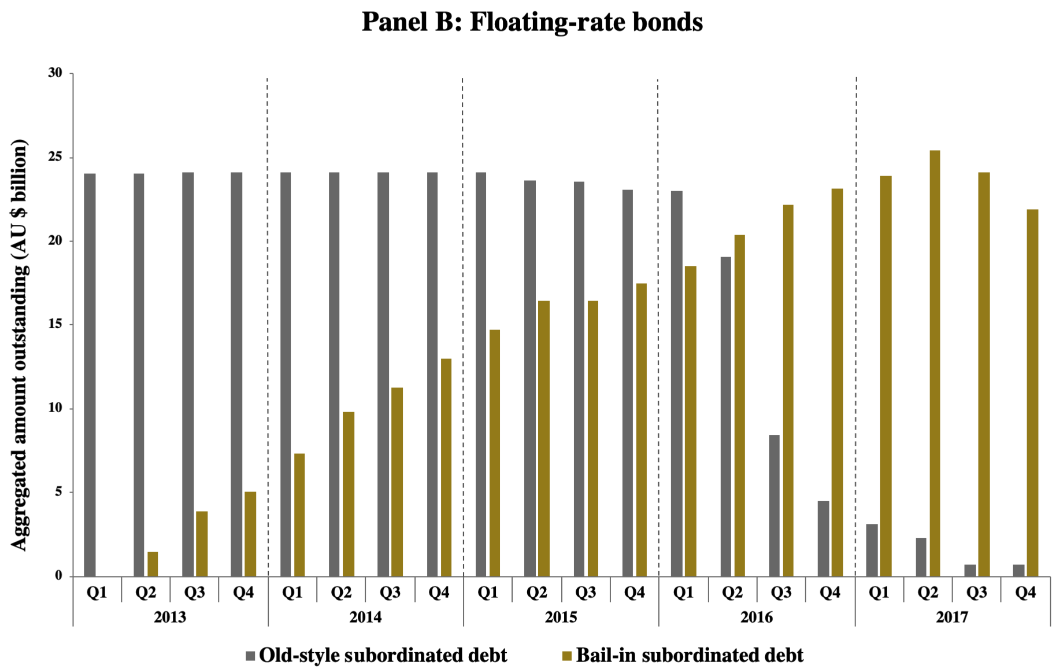
Panel B: Floating-rate bonds



This figure shows the quarterly average credit spreads of subordinated debt securities issued by the sample Australian banks, presented for fixed-rate bonds (panel A) and floating-rate bonds (panel B). *Credit Spread* (y-axis) is in basis points. For fixed-rate subordinated debt, *Credit Spread* is the difference in yields between the subordinated debt security and a maturity-matched government bond. For floating-rate subordinated debt, *Credit Spread* is the discount margin, which is the difference between the internal rate of return on the subordinated debt cash flows and the reference bank bill swap rate, assuming that the reference rate does not change over the life of the subordinated debt security. The time period (x-axis) is from quarter 1 2013 to quarter 4 2017. The gold bars represent the credit spreads of bail-in securities, which are subordinated debt securities issued under the Basel III regime, i.e., with the point of non-viability trigger. The grey bars represent the credit spreads of conventional subordinated debt securities, which are issued under the Basel I and II regimes, i.e., without the trigger.

Figure 4.2: Total market size for for old-style and bail-in subordinated debt





This figure shows the aggregate amount on issue of subordinated debt securities for the sample Australian banks in billions of Australian dollars, presented for fixed-rate bonds (panel A) and floating-rate bonds (panel B). The time period (x-axis) is from quarter 1 2013 to quarter 4 2017. The gold bars represent the total amount outstanding of bail-in debt, which are subordinated debt securities issued under the Basel III regime, i.e., with the point of non-viability trigger. The grey bars represent the amount outstanding of conventional subordinated debt securities, which are issued under the Basel I and II regimes, i.e., without the trigger.

Table 4.4: Pearson correlation coefficients for key variables of the sample bank subordinated debt observations

PONV is a dummy variable which equals to 1 if a subordinated debt security is issued with the Basel III loss-absorption feature, i.e. a point of non-viability trigger. *LOGT* is the logarithm of the term to effective maturity of the subordinated debt security. *LOGS* is the logarithm of the issue size of the subordinated debt securities in constant 2017 dollars. *-MDD* is the negative distance-to-default calculated using the Merton model. *SIGE* is the standard deviation of daily equity returns over the past twelve months. *IDIO* is the residual standard error estimated for the bank's common equity using a rolling market index model over the past 130 trading days. *NPL* is non-performing loans divided by total loans. *TRAD* is bank's trading book to total assets ratio. *CEQU* is the book value of common equity divided by the book value of assets. *CASH* is cash holdings divided by total assets. *ROA* is the return on assets, computed as net income divided by average assets. *TERM* is the term structure premium, measured by the yield spread between 10-year Australian Government bonds and 90-day bank accepted bills. *DEF* is the default risk premium, measured by the yield spread between bonds in the S&P/ASX corporate bond index and Australian Government bonds with nearest average time-to-maturity. *VIX* is the level of the S&P/ASX 200 VIX index. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

