HUNTING THE BIRP: IS THERE A "BAIL-IN RISK PREMIUM" IN AUSTRALIAN BANK HYBRIDS?

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Abstract
Regulatory requirements have led many banks to issue "bail-in" securities in recent years, often targeted at retail investors who are unlikely to be able to assess the risks associated with the bail-in feature. This paper examines use of these securities by Australian banks, argues that they are characterised by uncertainty rather than by risk which can be modelled probabilistically, and applies a number of empirical tests to determine to what extent "bail-in" risks are priced.

Keywords:

Contingent Capital, Bail-In Securities, Risk Premium, Regulatory Capital, Basel

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1. Introduction.

In 2011 as part of Basel 3, the Basel Committee introduced changes to capital standards aimed at, *inter alia*, achieving higher quality regulatory capital. The types of hybrid financial instruments eligible for inclusion as regulatory capital were reduced, and focus given to new "bail-in" securities. The defining characteristic of such securities is that in the event of some declared "non-viability" trigger being met, some, or all, of the securities would be written down or converted (according to some prescribed formula) into common equity. The trigger could be either breach of a specified risk-weighted, common equity tier 1 (CET1) capital ratio (5.125 per cent of risk weighted assets has been used) or a declaration of "point of non-viability" (PONV) by the relevant supervisor.[1] Only securities which included bail-in provisions would be eligible for inclusion as additional Tier 1 (AT1) capital, and some jurisdictions such as Australia have applied that requirement also for inclusion as Tier 2 (T2) capital.

There has been substantial issuance of various types of such securities worldwide.[2] The first issue (prior to the 2011 Basel 3 changes) as part of its restructuring was by Lloyds Bank in the UK in 2009 of GBP 8.3 billion of Enhanced Capital Notes. Further significant growth in the market can be anticipated when Total Loss Absorbency Capital (TLAC) requirements for Systemically Important Banks at a global level (GSIBs) and domestic level (DSIBs) are finally implemented.

Since "bail-in" is a new type of risk associated with such securities, it could be expected that there would be a bail-in risk premium (BIRP), reflecting conversion risk, associated with the pricing of these securities. The extent of any such BIRP would depend upon the structure of the securities, including the likelihood of bail-in and the extent to which bail-in imposes losses upon holders of the securities which would not be incurred by holders of otherwise equivalent (non-bail-in) securities. If a BIRP exists it should be reflected in the required rates of return of investors and thus in yields specified at issuance and subsequently observed in secondary market trading. While the BIRP is akin to a credit spread, it does not reflect

[1] In the original version of the standards requiring a "bail-in" condition for hybrid securities to count as regulatory capital, an undefined "objective" pre-specified trigger was a requirement (BCBS, 2011a, p11). Subsequently (BCBS, 2011b) that has been replaced by a "subjective" PONV trigger requirement.
[2] De Spiegeleer et al (2015) estimate the global size in 2015 to be EU 120 billion.

default risk *per se*, but rather potential loss due to conversion risk, and thus warrants specific attention.

Australian banks have made substantial use of bail in securities, often structured as a form of preference share, reflecting the lack of a tax bias against equity securities in Australia due to the dividend imputation tax system. While some bail-in securities have been issued into wholesale markets (both domestic and international) more often as a debt instrument, a significant part of the target investor market has been retail investors. Those securities are listed on the Australian Stock Exchange (ASX) facilitating assessment of how pricing and the BIRP has responded to relevant risk factors both at the time of primary issuance and in subsequent secondary market trading.

Because these securities are a relatively new concept, with new risk features, and little pricing history, there is the risk of significant mispricing. That is amplified by the fact that they are often available to retail investors. In the UK, the Financial Conduct Authority (FSA, 2014), holding a view that retail investors were unable to adequately assess the risks, placed a temporary ban on sales of such securities to retail investors, and subsequently (FSA, 2015) introduced strict requirements limiting sales to retail investors. In Australia, ASIC (2013) pointed out the difficulties in providing retail investors with clear and concise information about the risks in such securities.

Particularly for retail investors, it is conceivable that the BIRP is close to zero. They may not understand the risks from, and thus do not require compensation for, conversion under stress. Or it may be that the perceived probability of a conversion event (including perceptions of political will to enforce a bail-in) occurring is near zero.[3] But more generally, because of the opacity of the risk involved there may be little conversion-risk sensitivity of pricing, such that the BIRP does not vary adequately in response to factors relevant to the likelihood of, or loss from, conversion.

The importance of conversion-risk sensitivity of pricing is noted in a recent review of contingent capital literature by Flannery (2014, p237) who argues that "the success of orderly resolution depends on supervisors acting aggressively on the basis of slowly

[3] Initial primary market pricing is generally determined by a book build process among institutional investors and brokers providing "broker-firm offers" to retail clients. While there is generally also an open retail offer at the price established in the bookbuild, only a very small proportion of the issue is generally sold this way.

deteriorating bail-in-able bond prices". Flannery notes that much recent academic research has been directed towards modelling the design of contingent convertible capital instruments ("cocos") and consequent implications for incentives, risk-taking, and pricing. But these models do not generally reflect the actual features of "bail-in" securities issued in recent years by banks – such as those issued in Australia which can have bail-in triggers involving either or both of an accounting capital ratio trigger or a regulatory discretion (declaration of PONV) trigger.

This paper thus addresses four research questions in the context of the Australian experience. First, is there evidence of a non-zero BIRP? Second, if there is, what is its typical level? Third, is there any evidence that the BIRP differs between different types of investors (such as retail versus institutional)? Fourth, do cross-sectional and inter-temporal variations in the BIRP provide evidence of conversion risk being reflected in the BIRP, and thus the likelihood of actual, Basel compliant, bail-in security prices being a potential indicator to prompt aggressive supervisory action.

The approach adopted involves first comparing pricing of bail-in securities relative to other bank liabilities not involving such risk to assess the size of the BIRP. Second, pricing in retail and wholesale markets for bail-in securities is considered to assess whether there are differences in the BIRP required by retail and wholesale investors. . Third, the empirical relevance of potential determinants of cross sectional and intertemporal variations in market yields on bail-in securities is examined. Finally, a marked change in the level of the BIRP from mid 2014 is noted and some conjectures offered for its causes.

"Appropriate" pricing requires the ability to model the risks of such securities using some form of asset pricing model such as contingent claims valuation. However, the actual design of bail-in securities issued to date in Australia involve features which make use of such techniques problematic at best. Those features (outlined in more detail in section 3) include imprecise specification of the bail-in trigger event, imprecise specification of the actual conversion arrangements, difficulties in modelling the likely actions of bank management if the probability of bail-in is high, and conversion arrangements which make the value of bailed-in positions dependent upon the market response to the announcement that bail-in

has occurred. [4] For this reason, the bail-in securities are more appropriately characterised as involving "uncertainty" in the Knightian sense (Knight, 1921) rather than risk which can be modelled probabilistically.[5]

> "But uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated.... The essential fact is that 'risk' means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating.... It will appear that a measurable uncertainty, or 'risk' proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all." Knight (1921, pp19-20).

Consequently, the focus of this paper is more upon whether there is evidence that bail-in risk is priced rather than attempting to precisely model the determinants of and specific value which should be attached to such uncertainty/risk.[6]

The following section provides a very brief review of the regulatory decisions prompting use of bail-in bonds and of the available literature on pricing of contingent capital securities. It notes the differences between actual design features of Basel compliant bail in securities and those generally assumed in models used to price contingent capital in the academic literature. Then section 3 outlines the regulatory background to recent use of bail-in securities in Australia, and examines their characteristics in more detail. Section 4 then draws on that discussion of relevant design features to argue that "uncertainty" of investment outcomes rather than "risk" is a key feature for investors and issuers which makes security valuation and determination of an appropriate BIRP difficult. Section 5 provides information about the size and key features of the Australian bail-in market and data to be used in the empirical work. The following section presents a range of empirical

[4] Adding to these problems is the fact that many Australian bail-in securities have been designed to provide tax benefits to certain (domestic) investors, making valuation dependent upon the valuation of those tax benefits.
[5] King (2016) refers to this as "radical uncertainty" and argues for its relevance to be considered more thoroughly in modelling of financial and economic markets.
[6] It should be noted that even if there is no evidence of risk sensitivity of pricing at or soon after issuance, when bank solvency is high, this does not imply that this will remain the case at later times if concerns over solvency arise.

tests aimed at discovering whether there is evidence of a BIRP and, if so, whether its size is linked to observable risk-related characteristics of issuers or the securities. It is estimated that, for securities aimed primarily at retail investors, the BIRP for Tier 2 instruments is relatively small, at around 50 basis points, while AT1 instruments have an additional BIRP of around 200 basis points. There is some suggestive evidence of a higher BIRP for securities marketed to the wholesale/international markets. There is little evidence, to date, of security specific risk factors (as opposed to general or observable bank specific factors) explaining cross-sectional or time-series variations in the BIRP, and reasons for the marked increase in the BIRP since mid-2014 are a matter of conjecture. The conclusion considers the implications of these findings for regulatory policy towards design and issuance of bail-in securities.