	PONV	**LOGT**	**LOGS**	**-MDD**	**SIGE**	**IDIO**	**NPL**	**TRAD**	**CEQU**	**ROA**	**CASH**	**TERM**	**DEF**
LOGT	0.54***												
LOGS	-0.22***	0.20***											
-MDD	0.05	0.06*	0.14***										
SIGE	0.04	0.04	0.12***	0.94***									
IDIO	-0.11***	0.17***	0.16***	0.39***	0.38***								
NPL	0.21***	-0.07*	0.12***	0.01	-0.08**	-0.23***							
TRAD	-0.23***	0.05	0.34***	0.25***	0.24***	0.37***	-0.01						
CEQU	0.12***	0.22***	-0.03	0.15***	0.27***	0.41***	-0.59***	0.26***					
ROA	-0.09**	-0.09***	-0.09***	-0.20***	0.02	-0.07**	-0.39***	0.01	0.39***				
CASH	-0.02	0.15***	0.26***	0.26***	0.23***	0.23***	0.09***	0.56***	0.16***	-0.16***			
TERM	-0.02	0.09**	-0.08**	-0.32***	-0.35***	0.10***	-0.22***	-0.12***	0.11***	-0.12***	-0.05*		
DEF	0.01	-0.11***	0.09***	0.62***	0.65***	0.00	0.16***	0.11***	-0.09***	0.10***	0.07*	-0.78*	
VIX	-0.09**	-0.07**	0.10***	0.61***	0.63***	0.06*	0.12***	0.13***	-0.15***	0.12***	0.08**	-0.45***	0.68***

subordinated debt. The wider credit spreads can be expected to be contributed to by the additional risk premium required by investors in bail-in subordinated debt due to the point of non-viability trigger. However, it may also be a consequence of other factors that have an impact on the yield spreads of subordinated bonds. As illustrated in figure 4.2, the amount outstanding of bail-in subordinate debt increased steadily from 2013, while that of old-style subordinate debt declaimed from the second quarter of 2016. By the end of the sample period, the amount outstanding of fixed-rate subordinated debt issued with the Basel III point of non-viability trigger is greater than that of floating-rate subordinated debt issued with the trigger.

Table 4.4 presents the correlations between key variables included in the analysis. The key variable of interest, PONV, is a dummy variable used to identify whether a subordinated debt security is issued with the Basel III point of non-viability trigger. As shown in the correlation table, the PONV dummy variable is positively correlated with the ratio of non-performing loans to total loans, suggesting that banks with lower quality credit portfolios may have raised subordinated debt funding to buttress their regulatory capital positions under the Basel III rules. However, the PONV dummy variable is negatively correlated with idiosyncratic equity volatility and the proportion of trading assets to total assets, suggesting that banks that have issued the new-style securities have a safer profile overall. The PONV dummy variable is positively correlated with the issuing bank's common equity ratio, indicating that the pricing observations for subordinated debt with the point of non-viability trigger are for banks with generally stronger capital positions compared with the pricing observations for the old-style subordinated debt without the trigger.

4.4.2 Impact of the point of non-viability trigger on subordinated debt pricing

To determine whether investors may be concerned about the possibility of being bailed-in to support the resolution of a gone-concern bank, this subsection examines whether credit spreads are wider for subordinated debt issued with the Basel III regulatory discretionary point of non-viability trigger, relative to subordinated debts issued without the trigger. I regress the secondary market credit spreads of subordinated bonds on the indicator variable for the Basel III point of non-viability trigger mechanism, alternative bank risk variables, subordinated bond characteristics, the issuing bank's profitability and financial strength, and macroeconomic factors (following the modelling strategy of Flannery & Sorescu, 1996 and Krishnan et al., 2005). Using a panel regression approach, I include year fixed effects and bank fixed effects to control for any omitted variables at these levels and cluster the standard errors in the estimations by security and month-end date to control for heteroskedasticity and panel-related correlation in the regression residuals.[16]

The specification of the regression is as follows:

$$
\begin{aligned}
Spread_{i,t} =& \alpha_1 \ PONV_i + \beta_1 \ (Bank\ risk)_{i,t-1} + \gamma_1 \ Common\ equity\ ratio_{i,t-1} \\
&+ \sigma_B \ (Bank\ control\ factors)_{i,t-1} + \sigma_S \ (Subordinated\ bond\ characteristics)_{i,t} \\
&+ \sigma_M \ (Macroeconomic\ factors)_t + YearFE + BankFE + \varepsilon_{i,t}
\end{aligned}
$$

where, for fixed-rate subordinated bonds, $Spread_{i,t}$ is the spread between the month-end yield-to-effective-maturity of the bank subordinated bond and traded in month t, and the month-end yield-to-maturity of the benchmark government bond with the same currency-denomination and nearest maturity date. As the observation month t changes, the benchmark government bond for a fixed-rate subordinated bond can, in some cases, be replaced by another newly-issued government bond with a closer maturity date. For floating-rate subordinated bonds, $Spread_{i,t}$ is the discount margin, which is the difference between the internal rate of return on the bond cash flows assuming that the reference rate does not change over the life of the bond. *PONV* is a dummy variable which equals 1 if the subordinated debt security has the Basel III point of the non-viability trigger; and equals 0 if the subordinated debt security was issued under the Basel I or Basel II regimes, i.e., without the Basel III point of non-viability trigger. Five alternative measures are used to capture bank risk (*Bank Risk*), which are the negative of the Merton distance-to-default ($-MertonDD$), common equity volatility ($Equity\ volatility$), the residual standard error ($Idiosyncratic\ volatility$) estimated for the bank's common equity, the ratio of non-performing loans to total loans (*NPL*), and the ratio of trading assets to total assets ($Trading\ assets$). The regression model controls for the bank's profitability, liquidity position and common equity position ($Bank\ control\ factors$) using the return on assets (*ROA*), the

[16] There are insufficient clusters to cluster the standard errors by bank and year.

ratio of cash and liquid assets to total assets (*Cashholdings*) and the ratio of the book value of common equity to total assets (*Common equity ratio*). To control for subordinated debt characteristics (*Subordinated bond characteristics*), I include the logarithm of the amount issued of the security in millions of constant 2017 Australian dollars (*Log issue size*), the logarithm of the time-to-maturity in years (*Log TTM*), and a dummy variable which equals 1 if the security is callable by the issuer (*Callable*). Considering that macroeconomic factors could also result in credit spread differences between old-style and bail-in subordinated bonds, I further control for the default risk premium in the corporate bond market in general (*Default premium*), the term structure premium (*Term premium*) and the level of S&P/ ASX 200 VIX index (*VIX*).

If investors anticipate the possibility of being exposed to potential future bank loses on account of the Basel III loss absorbency mechanism for tier 2 capital instruments when pricing bail-in subordinated debt, it is expected that the coefficient on the *PONV* dummy variable will be significantly positive. The regression results for fixed-rate and floating-rate subordinated bonds are reported in panels A and B of table 4.6. Consistent with the prior expectation, the coefficient on the *PONV* dummy variable in all regressions, applying the different risk proxies, is positive and statistically significant. The regression results provide evidence that investors in the Basel III bail-in subordinated bonds take account of the Basel III point of non-viability trigger when making their pricing decision. The coefficient on the *PONV* dummy variable suggests that investors demand an additional risk premium of approximately 73 basis points and 45 basis points for fixed-rate and floating rate securities respectively when investing in the Basel III bail-in subordinated debt, relative to the risk premium they demand for investing in the old-style subordinated bonds. The results are consistent across all regressions, which use bank fixed effects to control for omitted bank-specific factors and use year fixed effects to control for any other factors that are common to all sample banks.

If investors of subordinated debt securities demand higher compensation for trading securities issued by riskier banks, the coefficients on the five alternate risk variables for measuring bank risk are expected to be positive and significant. In panel A, the significantly positive coefficients in front of two of the risk measures (columns 1 and 2), namely, $-MertonDD$ and *Equity volatility*, provide support for the idea that subordinated debt

Table 4.5: Impact of the point of non-viability trigger on subordinated debt pricing

This table presents regression results for the specification, $Spread_{i,t} = \alpha_1 PONV_i + \beta_1(Bank\ risk)_{i,t-1} + \gamma_1 Common\ equity\ ratio_{i,t-1} + \sigma_B(Bank\ control\ factors)_{i,t-1} + \sigma_S(Subordinated\ bond\ characteristics)_{i,t} + \sigma_M(Macroeconomic\ factors)_t + YearFE + BankFE + \varepsilon_{i,t}$. The sample period is from January 2013 to December 2017. For fixed-rate securities, *Spread* is the difference in yields between the subordinated debt security and the nearest maturity government bond. For floating-rate securities, *Spread* is the discount margin, which is the difference between the internal rate of return on the subordinated debt cash flows and the reference bank bill swap rate, assuming that the reference rate does not change over the life of the security. *PONV* is a dummy variable which equals 1 if a subordinated debt security is issued with the Basel III loss-absorption feature, i.e. a point of non-viability trigger. *-MertonDD* is the negative distance-to-default calculated using the Merton model. *Equity volatility* is the standard deviation of the bank's equity returns over the past twelve months. *Idiosyncratic volatility* is the residual standard error estimated for the bank's common equity using a rolling market index model over the past 130 trading days. *NPL* is non-performing loans divided by total loans. *Trading assets* is the bank's trading book to total assets ratio. *Common equity ratio* is the book value of common equity divided by the book value of assets. *ROA* is the return on assets, computed as net income divided by average assets. *Cash holdings* is cash holdings divided by total assets. *Log issue size* is the logarithm of the issue size of the subordinated debt security in constant 2017 dollars. *Log TTM* is the logarithm of the term-to-effective maturity of the subordinated debt security. *Callable* is a dummy variable which equals 1 if the security is callable by the issuer on a pre-defined date. *Term spread* is the term structure premium, measured by the yield spread between 10-year Australian Government bonds and 90-day bank accepted bills. *Default premium* is the default risk premium, measured by the yield spread between bonds in the S&P/ASX corporate bond index and Australian Government bonds with nearest average time-to-maturity. *VIX* is the level of S&P/ASX 200 VIX index. Robust t-statistics in parentheses are based on standard errors clustered at both the security and month-end date levels. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