2. Basel Bail-in requirements and the "Cocos" Literature

Bail-in securities came to prominence as a form of bank regulatory capital with the announcement of the Basel 3 revisions to capital requirements (BCBS, 2011). Previously, under Basel 2 (BCBS, 2006) various types of hybrid securities and subordinated debt had been allowable, within limits, as Tier 1 or 2 regulatory capital. Potential for going-concern loss-absorbency had been a condition required for hybrid securities to qualify as Tier 1 capital. However the experience of the global financial crisis demonstrated the inadequacy of those loss absorbency arrangements to assist distressed banks to restore core equity capital levels. Indeed, as Flannery (2014) notes, the resulting debt-overhang problem may actively reduce the incentive to issue new equity and encourage other less socially desirable responses (asset fire sales, balance sheet shrinkage) to try and meet regulatory capital requirements.

The Basel 3 changes to eligibility as regulatory capital involve, *inter alia*, mandatory conversion into common equity or write down, if a specified trigger is reached. For inclusion as Additional Tier 1 (AT1) regulatory capital as part of "going concern" capital, a pre-specified trigger point (such as the 5.125 per cent CET1 ratio and PONV) is required. This will generally be incorporated into the contractual conditions for such securities, giving some apparent similarity to the "cocos" discussed below and which have been the main focus of the academic literature. Tier 2 capital or "gone concern" capital, typically debt instruments, are only required to absorb losses in liquidation under the Basel guidelines. However as part

of bank resolution arrangements, regulators will have the discretionary power to "bail-in" holders of certain securities, such that Tier 2 capital instruments face this risk – which may also be made explicit in contract terms.[7]

In Australia, the prudential regulator (APRA) has enforced stringent conversion/write down requirements based on the Basel standards. For both AT1 and Tier 2 eligibility there is a requirement that conversion must occur if APRA makes a PONV declaration (APRA, 2014, Attachment J). This means that Tier 2 capital instruments are generally characterised by a PONV trigger, but not by a capital trigger. Implementation of the new requirements began in January 2013 with a phase-in period to allow for gradual replacement of now ineligible securities with the new bail-in securities to minimise disruption to bank regulatory capital adequacy positions.

The bail-in securities endorsed by the Basel Committee as appropriate for regulatory capital, differ substantially from those considered in the growing academic literature on design and implications of "contingent capital" or "cocos".[8] Flannery (2014) provides a recent overview of this literature – to which he was one of the earliest contributors (Flannery, 2002). Flannery proposed a requirement for a minimum required amount on issue of "reverse convertible debentures" (RCDs) as a mechanism for providing automatic recapitalisation of a banking firm. But, unlike the Basel requirements, and common in much of the subsequent literature, the trigger condition was based on a capital ratio using the stock market value of equity. Thus if the ratio of the market value of equity to the market value of assets fell below some trigger level, conversion of sufficient RCDs into a value of equity equal to their par value would be required.

Problems with such a proposal, which subsequent papers have sought to address, include the unobservability of the true market value of assets, the effect of coco design on consequences for uniqueness and stability of equilibrium prices for bank issued securities, and impacts upon incentives. Flannery (2014) provides a valuable summary.

[7] Depending on resolution powers of the bank regulator, many other types of bank liabilities, including senior debt without specific contractual "bail-in" provisions, can be at risk of bail in (with that risk declining with increasing seniority of the claim).

[8] Chennells and Wingfield (2015) stress that "bail-in" as a resolution tool, where regulatory discretion is involved, is a different concept to "cocos" which are securities for which an objective conversion or write down condition is contractually specified.

De Spiegeleer and Schoutens (2012) is one paper which applies conventional asset pricing techniques to examining actual bail-in securities. They note that securities with conversion triggers and specified conversion arrangements could be modelled in a number of different ways including credit derivatives and equity derivatives approaches. They apply their models to bail in securities issued by Lloyds and Credit Suisse, but because both involve triggers based on CET1 ratios, additional assumptions linking stock market equity values to accounting values of assets are required.

Glasserman and Nouri (2012) also apply contingent valuation principles to value hypothetical contingent capital instruments which have a trigger of a regulatory capital ratio. They also assume "progressive" conversion (ie just enough to restore the required capital ratio), and assume correlated stochastic processes for accounting and market value of bank assets to make their analysis tractable. They conclude that "the fair yield for contingent capital in our model is quite sensitive to some of the model's inputs – in particular, the size of the convertible tranche, to the volatility of the firm's assets, and to recovery rates in the event that the firm breaches its minimum capital requirements and is seized by regulators". They note the complications which inability to observe or estimate the latter two of these inputs and general product complexity may create for generating investor demand.

In practice, retail investor demand in Australia (and elsewhere) has been high for bail in securities that are much more complex than those modelled by Glasserman and Nouri, raising the question of whether this can be attributed to provision of an adequate BIRP or to lack of investor understanding of the risks involved. In the following section we examine the features of the Australian bail-in securities and argue that the complexity involved leads to investors facing a problem of valuation under uncertainty rather than risk – which limits the use of standard finance valuation models based on probabilistic modelling of risk.

3. Bail-in securities in Australia: Characteristics and Risks

Australian banks are required to meet capital adequacy requirements imposed by the Australian Prudential Regulation Authority (APRA). From January 1, 2016 these include a minimum CET1 ratio (to risk weighted assets) of 4.5 per cent (which has applied from January 1, 2013), a capital conservation buffer (CET1) of 2.5 per cent, and for the four major

banks designated as D-SIBs an additional 1 per cent giving for them a total CET1 minimum ratio of 8 per cent. The D-SIBS and Macquarie Bank operate under the Advanced Internal Models approach to capital adequacy while the four other smaller banks which have also issued ASX-listed bail-in securities operate under the Standardised approach.

Based on the Basel Committee standards, APRA imposes a number of conditions on contingent capital securities if they are to qualify as Additional Tier 1 capital or Tier 2 capital.[9] These include: non-cumulative distributions (for AT1), subordination to other unsecured creditors, and a "bail-in" requirement. Bail-in could be triggered by a regulatory declaration of point of non-viability (PONV) and/or a capital trigger (CT) involving breach of a specified CET1 capital ratio (set at 5.125 per cent of RWA). Bail-in takes the form of conversion into common equity according to some pre-specified conversion formula or, if the issuer is unable to issue new equity for some reason, write-off of those liabilities. [10]

A further complication is that triggers for some instruments may be related to level 1, level 2 or level 3 capital adequacy.[11] In some cases where banks are a subsidiary of a Non Operating Holding Company (NOHC) structure, such as Suncorp, only a PONV trigger is specified for securities issued by the NOHC (since a capital trigger is not well defined for the NOHC with both banking and insurance subsidiaries operating under different capital regulation). The same also applies for the Macquarie Group and AMP, although the Macquarie bank subsidiary has issued AT1 capital notes (ASX Code, MBLPA) with both triggers.

Substantial use of bail-in capital has been made by Australian Banks (see section 5 below), including securities listed on the Australian Securities Exchange (and generally targeted at domestic retail investors) as well as wholesale (unlisted) domestic and foreign issues (including in foreign currencies). The primary focus of this paper is on the domestic listed

[9] These were finalised in 2012 with effect from January 1, 2013, with the conditions for eligibility as Additional Tier 1 capital leading to a change in the conversion terms of at least one security already on issue (ANZ CPS3, ASX Code ANZPC).

[10] In all cases, the conversion requirement is contractual rather than statutory, creating the possibility that a bail-in decision could be subject to legal challenge.

[11] APRA applies capital adequacy requirements at different levels of group consolidation, with level 1 referring to a stand-alone institution, level 2 being single industry activities such as banking, and level 3 relating to group-wide (conglomerate) activities which span different prudentially regulated and/or non-regulated activities. It is also worth noting that for most Australian banks (including the D-SIBs) the bank is the parent company. Only in the cases of Macquarie, Suncorp and AMP Bank is there a non-operating holding company structure of which the bank is a subsidiary.

securities targeted at retail investors, for which information on primary issuance and secondary market activity is more readily available, although some comparisons with wholesale issuance are made.