Panel A: Fixed-rate bonds

	Dependent variable: Credit spread				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Independent variables	**- MertonDD**	**Equity volatility**	**Idiosyncratic volatility**	**NPL**	**Trading assets**
PONV (α_1)	0.732***	0.732***	0.743***	0.756***	0.752***
	(3.48)	(3.48)	(3.50)	(3.43)	(3.54)
Bank Risk (β_1)	0.057**	0.016***	0.021	-0.059	-0.022
	(2.47)	(3.14)	(0.55)	(-0.89)	(-1.26)
Common equity ratio (γ_1)		-0.028	-0.016		
		(-0.38)	(-0.23)		
ROA (σ_1)	-0.583***	-0.619***	-0.643***	-0.708***	-0.661***
	(-3.69)	(-4.07)	(-3.96)	(-3.76)	(-4.22)
Cash holdings (σ_2)	0.002	0.002	0.002	0.001	0.002
	(0.52)	(0.45)	(0.42)	(0.16)	(0.56)
Log TTM (σ_3)	0.022	0.022	0.020	0.018	0.016
	(0.60)	(0.61)	(0.54)	(0.46)	(0.44)
Log issue size (σ_4)	-0.029	-0.029	-0.026	-0.028	-0.025
	(-0.48)	(-0.48)	(-0.43)	(-0.46)	(-0.42)
Callable (σ_5)	0.410***	0.411***	0.411***	0.404***	0.404***
	(4.70)	(4.72)	(4.70)	(4.65)	(4.61)
Term premium (σ_6)	0.039	0.033	0.078	0.065	0.083
	(0.42)	(0.38)	(0.79)	(0.64)	(0.86)
Default premium (σ_7)	0.728***	0.701***	0.837***	0.825***	0.857***
	(3.60)	(3.48)	(4.01)	(3.87)	(4.17)
VIX (σ_8)	0.023***	0.022***	0.032***	0.032***	0.032***
	(3.74)	(3.64)	(3.99)	(3.97)	(3.83)
Observations	1,389	1,389	1,389	1,389	1,389
No of banks	5	5	5	5	5

No of subordinated bonds	46	46	46	46	46
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.571	0.571	0.567	0.568	0.569

Panel A: Floating-rate bonds

	Dependent variable: Credit spread				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Independent variables	**- MertonDD**	**Equity volatility**	**Idiosyncratic volatility**	**NPL**	**Trading assets**
PONV (α_1)	0.446***	0.447***	0.449***	0.454***	0.485***
	(3.47)	(3.50)	(3.52)	(3.40)	(3.74)
Bank Risk (β_1)	0.015	0.007	0.079	-0.063*	-0.017
	(0.50)	(0.96)	(0.53)	(-1.92)	(-0.78)
Common equity ratio (γ_1)		-0.164***	-0.133**		
		(-3.60)	(-2.40)		
ROA (σ_1)	-0.667***	-0.679***	-0.674***	-0.634***	-0.507**
	(-3.31)	(-3.51)	(-3.38)	(-3.19)	(-2.26)
Cash holdings (σ_2)	0.004	0.003	0.004	0.005	0.006***
	(1.07)	(1.03)	(0.97)	(1.51)	(9.17)
Log TTM (σ_3)	0.086*	0.087*	0.084*	0.087*	0.087*
	(1.77)	(1.78)	(1.78)	(1.87)	(1.91)
Log issue size (σ_4)	-0.407**	-0.406**	-0.406**	-0.421***	-0.390**
	(-2.51)	(-2.49)	(-2.51)	(-2.61)	(-2.58)
Callable (σ_5)	-0.738***	-0.731***	-0.732***	-0.735***	-0.775***
	(-3.57)	(-3.47)	(-3.52)	(-3.50)	(-3.85)
Term premium (σ_6)	0.374***	0.361***	0.377***	0.386***	0.389***
	(4.38)	(4.35)	(5.02)	(5.33)	(5.52)
Default premium (σ_7)	0.965***	0.926***	0.973***	1.048***	1.120***
	(4.34)	(3.94)	(4.35)	(4.87)	(5.09)
VIX (σ_8)	0.013**	0.012*	0.015**	0.015**	0.016***
	(2.16)	(1.95)	(2.30)	(2.35)	(2.67)
Observations	861	861	861	861	800
No of banks	8	8	8	8	8
No of subordinated bonds	29	29	29	29	29
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.812	0.812	0.812	0.817	0.771

investors demand a higher compensation for investing in banks with a higher risk of insolvency, as captured by the negative distance-to-default and common equity volatility. However, the estimated coefficients on the other risk measures are statistically insignificant or negative (columns 3, 4 and 5 in panel A and columns 1 to 5 in panel B). There is no evidence that investors price subordinated bonds based on bank risk captured by idiosyncratic equity volatility, non-performing loans or trading assets. Analysis on whether the Basel III point of non-viability trigger may result in an increased sensitivity of credit spreads to bank risk is reported in the next subsection.

To disentangle the effect of the Basel III bail-in mechanism from other factors that might impact on the credit spreads of subordinated debt securities, the model includes variables to control for other subordinated debt characteristics, bank-level characteristics and macroeconomic conditions. With regard to variables measuring subordinated debt security characteristics, the significant and negative coefficient on *Log issue size* in the floating-rate security regressions (panel B) is consistent with a benefit of larger issues to subordinated debt investors, derived from better liquidity in the secondary market. However, the coefficient on this variable is insignificant in the fixed-rate subordinated debt regressions (panel A). The estimated coefficient on $Log\ TTM$ is positive and significant at the 10% level in all of the floating-rate subordinated debt regressions, which suggests that the default premiums are higher for floating-rate subordinated debt securities with longer times remaining to maturity. The results indicate a significantly positive relationship between credit spreads and the dummy variable $Callable$ in the fixed-rate security regressions. With bonds that have a call option, the issuer may buy back the bonds from investors at a pre-defined call date, which is valuable to the issuer when interest rates go down and bond prices increase. However, the coefficient on $Callable$ in floating-rate security regressions is significantly negative. This result is unexpected, but likely arises from the unbalanced sample, with almost all of the floating-rate bonds being callable by the issuer.

In relation to characteristics of the bank that has issued the subordinated bond, the regressions include the ratio of common equity to total assets to control for the bank's solvency position, the return on assets to control for the bank's profitability and the ratio of cash holdings to total assets for the bank's liquidity position. The book value of the bank's total assets is excluded from the regressions, due to its high collinearity with the issue size of the subordinated bonds and with the bank fixed effects. Also, to avoid collinearity with the bank risk measures, the common equity ratio is omitted as an explanatory variable if the risk measure incorporates the bank's capital adequacy (as is the case for $-MertonDD$, $Equity\ volatility$ and $Idiosyncratic\ volatility$). It is expected that the coefficient on the $Common\ equity\ ratio$ will be negative and significant if the credit spreads for the subordinated bonds are sensitive to the bank's capital position. The results show a significant and negative coefficient on the $Common\ equity\ ratio$ in the floating-rate bond regressions having NPL and $Trading\ assets$ as the risk variables, which suggests that the credit spreads are sensitive to the banks' common equity position. If investors take account of a bank's profitability and operating efficiency, I expect to observe a negative coefficient on the bank's lagged return on assets. The negative and significant coefficient on ROA in all of the regressions for both fixed-rate and floating-rate subordinated bonds suggests that investors view banks with better profitability and greater operating efficiency as less likely to become financially distressed. The coefficient on cash holdings is expected to be negative if investors in subordinated bonds perceive that banks with more liquid assets have greater capacity to meet future payment obligations. However, the coefficient on $Cash\ holdings$ is not significantly negative in any of the regressions.

To allow for changes in credit market conditions over the sample period, the regressions include the term premium, the default premium and the level of S&P/ASX 200 VIX index. It is expected that the credit spreads for subordinated debt securities will be positively related to the slope of the yield curve. Consistent with this expectation, in all of the floating-rate bond regressions, the coefficient on the $Term\ premium$ variable is positive and significant. The coefficient on the $Default\ premium$ variable is positive and significant in all of the regressions in both panel A and panel B. This suggests that changes in credit spreads for banks' subordinated bonds are closely related with conditions prevailing in the Australian corporate bond market. The regression results for both fixed-rate and floating-rate securities indicate a significantly positive relationship between the credit spreads for bank subordinated bonds and the level of S&P/ASX 200 VIX index, which suggests that aggregate uncertainty in the securities market has a significant influence on the pricing of bank subordinated debt.