All Australian domestic listed issues to date have been floating rate securities (with quarterly or semi-annual resets) paying a fixed margin over the relevant indicator rate (the Bank Bill Swap Rate). A preference share structure is often used because the Australian dividend imputation tax system removes any tax bias towards debt financing when investors are resident taxpayers (by attaching tax credits, based on company tax paid, to dividends paid out).[12] Because, in most cases, the issuers are able to distribute tax credits along with the cash distribution, the distribution rate is typically expressed in those cases as being (BBSW + margin)*(1-t) where t is the corporate tax rate.[13] (For example, if BBSW = 4.00 per cent, the margin is 1.5 per cent, and the corporate tax rate is 0.3, the cash distribution rate would be 3.85 per cent). The Australian dividend imputation tax system means that, because of the tax credits received, domestic investors in the securities effectively receive the equivalent of a cash distribution of (BBSW+margin) on which tax would be paid at their marginal tax rate.[14] (In the example above (where BBSW+margin = 5.5 per cent) a resident investor on a marginal tax rate of, for example, 0.5 would have an after tax return of 2.75 per cent). Foreign investors, who are unable to use the tax credits , thus receive a lower return on such instruments after payment of investor-level taxes than domestic investors, and are typically not holders of these securities. Some of the listed securities (and all of those issued into wholesale/international markets) are issued without tax credits attached to the distributions and thus do not have the tax adjustment applied to the coupon rate.

Many of the ASX listed securities are perpetual, with a mandatory conversion date (subject to certain conditions being met) often around 8 years after issuance, and with an issuer option to redeem the securities at face value typically at a date around two years prior to

[12] However, the conversion arrangements also mean that many bail-in securities structured as debt are classified as equity for tax purposes.

[13] In the few cases where issuers expect that only some part of the distribution will have attached tax credits, a slightly different tax adjustment factor is specified. The effect is, however the same in the sense that the sum of the indicator rate plus margin gives the rate of return on which the investor's tax rate is applied.

[14] If the issuer is unable to distribute tax credits, the terms of the security require it to increase the cash distribution sufficiently to offset the absence of tax credits.

the mandatory conversion date.[15] Some have a fixed maturity and no conversion option or requirement involved. In general mandatory conversion involves, subject to one qualification, receipt of common stock of value (calculated using the VWAP over the preceding 5 days) equal to a small increment (approximately 1 per cent) over the par value of the instrument.[16]

The nature of bail-in conversion is in most cases similar to mandatory conversion, but with one main difference. Typically a $100 security will convert into $100 of common equity with the number of shares received given by $\$100/S_T$ where S_T is the VWAP share price over the five days before the conversion date. However, if the conversion date bank's VWAP is below 20 per cent of the share price at the date of issuance of the securities (S_0), a maximum conversion ratio of $N^{max} = \$100/0.2S_0$ applies. This means that the investor faces a loss (which increases as the share price declines) if the share price has fallen below $0.2S_0$ at the conversion date. There are a range of different trigger and conversion arrangements currently applying, in part due to the transitional arrangements in place for hybrid securities issued prior to the implementation of the Basel 3 arrangements. Table 1 provides selected AUD denominated examples for the case of ANZ Bank as at December 2015. (A number of foreign currency denominated examples were also on issue). Additional Tier 1 instruments all provide tax (franking) credits as part of the distribution, and those which are perpetual have a mandatory conversion date specified (subject to meeting specified conditions). However, for all instruments shown, the bank has a call option (subject to APRA's approval – involving a requirement to issue new replacement regulatory capital instruments) prior to either the mandatory conversion or maturity date. For ANZPC, which only has transitional status as regulatory capital, only a capital ratio trigger is specified and full conversion is required. For other securities, conversion may be partial or full, involving conversion into equity sufficient to restore the CET1 ratio to "a percentage above" 5.125 per cent, where no guidance is given as to what that percentage is. Not all instruments in a given Tier rank

[15] This requires APRA approval, including (generally) that similar eligible replacement securities are to be issued. Given prevailing views among bankers that the cost of CET1 exceeds that of AT1 or Tier 2 instruments, exercise of the option rather than allowing conversion into CET1 would generally be expected.

[16] The qualification is that a maximum number of shares to be received is specified and calculated by dividing the par value by half of the stock's issue date twenty day VWAP. Thus investors would receive a smaller value of stock if the share price at the mandatory conversion date is below half of the issue date price. In practice, however, necessary conditions specified for mandatory conversion to occur are likely to preclude this qualification taking effect and lead to deferral of the mandatory conversion until such time as the necessary conditions are met.

equally nor would share equally in a triggered conversion (due to the transitional nature of some), and some "old-style" instruments benefit from the enhanced seniority due to introduction of newer "bail-in" style instruments.

Table 1: ANZ Bank selected regulatory capital examples, December 2015

Identifier: ASX Code or ISIN	Type	Issue Date	Amount ($Bill)	Bail-In Trigger	Margin (%)	mandatory conversion / maturity date	First issuer call option date
Additional Tier 1 (all with non-cumulative distributions and including tax (franking) credits)							
ANZPC[c]	CPS[a,b]	29/09/11	1.34	CT	3.1*	1/09/19	1/09/17
ANZPD	Capital Note	8/08/13	1.12	PONV/CT	3.4*	1/09/23	1/09/21
ANZPE[c]	Capital Note	1/04/14	1.61	PONV/CT	3.25*	24/03/24	24/03/22
ANZPF[c]	Capital Note	6/03/15	0.97	PONV/CT	3.6*	24/03/25	24/03/23
Tier 2 (all with cumulative distributions)							
AU3FN0017612	Sub Note[a]	19/12/12	0.75	na	2.20	19/06/23	19/06/18
AU3FN0023859	Sub Note	25/06/14	0.75	PONV	1.93	25/06/24	25/06/19
AU3FN0029575	Sub Note	17/11/15	0.60	PONV	2.70	17/05/26	17/05/21
AU3FN0014957	Sub Note[a]	24/02/12	0.50	na	3.10	24/07/22	24/07/17
ANZHA	Sub Note[a]	20/03/12	1.51	na	2.75	20/06/22	20/06/17
Notes: (a) transitional status as regulatory capital only; (b) Converting Preference Share, full conversion occurs on trigger event; (c) Perpetual; (*) six-monthly resets - others quarterly *Source:* ANZ Bank, APS330 Regulatory Capital Disclosure, December 2015							

4. Valuing the BIRP – is it possible?

Contingent valuation of bail-in securities such as these is extremely complex. Indeed, for the reasons given in subsequent paragraphs, it is argued here that estimates of the BIRP derived from valuation methods based on stochastic modelling of quantifiable risk cannot be relied upon to provide reliable results. Nevertheless, approaching the valuation of bail-in securities from the perspective of derivative securities provides intuition and identifies why reliable results cannot be expected from conventional approaches. At the same time, if market prices are determined by investors using such models, then explanatory variables derived from such models may explain much of the cross-sectional and temporal variation in market prices and yields.

Bail-in securities such as ANZPE (Capital Notes) described in Table 1 can be envisaged, from the investor's perspective, as equivalent to purchasing a perpetual floating rate security (with fixed margin to the indicator rate) plus writing a barrier option, with no terminal date, over that security in favour of the bank. The barrier option involves the exchange of one asset (Capital Notes) for another (bank equity) and is exercised if the risk weighted capital ratio falls to 5.125 per cent or less. The strike price is $100 (paid in the equivalent market value of the issuer's shares) if at that time (T), $S_T > 0.2S_0$, or $\$100S_T/(0.2S_0)$ otherwise, also paid in the issuer's shares. In practice, even this intuitive formulation is complicated by various features of such securities, such as other call options available to the issuer, mandatory conversion requirements (subject to certain conditions), non-cumulative distributions, as well as the existence of a second trigger for conversion – that of a declaration of non-viability by the regulator.

The complexities in assessing the likelihood and nature of outcomes from purchasing such securities and thus the possibly insurmountable problems of confidently applying standard asset pricing and/or contingent valuation techniques, are readily apparent.

First, consider the trigger events. The capital ratio trigger is a risk weighted capital ratio, and its actual value cannot be considered to follow a pre-specified stochastic path. Management can be expected to take actions (equity capital raisings, portfolio risk composition, or size, adjustments) in response to recent movements in the ratio which have increased the probability of a breach of the ratio.[17] For investors the actual CET1 ratio is non-transparent (or lagged at best) giving the bank and (arguably) the regulator superior insight. More problematic is the PONV trigger. The regulator, APRA, has given no guidance on what would prompt a PONV declaration. Moreover, no information is expected from the regulator on the potential of such a declaration.