4.4.3 Impact of the point of non-viability trigger on the relation between bank risk and subordinated debt pricing

One explanation for the results reported in table 4.6 is that investors in Basel III bail-in subordinated debt securities demand an additional risk premium compared with old-style securities because they anticipate being exposed to potential future bank losses if the bank breaches the discretionary point of non-viability trigger. However, previous studies argue that the additional risk premium might be attributable to the uncertainty associated with the way in which the regulator's will exercise in discretion in relation to the non-viability trigger, rather than to an increased exposure to potential bank losses (see for example, Davis & Saba (2016)). If investors in Basel III bail-in subordinated bonds have greater exposure to potential bank losses than those in conventional securities issued without the loss-absorption feature, they can be expected to be more sensitive to the bank's risk profile when pricing the securities. To address this question, the analysis reported in this subsection examines whether the Basel III bail-in feature affects the risk-sensitivity of the credit spreads for subordinated bonds. The pricing regression model is augmented with an interaction term between the *PONV* dummy variable and the measure of bank risk, as well as an interaction term between the *PONV* dummy variable and the equity capital ratio. Using this approach, the main effects of the risk variable and the equity capital ratio capture the sensitivity of credit spreads to bank risk and equity capital for investors in the old-style subordinated bonds, while the interaction terms capture the incremental sensitivity of credit spreads to bank risk and equity capital for investors when investing in bail-in subordinated bonds with the Basel III point of non-viability trigger. Investors are expected to be better incentivised to monitor bank risks if the loss-absorbing capacity of the subordinated bonds is improved, which would be reflected in an increased sensitivity of security credit spreads to bank risk and equity capital. If investors are more sensitive to bank risk, I expect to observe positive and significant coefficients on the interaction terms between the *PONV* dummy variable and bank risk and between the *PONV* dummy variable and equity capital.

Table 4.8 presents the regression results for fixed-rate bonds (panel A) and floating-rate bonds (panel B). The estimated coefficients on the main risk variables are not positive and significant in any of these regression for either fixed-rate or floating-rate subordinated bonds. There is no evidence that the credit spreads for conventional subordinated debt securities

Table 4.7: Impact on the relation between bank risk and subordinated debt pricing

This table presents regression results for the specification, $Spread_{i,t} = \alpha_1 PONV_i + \beta_1(Bank\ risk)_{i,t-1} + \beta_2 PONV_i \times (Bank\ risk)_{i,t-1} + \gamma_1 Common\ equity\ ratio_{i,t-1} + \gamma_2 PONV_i \times Common\ equity\ ratio_{i,t-1} + \sigma_B(Bank\ control\ factors)_{i,t-1} + \sigma_S(Subordinated\ bond\ characteristics)_{i,t} + \sigma_M(Macroeconomic\ factors)_t + YearFE + BankFE + \varepsilon_{i,t}$. The sample period is from January 2013 to December 2017. For fixed-rate securities, *Spread* is the difference in yields between the subordinated debt security and the nearest maturity government bond. For floating-rate securities, *Spread* is the discount margin, which is the difference between the internal rate of return on the subordinated debt cash flows and the reference bank bill swap rate, assuming that the reference rate does not change over the life of the security. *PONV* is a dummy variable which equals 1 if the subordinated debt security is issued with the Basel III loss-absorption feature, i.e. a point of non-viability trigger. *-MertonDD* is the negative distance-to-default calculated using the Merton model. *Equity volatility* is the standard deviation of the bank's equity returns over the past twelve months. *Idiosyncratic volatility* is the residual standard error estimated for the bank's common equity using a rolling market index model over the past 130 trading days. *NPL* is non-performing loans divided by total loans. *Trading assets* is the bank's trading book to total assets ratio. *Common equity ratio* is the book value of common equity divided by the book value of assets. *ROA* is the return on assets, computed as net income divided by average assets. *Cash holdings* is cash holdings divided by total assets. *Log issue size* is the logarithm of the issue size of the subordinated debt security in constant 2017 dollars. *Log TTM* is the logarithm of the term-to-effective maturity of the subordinated debt security. *Callable* is a dummy variable which equals 1 if the security is callable by the issuer on a pre-defined date. *Term spread* is the term structure premium, measured by the yield spread between 10-year Australian Government bonds and 90-day bank accepted bills. *Default premium* is the default risk premium, measured by the yield spread between bonds in the S&P/ASX corporate bond index and Australian Government bonds with nearest average time-to-maturity. *VIX* is the level of S&P/ASX 200 VIX index. Robust t-statistics in parentheses are based on standard errors clustered at both the security and month-end date levels. ***, **, and * indicate significance at 1%, 5% and 10% levels, respectively.