Second consider the conversion outcome should bail-in occur. This is contingent on the stock price at that date relative to the stock price at issuance date. Valuation of the option implicitly sold by investors would thus require modelling of the simultaneous evolution of an

[17] Those actions could be prompted by the adverse reputational effects of a trigger event occurring, although shareholders may benefit from the conversion arrangements involving a value of equity no greater than, and potentially less than, the face value of the bail-in security (although the market value of that security would likely reflect that risk).

accounting variable (CET1 ratio) and the bank stock price.[18] Another complication is that there is no guidance on what proportion of bail-in securities would be subject to conversion. One reason is a lack of a specific regulatory statement of what CET1 ratio needs to be achieved by the bail in. A second reason is that there is no restriction on future issues of bail-in securities of equal (or junior) rank and thus no information about the stock of bail-in securities likely to be available for conversion if a trigger event occurs.[19]

An additional, and significant, complication regarding the conversion outcome arises because of the use of a VWAP calculation with the conversion ratio being determined on the VWAP of 5 days prior to the conversion. Consequently the marketable value of stock received on conversion (if at the same day as the announcement) would differ from the amount implied by the VWAP depending on the impact of the announcement on the market price. This is likely to be negative since the conversion is likely to be triggered by some negative event (such as previously unannounced loan losses).[20] In the absence of prior experience with such bail-in events, it is impossible to estimate with any degree of confidence how the post-announcement share price would differ from the pre-announcement VWAP on which conversion value is calculated.[21]

More generally, despite strong statements of government and regulatory intent to use bail-in rather than tax-payer bail-outs of distressed banks, the political will to impose losses on, particularly retail, investors in such securities remains to be tested. In addition the scenario that if conversion cannot occur within five days the security is terminated (written off) creates another risk for investors.

For these reasons, it is appropriate to view the bail-in requirements as involving uncertainty (in the sense of Knight, 1921) rather than involving probabilistic risk as underpins standard asset pricing techniques. While probabilistic modelling of the fair value of bail-in securities as involving a barrier option to exchange one asset (the bail-in security) for another (equity)

[18] In general, public information on bank CET1 ratios is only provided quarterly with a lag of several months.
[19] APRA (2014, Attachment J, p 60-61) notes that Tier1 instruments must be fully bailed in before bail-in applies to Tier 2 instruments, and also that issue terms may provide for a bail-in ranking within each category.
[20] Another possibility is that the regulator may announce a bail-in is to occur some specified number of days (such as five) from the announcement date. While this might reduce the potential loss to holders of the security (since the share price and VWAP will decline before the conversion date, the consequences for share price dynamics and stability due to resulting investor trading strategies are unclear).
[21] Another complication is that in many cases the contractual conditions are that, if conversion cannot occur within 5 days for some reason, the securities "terminate" and investors lose all funds.

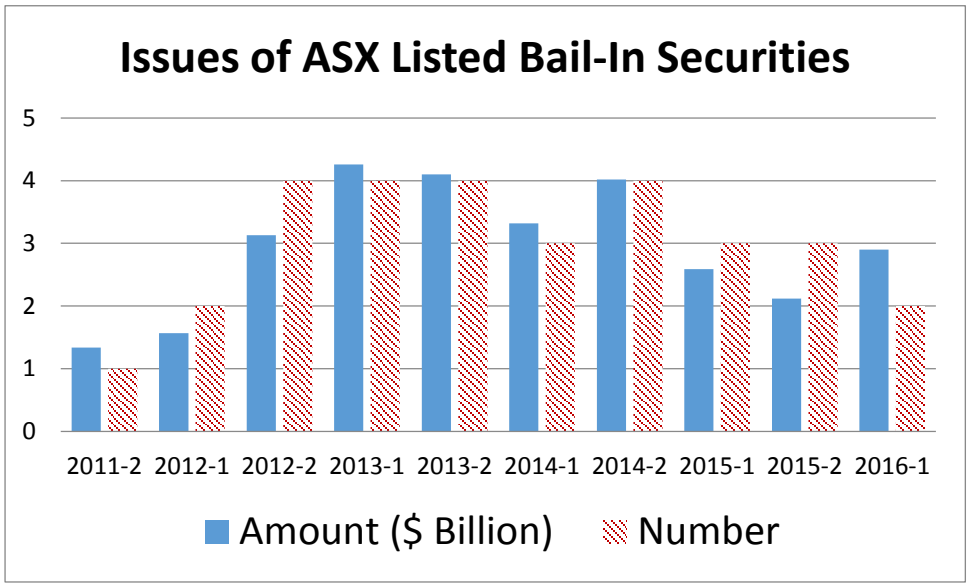
could be undertaken, there is no obvious way to assess the robustness of many of the critical assumptions needed in such modelling and thus the values estimated.

Consequently, this paper instead takes the approach of attempting to identify whether there is, in practice, evidence of a BIRP and assessment of its size and risk sensitivity in Australian bank bail-in securities targeted primarily at retail investors. Whether the BIRP that retail investors have been willing to accept in subscribing to such securities provides "fair" compensation for the uncertainty surrounding possible outcomes is an important question, but one beyond the domain of this paper.

5. The Australian Listed "Bail-in" Market

The number and value of ASX listed bail-in securities issued by Australian banks and insurance companies is shown in Figure 1. Peak issuance to date occurred in 2013 and 2014 as banks responded to the introduction of Basel 3 requirements to build regulatory capital. The average size of issue was around $1 billion with issues by the major banks typically larger than the average and those of other banks smaller.

Figure 1: Bail-In Securities Issuance*



* 2016-1 figure is issues made or announced by 29 May 2016

As at mid 2016, there had been 30 issues of bail-in securities listed on the ASX by 10 different issuers as shown in Table 2. The total amount raised was $30.35 billion, with

largest issues by the four major banks (ANZ, CBA, NAB, WBC). [22] Almost all issues distribute tax credits with cash distributions, making them relatively unattractive for foreign investors.

Bail-in securities now appear to be a permanent part of bank (and insurer) capital structure due to regulatory capital requirements. Current issues are expected to be replaced with new issues at the issuer call-date.

[22] To provide perspective on the magnitudes, the cumulative amount raised by ANZ was $5 billion which compares to its eligible CET1 at June 2014 of $32 billion. The total of ASX listed bail-in securities on issue of $30 billion is around 60 per cent of the size of the non-financial-sector domestic corporate bond market.

Table 2: Issues of ASX listed bail-in securities at May2016*

ASX Code	Issue Date	Coupon	Capital Tier	Issue amount ($ bill)	Tax Credits**
ANZPC	29/09/2011	BBSW+3.1	AT1	1.34	Y
WBCPC	23/03/2012	BBSW+3.25	AT1	1.19	Y
IAGPC	1/05/2012	BBSW+4	AT1	0.38	Y
CBAPC	17/10/2012	BBSW+3.8	AT1	2.00	Y
BENPD	1/11/2012	BBSW+5	AT1	0.27	Y
SUNPC	7/11/2012	BBSW+4.65	AT1	0.56	Y
BOQPD	24/12/2012	BBSW+5.1	AT1	0.30	Y
WBCPD	8/03/2013	BBSW+3.2	AT1	1.38	Y
NABPA	21/03/2013	BBSW+3.2	AT1	1.51	Y
SUNPD	23/05/2013	BBSW+2.85	2	0.77	N
MQGPA	11/06/2013	BBSW+4	AT1	0.60	Y (40%)
ANZPD	8/08/2013	BBSW+3.4	AT1	1.12	Y
WBCHB	22/08/2013	BBSW+2.30	2	0.93	N
AMPHA	18/12/2013	BBSW+2.65	2	0.33	N
NABPB	18/12/2013	BBSW+3.25	AT1	1.72	Y
ANZPE	1/04/2014	BBSW+3.25	AT1	1.61	Y
SUNPE	9/05/2014	BBSW+3.4	AT1	0.40	Y
WBCPE	23/06/2014	BBSW+3.05	AT1	1.31	Y
CGFPA	1/10/2014	BBSW+3.4	AT1	0.34	Y (70%)
CBAPD	2/10/2014	BBSW+2.8	AT1	3.00	Y
MBLPA	8/10/2014	BBSW+3.3	AT1	0.43	Y (40%)
BENPE	10/10/2014	BBSW+3.2	AT1	0.25	Y
ANZPF	6/03/2015	BBSW+3.6	AT1	0.97	Y
NABPC	26/03/2015	BBSW+3.5	AT1	1.34	Y
BENPF	15/06/2015	BBSW+4.00	AT1	0.28	Y
WBCPF	8/09/2015	BBSW+4	AT1	1.32	Y
AMPPA	30/11/2015	BBSW+5.1	AT1	0.27	Y (80%)
MQGPB	21/12/2015	BBSW+5.15	AT1	0.53	Y (40%)
CBAPE	30/3/2016	BBSW+5.2	AT1	1.45	Y
WBCPG	30/6/2016	BBSW+ 4.9	AT1	1.45	Y

* The first three letters of the ASX code represents the issuer. MBL indicates the bank subsidiary of Macquarie Group (MQG). Funds from issues by the holding company are provided to the bank subsidiary as additional tier 1 capital.Two of the issuers are insurance groups (CGF and IAG) while SUN and AMP are holding companies with bank and insurance subsidiaries.

** The figures in brackets indicate the expected degree of partial franking.

Table 3 provides information on the distribution of initial investors for 19 bail-in issues for which such data is readily available. The focus on retail investors can readily be seen with, on average, 61 per cent of investments being in parcel sizes of less than $500,000 which is the minimum parcel size in wholesale markets. Around 90 per cent of investors purchased parcels less of than $100,000 with an average size for that group of around $33,000. Institutional investors purchasing parcels of over $10 million, which on average is 6 such investors, accounted for on average 14 per cent of each issue. Some investors in the next size category (where the average and maximum size investment is $2.85 and $3.54 million) are institutional investors as well as wealthy retail clients of brokers participating in the book-build.

Table 3: Distribution of Initial Investors in Listed Bail-In Securities

Amount Purchased	<$100,000	$100,000 to 500,000	$500,000 to 1,000,000	$1,000,000 to 10,000,000	>$10,000,000
Percentage of Investors					
Min	86.9%	5.4%	0.4%	0.3%	0.0%
Average	90.5%	8.2%	0.7%	0.6%	0.1%
Max	93.9%	11.3%	1.1%	0.9%	0.2%
Percentage of Issue					
Min	23%	15%	5%	13%	0%
Average	38%	23%	7%	18%	14%
Max	53%	30%	8%	28%	35%
Average amount Invested					
Min	$ 26,885	$ 199,725	$ 731,517	$ 2,129,650	$ -
Average	$ 32,638	$ 225,051	$ 795,921	$ 2,849,208	$ 22,283,190
Max	$ 37,305	$ 241,433	$ 864,252	$ 3,543,312	$ 35,577,288
Number of Investors					
Min	2,509	231	24	18	1
Average	10,856	1,055	88	60	6
Max	29,051	3,755	323	207	15

Source: author calculations based on issuer media releases

A typical issue method has involved preference being given to existing holders of the issuer's equity or other securities, in the event of oversubscription, or via a special allocation to such investors. For example the 2013 ANZ Capital Notes offer involved offers to ANZ security holders, a general offer, an offer to clients of brokers under the broker firm offer, and an institutional investor offer. The issue yield is determined based on lodgement of bids by institutional investors and brokers under the book-build process. In many cases excess

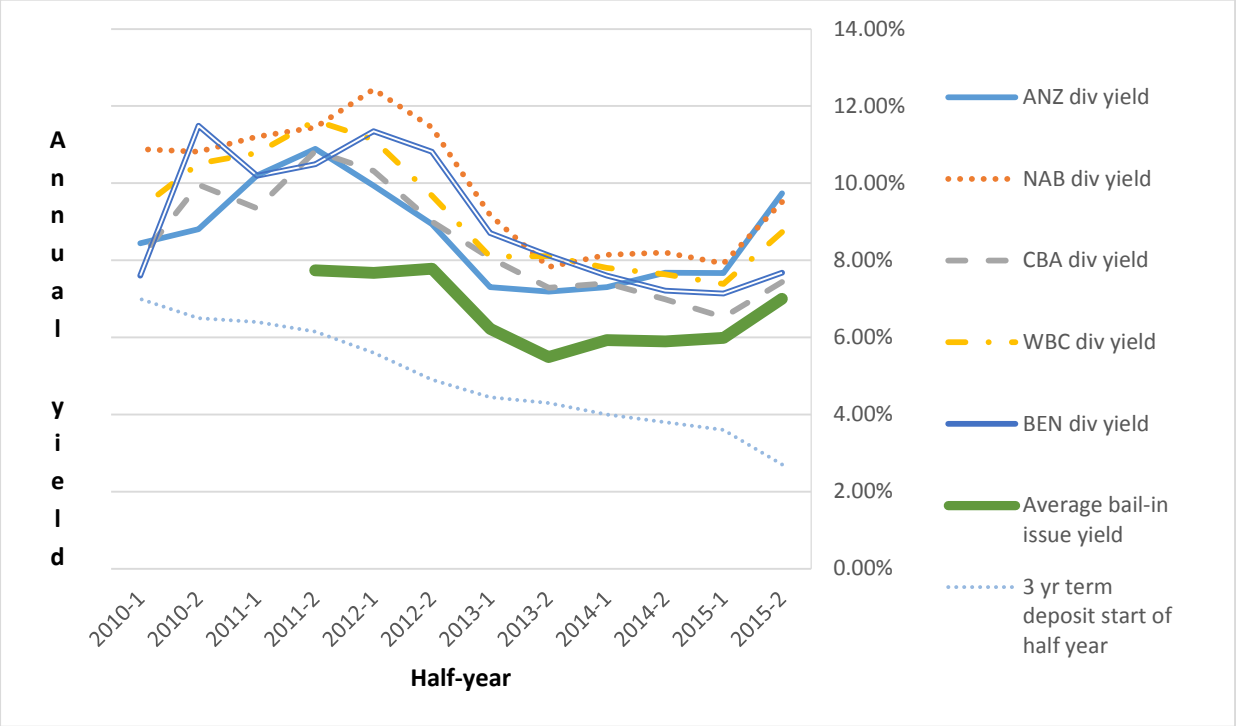
demand has led instead to an increase in the offer size, or a scaling back of allocations to some types of investors. A very small proportion of issue amounts have been sold via the general offer component and some recent issues have not included such a component.

Figure 2 provides comparative information on issue yields of bail-in securities relative to contemporaneous dividend yields on bank shares and the interest rate on three year term deposits which could be viewed as alternative investments for retail investors. (There has been no substantive retail corporate bond market in Australia). Both the dividend yields and bail-in issue yields shown are calculated on a "grossed-up" basis to incorporate the value of tax (franking) credits, which makes them directly comparable to the term deposit rate from a domestic investor tax perspective. There is some suggestion of a positive relationship between bail-in issue yields and contemporaneous bank dividend yields.

To the extent that retail investors discount the risk of bail-in, the normal conversion / maturity arrangements (involving receipt of the face value in shares or cash) would enable interpretation of the bail-in security as approximately equivalent to purchasing bank shares and swapping capital gains or losses and equity dividends over that period for the yield on the bail-in security. Bail-in yields below corresponding stock dividend yields might then be interpreted as reflecting expectations of capital losses on shares or retail investor risk aversion to stock price volatility. (Australian banks, responding to the imputation tax system, have high dividend payout ratios in the order of 70-80 per cent, suggesting relatively limited potential for capital gains from earnings retention).

Clearly, there are many other relevant factors to take into account in any such comparison, but the discount of bail-in yields to bank stock dividend yields is suggestive of retail investors applying a low value for the BIRP in their investment decisions. On the other hand, the significant margin of bail-in yields over rates on bank term deposits (which are government guaranteed up to a cap of $250,000) is suggestive of some form(s) of risk premia being relevant. That could, however, reflect the longer maturity of the bail-in securities and associated market price risk from sale before maturity rather than bail-in risk.

Figure 2: Bail-in issue yields relative to alternatives



Sources: Dividend yields – from www.dividends.com.au; Bail in issue yields – author's calculations using issue date bank bill swap rates from RBA Statistical Tables f04hist.xls, 3 year term deposit rate from RBA Statistical Tables f03hist.xls.

6. Estimating the BIRP and its determinants

In this section three questions are addressed. First, is there any evidence which could throw light on the size of the BIRP demanded by investors, and on whether this might vary between retail and institutional investors? Second, do conventional risk measures explain the price behaviour of securities for which a BIRP exists? Third, what other factors can explain the marked shift since 2014 in trading yields?

Estimating the BIRP by pairwise comparisons of bail-in and non-bail-in securities.

In principle, calculating the BIRP implicit in securities on issue is straightforward. Find otherwise identical securities which are not subject to bail-in risk and compare rates of returns promised (or available in secondary market trading) to investors. In practice, matters are much more complicated. First, the design of bail-in securities means that it is not generally possible for a bank to have otherwise identical, but non-bail-in securities on issue because they must, by definition, have a different level of seniority. One way in which this occurs is via classification as AT1 or Tier2 instruments. Second, some securities may be issued with tax credits attached and others without, and maturities (time to call) can differ.

Third, while other banks with no bail-in securities on issue may have similar priority-ranking non-bail-in securities on issue, there will be different bank characteristics which need to be controlled for.[23] Nevertheless, there are some Australian examples[24] which can be used to get indicative estimates, while comparisons of bail-in yields with other types of securities are also informative.

There is a small number of cases of otherwise similar securities issued by the same bank, with similar maturities, where one has a bail-in provision and the other does not. Figure 3 illustrates with issues from the same bank shown in the same shading, and showing ASX codes, maturity (call date), tax status, Capital Tier, and Bail-In status.