Panel A: Fixed-rate bonds

	Dependent variable: Credit spread				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Independent variables	**- MertonDD**	**Equity volatility**	**Idiosyncratic volatility**	**NPL**	**Trading assets**
PONV (α_1)	1.291***	0.107	0.502**	0.856	0.970*
	(3.81)	(0.47)	(2.02)	(0.65)	(1.70)
Bank Risk (β_1)	0.022	0.005	0.019	-0.058	-0.016
	(1.03)	(0.88)	(0.51)	(-1.27)	(-0.81)
PONV $\times$ Bank Risk (β_2)	0.122***	0.030***	0.331*	-0.006	-0.021
	(3.03)	(3.12)	(1.84)	(-0.04)	(-0.72)
$\beta_1 + \beta_2$	0.144***	0.035***	0.351*	-0.064	-0.037
	(4.52)	(4.68)	(1.89)	(-0.41)	(-1.31)
Common equity ratio (γ_1)				-0.026	-0.014
				(-0.35)	(-0.19)
PONV $\times$ Common equity ratio (γ_2)				-0.014	-0.003
				(-0.10)	(-0.03)
$\gamma_1 + \gamma_2$				-0.040	-0.017
				(-0.26)	(-0.15)
ROA (σ_1)	-0.668***	-0.733***	-0.680***	-0.704***	-0.568***
	(-4.19)	(-4.60)	(-4.12)	(-3.52)	(-3.20)
Cash holdings (σ_2)	0.000	0.000	0.001	0.001	0.003
	(0.05)	(0.10)	(0.36)	(0.14)	(0.67)
Log TTM (σ_3)	0.023	0.022	0.020	0.018	0.011
	(0.63)	(0.62)	(0.54)	(0.44)	(0.27)
Log issue size (σ_4)	-0.016	-0.022	-0.023	-0.028	-0.022
	(-0.26)	(-0.36)	(-0.38)	(-0.45)	(-0.36)

Callable (σ_5)	0.415***	0.411***	0.415***	0.404***	0.389***
	(4.66)	(4.68)	(4.73)	(4.75)	(4.83)
Term premium (σ_6)	0.034	0.037	0.075	0.065	0.094
	(0.39)	(0.44)	(0.77)	(0.66)	(0.98)
Default premium (σ_7)	0.635***	0.613***	0.807***	0.823***	0.900***
	(3.12)	(3.09)	(3.75)	(3.74)	(4.30)
VIX (σ_8)	0.022***	0.022***	0.031***	0.032***	0.031***
	(3.60)	(3.79)	(3.92)	(4.00)	(3.84)
Observations	1,389	1,389	1,389	1,389	1,389
No of banks	5	5	5	5	5
No of subordinated bonds	46	46	46	46	46
Adjusted R-squared	0.579	0.580	0.568	0.567	0.571

Panel B: Floating-rate bonds

	Dependent variable: Credit spread				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Independent variables	**- MertonDD**	**Equity volatility**	**Idiosyncratic volatility**	**NPL**	**Trading assets**
PONV (α_1)	0.962***	-0.118	0.343**	0.713	-0.833
	(4.70)	(-0.82)	(2.19)	(1.04)	(-0.89)
Bank Risk (β_1)	-0.028	-0.006	0.021	-0.077**	-0.029
	(-1.36)	(-0.92)	(0.15)	(-2.14)	(-1.35)
PONV $\times$ Bank Risk (β_2)	0.108***	0.029***	0.151	0.030	0.043*
	(3.73)	(4.21)	(0.84)	(0.38)	(1.89)
$\beta_1 + \beta_2$	0.080**	0.023**	0.172	-0.047	0.014
	(2.12)	(2.85)	(0.92)	(-0.73)	(0.55)
Common equity ratio (γ_1)				-0.160***	-0.223***
				(-2.88)	(-3.12)
PONV $\times$ Common equity ratio (γ_2)				-0.048	0.168
				(-0.46)	(1.20)
$\gamma_1 + \gamma_2$				-0.021**	-0.055
				(-2.27)	(-0.56)
ROA (σ_1)	-0.729***	-0.711***	-0.707***	-0.617***	-0.585**
	(-3.56)	(-3.59)	(-3.55)	(-3.13)	(-2.58)
Cash holdings (σ_2)	0.006*	0.006***	0.004	0.003	0.006**
	(1.91)	(3.43)	(1.38)	(.)	(1.99)
Log TTM (σ_3)	0.075	0.082*	0.082*	0.081*	0.080*
	(1.59)	(1.70)	(1.73)	(1.72)	(1.71)
Log issue size (σ_4)	-0.413***	-0.410***	-0.411**	-0.426**	-0.391***
	(-2.61)	(-2.58)	(-2.52)	(-2.53)	(-2.60)
Callable (σ_5)	-0.855***	-0.827***	-0.814***	-0.686**	-1.122***
	(-4.04)	(-3.72)	(-3.26)	(-2.48)	(-2.92)
Term premium (σ_6)	0.374***	0.373***	0.377***	0.381***	0.389***
	(4.58)	(4.75)	(5.04)	(5.27)	(5.43)
Default premium (σ_7)	0.931***	0.902***	0.959***	1.052***	1.110***
	(4.15)	(3.87)	(4.30)	(4.86)	(5.05)
VIX (σ_8)	0.014**	0.013**	0.015**	0.015**	0.018***
	(2.38)	(2.19)	(2.36)	(2.35)	(2.90)
Observations	861	861	861	861	800
No of banks	8	8	8	8	8
No of subordinated bonds	29	29	29	29	29
Adjusted R-squared	0.819	0.822	0.812	0.817	0.773