Figure 3: Potential Comparables*

	Additional Tier 1	Tier 2
Bail-In	SUNPC, Dec 17, Franked WBCPC, Mar 18, Franked ANZPC, Sep 17, Franked NABPA, Mar 19, Franked	SUNPD, Nov 19, Unfranked WBCHB, Aug 18, Unfranked
Non-Bail-In	WCTPA, Jun 16, Franked	WBCHA, Aug 17, Unfranked ANZHA, Jun 17, Unfranked NABHB, Jun 17, Unfranked

* WCTPA is an issue by WBC using a trust structure.

The clearest example for comparison is the subordinated notes, WBCHA and WBCHB issued by Westpac Bank. The former, issued in August 2012 before the Basel 3 requirements came into force does not have a bail-in condition whereas the other issued one year later has a PONV condition. Both are classified as Tier 2 and pay unfranked non-cumulative distributions. The conversion date for WBCHA is August 2022 with an issuer call option in August 2017, while the corresponding dates for WBCHB are one year later. As explained earlier, it can be assumed that the issuer call option will be exercised if possible. Although

[23] Avdjiev et al (2013) have estimated spreads on European Cocos relative to other non-subordinated non-coco bonds for several years up till mid-2013. For primary market issuance they found a spread of 230 basis points for "conversion to equity" low trigger (CET1 ratio below 6 per cent) cocos with higher spreads for high trigger cases and for principal write down cases.

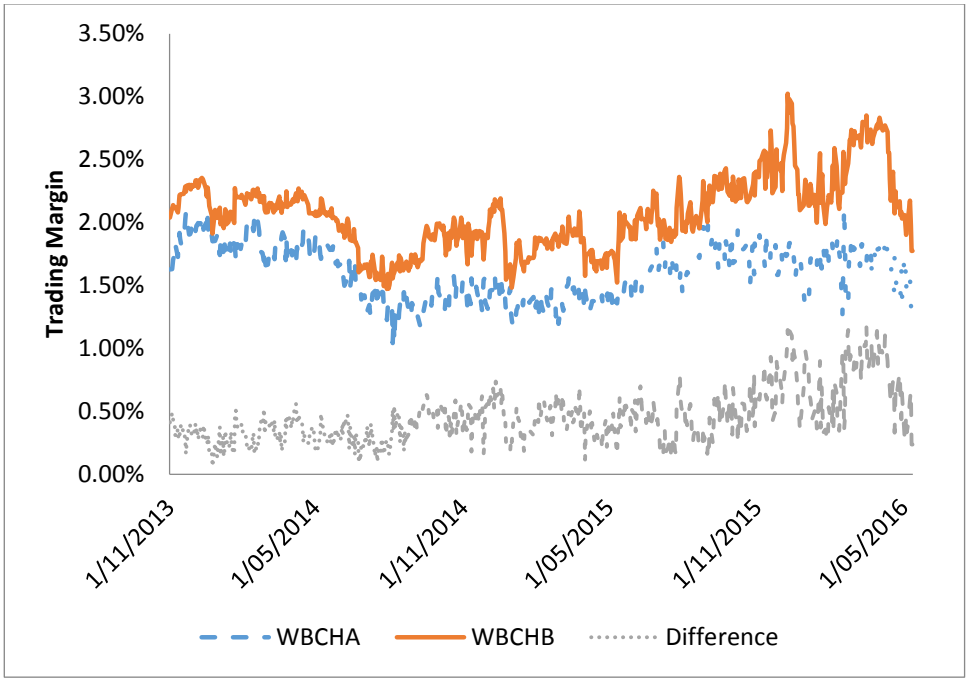
[24] Some older securities without bail-in provisions have transitional status as AT1 or T2 regulatory capital.

traded on a dirty price basis, market practice quotes current market yields in the form of the traded margin (over the indicator rate, BBSW) till call date.[25]

The one year difference in call dates could arguably lead to a higher traded margin for WBCHB due to higher credit spreads for longer term securities, but this implies (because the longer "maturity" security, WBCHB has the bail-in provision) that the difference in margins is an upper bound for the BIRP for this relatively short maturity.

Figure 2 shows the traded margins on these securities and the difference between them. Over most of the period since late 2013 the difference in the margins has averaged around 40-60 basis points, with some suggestion that the level of the margins has increased over time. (That increase in margins as the remaining time to maturity has declined would be unexpected, but partially reflects a general increase in market credit spreads over that period). Assuming that no part of the difference in margin is due to the different time to conversion, this suggests that the BIRP at the shorter end of the maturity spectrum for Tier 2 instruments is well below 100 basis points, and averaged 55 basis points for the period since the start of 2015.

Figure 4: Implied BIRP from WBCHA and WBCHB trading margin difference



[25] The traded margin is derived from end of day market prices as that margin over BBSW which equates the market price with present value. The estimates are provided by Evans and Partners based on last traded daily price and and assume a 10 basis point transactions cost.

However, the bail-in risk premium would be expected to be lower for Tier 2 instruments than Additional Tier 1 instruments, due to their lower risk of bail-in. There is available, only one case of an AT1 pair of bail-in and non-bail-in securities available, that being WBCPC and WCTPA. Unfortunately, the maturity difference is almost two years with the WCTPA maturing in June 2016. We temporarily postpone comparison of this pair, and pursue another approach.

There are several comparisons available of differential tier bail-in securities available, which provide some information on the additional BIRP for AT1 versus T2 securities. Comparing SUNPC (AT1, Dec 2017) and SUNPD (AT1, Nov 2018), the differential (SUNPC-SUNPD) has averaged 140 basis points since the start of 2015, having increase substantially from around 75 basis points for the year ending June 2014. For WBCPC(AT1, Mar 2018) and WBCHA(T2, Aug 2017), the average differential (WBCPC-WBCHA) was 212 basis points since the start of 2015 versus 107 basis points for the year ending June 2014. Noting that the difference in maturity in the comparisons in the two pairs is in the opposite direction, and of similar magnitude, a ball-park estimate of the average differential BIRP for AT1 versus T2 securities since the start of 2015 is the average of 140 and 212 basis points, ie 176 basis points. Prior to July 2013, that differential was 91 basis points.

Combining the estimated Tier 2 BIRP of 55 basis points since Jan 2015 with the corresponding AT1-T2 differential of 176 basis points, suggests an overall AT1 BIRP of around 231 basis points relative to T2 securities without bail-in provisions.

Other pairwise comparisons involving similar maturity, bail-in and non-bail-in, securities of the same issuers (NAB and ANZ) shown in Figure 3 also involve AT1 versus T2 differences. An additional complication in these comparisons is that the non-bail-in securities pay no tax credits while the others do. For international investors the grossed up traded margin, which includes tax credits that are unusable by them, overstates the return they can access. Similarly, if the full value of franking credits is, for some reason, not fully valued in market prices, the grossed up traded margin will overstate the effective (after tax) return, and thus the difference in margin.

It can reasonably be assumed that international investors would not be significant holders of bail-in securities paying franked dividends. For example, focusing solely on the cash returns, the implied “cash-only” trading margin of ANZPC at 7 March 2016 was 24 basis

points while that on NABPA was 115 basis points.[26] Since these are well below the trading margins on the non-bail-in securities (of 167 basis points for ANZHA and 174 basis points for NABHB) this suggests that, with domestic investors determining market prices, use of the grossed-up margins is appropriate.

The trading margins (grossed up to include tax credits) and the differences in margins are shown for half-yearly periods in Table 4. Prior to the second half of 2014, the difference in margin (the BIRP) for ANZ was around 100 basis points and that for NAB around 125 basis points. Since then the margins have increased significantly (to an average since mid 2014 of 205 and 265 basis points respectively), reflecting primarily an increase in the margins on the bail-in, franked distribution paying securities. While margins on WBCHA, ANZHA, and NABHB all move similarly post 2014H1, those on ANZPC and NABPA (bail-in, franked) have increased significantly vis a vis WBCHB (bail-in, unfranked).

This divergence is unlikely to be related to the difference in franking status. Rather, the ANZPC and NABPA securities are Tier 1 capital instruments and thus, *ceteris paribus,* subject to greater relative risk of bail-in than WBCHB which is Tier 2. Thus, while the WBC comparison provides a potentially cleaner estimate of the BIRP, by comparing equally rating securities, it is for securities which are lower down the ranking order for possibility of bail-in. The ANZ comparison suggests an average BIRP differential between AT1 bail-in and T2 non-bail-in securities of around 205 basis points since mid-2014. The higher NAB figure is more likely to be affected by the greater maturity difference. For example, while the term structure of spreads in 2014 and 2015 would have implied a contribution of around 20-30 basis points for the higher NABPA margin, in the first quarter of 2016 the term structure contribution was around 100 - 110 basis points. Adjusting for this maturity effect would make the difference (AT1 bail-in minus T2 non-bail-in) for the NAB securities very similar to those for ANZ (205 basis points). Note that this estimate of 205 basis points is relatively close to the estimate obtained by aggregating the AT1 – T2 bail-in differential of 176 basis points and the 55 basis point T2 bail-in minus non-bail in yields – which gave an estimate of 231 basis points.

[26] These are calculated as (BBSW+margin)*(1-t_c) where t_c =0.3 is the corporate tax rate. Because the tax adjustment applies to the indicator rate component as well as the margin component, the gap between the grossed up and cash trading margins will vary with the level of BBSW.

Table 4: Pairwise Security Comparisons

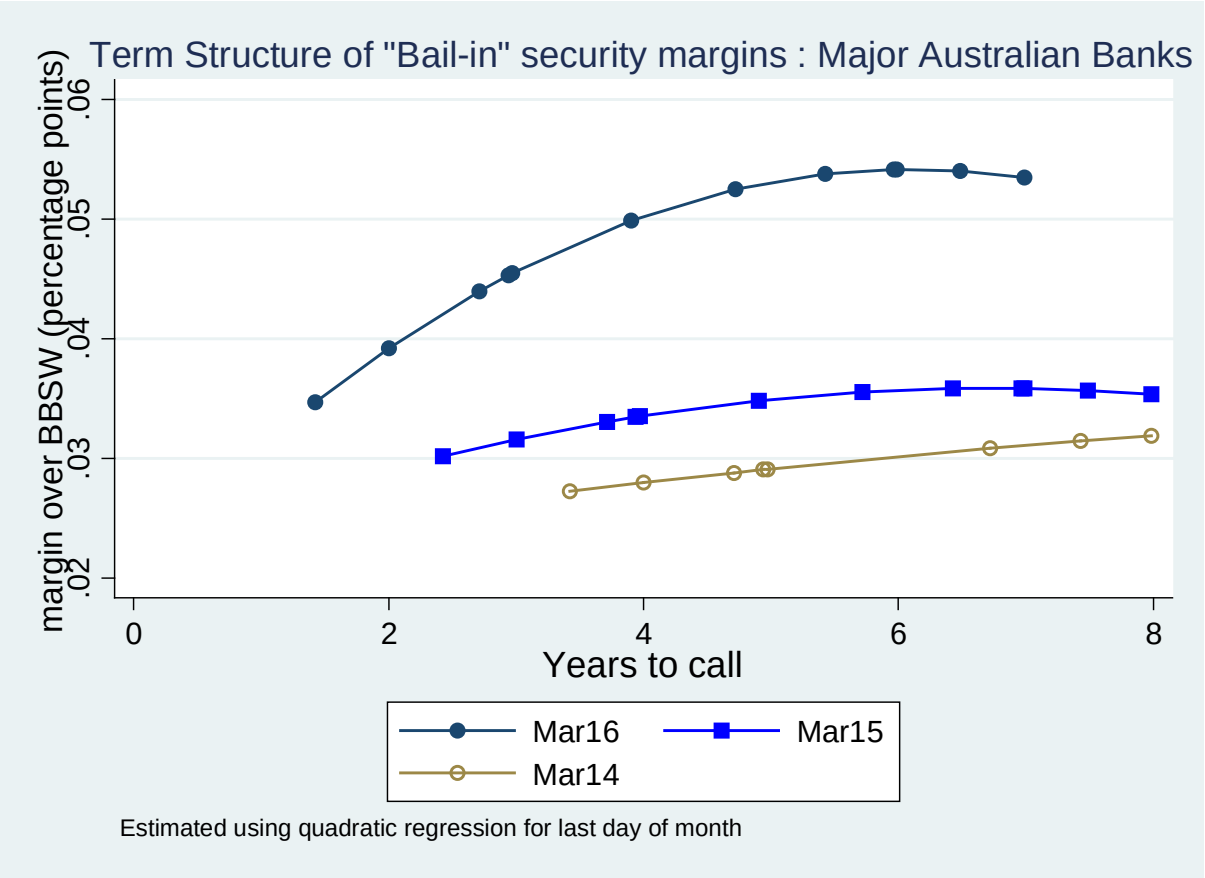
		Average for Half Year[a]								
	Call date	2012H1	2012H2	2013H1	2013H2	2014H1	2014H2	2015H1	2015H2	2016H1
WBCHA	23/8/17					1.77	1.39	1.42	1.74	1.70
WBCHB	22/8/18					2.08	1.80	1.85	2.26	2.40
WBCDiff						**0.31**	**0.42**	**0.43**	**0.53**	**0.69**
ANZHA	14/6/17	2.73	2.29	1.98	1.94	1.71	1.31	1.34	1.65	1.64
ANZPC	1/9/17	3.62	3.42	3.19	2.99	2.80	2.86	3.24	3.84	3.69
ANZDiff		**0.89**	**1.12**	**1.22**	**1.05**	**1.10**	**1.55**	**1.90**	**2.20**	**2.05**
NABHB	18/6/17			1.98	1.93	1.66	1.31	1.36	1.63	1.65
NABPA	30/3/19			3.21	3.14	2.90	3.07	3.55	4.34	4.69
NABDiff				**1.23**	**1.21**	**1.23**	**1.75**	**2.19**	**2.72**	**3.04**

a: 2016H1 data till May 12th; 2012H1 data from March 21st; 2013H1 data for NAB from March 19th

Returning to the comparison of WCTPA (no-bail-in, AT1 Jun 2016) with WBCHA(no-bail-in, T2, Aug 2017) or WBCPC(bail-in, AT1, Mar 2018), the potentially interesting comparison with the latter is complicated by the shorter maturity of WCTPA and the problem that after December 2015, the yield data is distorted by the interaction of the near maturity and tax credit status. However, for the period, 1/7/13 till 22/12/15, the WCTPA-WBCHA average differential (ie for AT1-T2) is 140 basis points which, allowing for maturity difference of 13 months, is not inconsistent with the AT1-T2 differential of 176 basis points derived from bail-in securities. Turning to the WBCPC-WCTPA differential (which reflects the BIRP for AT1 securities) the average for the period July 2014 – December 2015 was 60 basis points. However, since some part of this differential will also reflect the longer maturity of WBCPC, this is an overestimate of the BIRP differential between these AT1 securities.

It is to be expected that there will be larger spreads required on securities with longer time till call. Figure 4 illustrates the higher trading margins at the longer end. The fact that all securities shown are floating rate implies that the margin reflects issuer related risks rather than any market yield curve effect. (Note, however, that these figures are not estimates of the BIRP, since they are not comparisons with non-bail-in security margins).

Figure 5: Major Bank "Bail-in" security trading margin maturity curves



International v Domestic Investor BIRP

Another consideration is whether there is any difference in the BIRP between different categories of investors. In particular, it might be expected that international and institutional investors would be more likely to be aware of the bail-in risk, and might feel more exposed to it due to political considerations (which could lead to their security holdings being bailed-in prior to those held by domestic retail investors).[27] One approach to examine this is pairwise comparison of near-contemporaneous issue pricing of securities with different characteristics from the same issuer aimed at different markets.

Both CBA and NAB have each made near-contemporaneous issues of Tier1 securities with tax credits aimed at domestic investors and Tier 2 securities without tax credits aimed at wholesale/international investors. Table 5 gives details of the characteristics of these issues and issue date yields. For international investors the tax credits have no value and thus

[27] However, because there is no statutory (rather than contractual) bail-in power currently available to the regulator in Australia, the risk of a non-priority bail-in sequence could be assumed to be remote.

comparison of pre-tax "cash" returns indicates whether the pricing differs from their perspective. If the Tier 1 security has a lower "cash" return than the Tier 2 security, this means that, once adjusted for tax credits, its BIRP as relevant to international investors is lower, and suggesting a lower BIRP being demanded by domestic retail investors.[28] In fact, because the Tier 1 securities would be subject to bail in prior to the Tier 2 securities, it would be expected that the former would have a higher BIRP. Table 5 calculates the issue date cash coupon rate, which for Tier 2 securities is (BBSW+margin) while for Tier 1 securities with tax credits it is (BBSW+margin)(1-t_c) where t_c=0.7 is the corporate tax rate.

As shown in Table 5, the Tier 2 securities offered a cash rate of return higher than the Tier 1 securities in both cases. In the case of CBA it was 84 basis points p.a. (ignoring any effect of the longer maturity (time to call) of the Tier 1 security which would have added approximately 20 basis points to the spread, and increased the difference to over 100 basis points). In the case of the NAB securities (which have common call dates) the difference is quite small at around 10 basis points. However, since Tier 1 securities should have a higher BIRP than Tier 2 securities, these results suggest that the banks have been able to offer securities into the domestic retail market relatively cheaply compared to wholesale/international issues due to a lower risk premium applied by domestic retail investors.