are sensitive to the risks captured by the market value-based measures ($-MertonDD$, $Equity\ volatility$ and $Idiosyncratic\ volatility$) or the accounting-based measures (*NPL* and $Trading\ assets$). This can possibly be explained by the fact that, before the Basel III reforms were implemented, subordinated debt investors were not required to absorb bank losses until a bank entered a formal bankruptcy process. The Basel III bail-in rule attempts to increase the exposure of subordinated debt investors to bank losses by applying discretionary point of non-viability trigger mechanism to these securities. Among the interaction terms between the *PONV* dummy variable and bank risk, those involving the negative distance-to-default and equity volatility are positive and significant in the regressions for both fixed-rate and floating-rate bonds (columns 1 and 2 in panel A and panel B). In addition, for fixed-rate bonds, the coefficient on the interaction term between the *PONV* dummy variable and $Idiosyncratic\ volatility$ is positive and statistically significant at the 10% level. However, the coefficients on the interaction terms between the *PONV* dummy variable and the accounting-based risk measures, *NPL* and $Trading\ assets$, are not statistically significant, which may be a consequence of less timely nature of the accounting data. These results based on the market-derived risk measures in the Basel III bail-in subordinated bonds are more responsive to banking risks in their pricing decisions than investors in the old-style subordinated bonds. This finding is consistent with the idea that the point of non-viability trigger is recognised by investors as giving them greater potential exposure to bank losses.

The regressions reported in columns 4 and 5 include the main effect of the $Common\ equity\ ratio$ and the interaction term between the *PONV* dummy variable and $Common\ equity\ ratio$. The coefficient on the interaction term can be expected to be negative if the probability of non-viability trigger being activated is lower for better capitalised banks. As reported in table 4.8 panel B, the coefficient on the main effect of the $Common\ equity\ ratio$ is negative and significant. However, the coefficient on the interaction term $PONV \times Common\ equity\ ratio$ is insignificant in all of the regression for both fixed-rate and floating-rate bonds. Thus, there is no evidence that investors are more responsive in their pricing decisions to a bank's equity capital position on account of the gone-concern loss-absorption mechanism.

In summary, the results reported in table 4.8 suggest that, all else being equal, compared with the conventional subordinated debt securities, the pricing of bail-in subordinated debt is more sensitive to bank default risk as captured by market -based measures i.e., the negative Merton distance-to-default, common equity volatility and idiosyncratic equity volatility. There is no evidence that the pricing of Basel III bail-in subordinated debt is more sensitive to the bank's common equity position. In general, the results provide evidence about the credibility assigned by investors to the Basel III point of non-viability trigger mechanism, which is consistent with the investors anticipating that they have greater potential exposure to bank losses under the new regime.

4.5 Summary

To address the moral hazard problem highlighted by the 2007-2009 financial crisis and shortcomings in the resolution procedures for gone-concern banks, the Basel III reforms introduced a regulatory discretionary loss absorbency requirement for subordinated debt to qualify as tier 2 capital under international standards. Australian banks began transitioning to the new requirement from the beginning of 2013. If the regulator declares the bank to be non-viable, subordinated bonds with the non-viability trigger are converted to common equity or written-off, which gives the regulator greater flexibility in imposing losses on subordinated creditors. While Australian banks started to issue Basel III bail-in subordinated bonds, the conventional subordinated bonds, i.e., those without the point of non-viability trigger, are phased out over a ten-year period to 2023. Using secondary market data for subordinated debt securities issued by Australian banks and traded by investors in the period from January 2013 to December 2017, this study examines the impact of the Basel III point of non-viability trigger on the credit spreads of the subordinated bonds. I find evidence suggesting that the loss-absorption mechanism is taken into account by investors when they are pricing the Basel III bail-in debt securities. The results suggest that investors require a bail-in risk premium associated with the discretionary point of non-viability trigger mechanism. This pricing effect is evident when controlling for other debt security characteristics, bank profitability and financial strength, and macroeconomic factors. The average bail-in risk premium is estimated to be approximately 73 basis points for fixed-rate subordinated bonds and 45 basis points for floating-rate subordinated bonds.

To further elucidate about the credibility of the discretionary trigger mechanism for imposing potential bank losses on subordinated creditors, this study examines whether the Basel III discretionary bail-in feature has resulted in an increased sensitivity of the credit spreads on subordinated debt securities to bank risks. The results suggest that the pricing of Basel III bail-in subordinated bonds has become more sensitive to bank risk as captured by market-based measures, i.e., the negative Merton distance-to-default, common equity volatility and idiosyncratic equity volatility. These findings are consistent with the idea that investors in the Basel III bail-in subordinated bonds have greater potential exposure to banking losses than investors in the old-style subordinated bonds.