Table 5: International v Domestic Issue BIRP comparison

	Issue date cash rate of return:	Difference
CBA Tier 1 (CBAPD), coupon = (BBSW+2.8)%, franked, issue date 2/10/14, call date 15/12/22, PONV and CET triggers. Issue date BBSW=2.70%	3.85	
CBA Tier 2 (ISIN: AU3FN0025367), coupon = (BBSW+1.95)%, issue date = 5/11/2014, call date 5/11/19, PONV trigger, Issue date BBSW = 2.74%	4.69	
		0.84
NAB Tier 1 (NABPC), coupon = (BBSW+3.5)% franked, issue date = 26/3/15, call date = 23/3/20, PONV or CET trigger, Issue date BBSW = 2.23%	4.01	
NAB Tier 2 (ISIN AU3FN0026928), coupon = (BBSW+1.85)%, issue date = 1/3/15, call date = 23/3/20, PONV trigger, Issue date BBSW = 2.28%	4.13	
		0.12

[28] An alternative, but equivalent, approach would be to ask whether the margin on the Tier 2 instruments is sufficiently higher than that on the Tier 1 instruments to make them equally attractive to domestic retail investors.

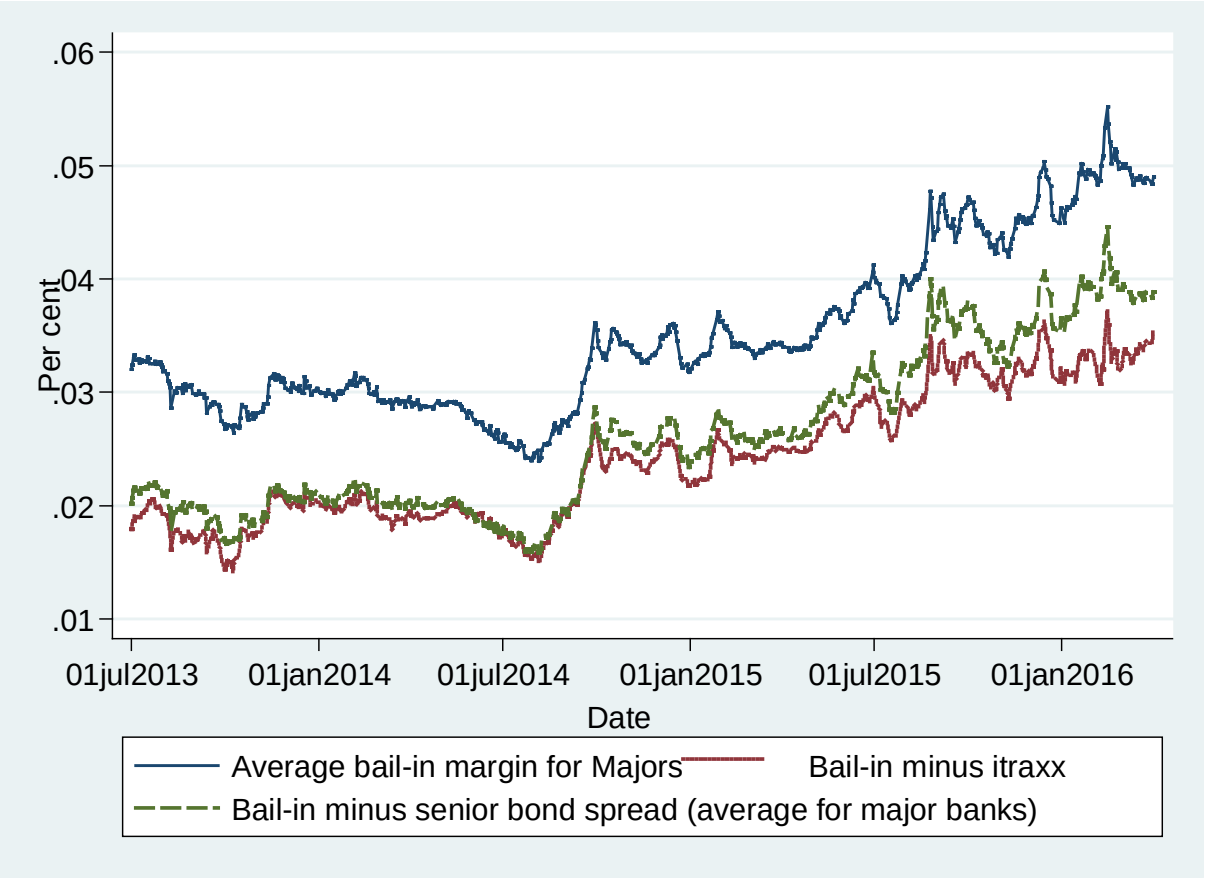
The time-series behaviour of the BIRP

The BIRP appears to have increased quite substantially since the second half of 2014 as can be seen in Figure 5 which shows the average of traded margins for major bank bail-in securities (Basel 3 hybrids) and movement in that margin relative to other credit risk indicators. The latter include the Itraxx and the average margin on bank senior floating rate debt (of maturity around five years), and while these also increased after mid-2014, the increase was less than that of bail-in margins. Prior to mid 2014, the Basel 3 hybrids traded at around 150 -200 basis points higher margin than bank issued non-bail-in debt. Since then, the difference has increased. The same pattern of bail-in margins having increased more than other credit risk indicators applies also for the Itraxx and the BBSW-OIS spread (not shown).[29]

It is beyond the scope of this paper to provide and test explanations for this apparent increase in the BIRP. The phenomenon is at variance with significant increases in bank CET1 capital ratios over the period – which should reduce the BIRP. Possibly, investors have become more aware of "bail-in" risk, given developments in banking markets internationally, and there was significant media publicity given to the potential risks of bail-in securities and suggested inadequacy of yields relative to risk during 2014. Or possibly, the significant increase in supply of bail-in securities aimed at domestic retail investors has confronted some inelasticity in demand which has pushed up the equilibrium margin. Regardless, the time-series behaviour of the margin creates complications for testing whether typical variables which might be used to explain margins, and be determinants of the BIRP, have empirical significance.

[29] A similar increase in spreads on "cocos" has occurred elsewhere. The iBoxx EUR Contingent Convertible Index spread increased from around 450 basis points in mid 2014 to nearly 700 basis points in early 2016. https://www.creditmarketdaily.com/corporate-bond-index-spread-data/coco-bond-market-index-spreads-yields/

Figure 6: Bail-in yields and Credit risk indicators*



* Average bail-in margin for Majors is average of traded margins (over BBSW) for bail-in securities (AT1 and T2) on issue of the four major banks at that date. Senior bond spread is traded margin over BBSW.

Determinants of the BIRP

The question addressed here is: how do variables which are potentially indicators of bail-in risk affect the pricing and returns on bail-in securities? Even if bail-in risk is better viewed as uncertainty rather than measurable risk, market prices can be expected to reflect, to some degree, the assessment of risk by professional investors using conventional valuation techniques. Consequently, a focus of this empirical section is to test a number of hypotheses about bail-in risk pricing based on derivative pricing models, such as considered by Wilkins and Bethke (2014).

Drawing on the credit and equity derivatives literature, the BIRP should be positively related to the risk of bail-in and the size of loss should bail-in occur. Bank CDS spreads provide direct

information on market assessment of bank default risk and thus bail-in risk and thus should be positively related to the yield on bail-in securities. In the absence of available data for some banks on individual bank CDS spreads, the Itraxx (available from early 2013) is used as a proxy for general movements in market credit spreads. Higher credit ratings of bank senior debt would be expected to be negatively related to yields, while bank senior bond margins (reflecting bank risk) should be positively related to bail in yields.[30] These variables, credit ratings and bank floating rate senior bond margins, are used as indicators of bank specific credit risk. Because the CET1/RWA ratio is one trigger and a declaration of PONV likely to be related to this, it provides an indirect indicator of bail-in risk and should be negatively related to bail in yields.

Higher bank share prices relative to book value should signal market confidence in bank viability and thus be negatively related to the bail-in yield. Also, mandatory conversion (should the bank not be able to call the securities) involves a loss to investors should the bank share price at conversion date be below 50 per cent of the issue date VWAP. We thus use the variable *proximity to strike*, defined as current share price divided by half the issue date VWAP, to indicate the effects of changes in the bank share price. A negative relationship between margins and bank share price expected. Avdjiev et al (2013) found European secondary market coco bond yields had positive correlations with those on other non-coco subordinated bonds and bank CDS spreads, and negative correlations with the issuer's equity price, consistent with the above arguments.[31]

From an equity derivatives perspective, the bail in security can be thought of as investment in a bond and writing a (barrier) option to exchange that into a specified value of equity on hitting the trigger. Thus, assuming some correlation of the share price with the underlying trigger variable (CET1 ratio or probability of PONV declaration), the share price (or market/book ratio) should be negatively related to the yield, bank share price volatility should be positively related to yield, maturity (call date) of the security and the dividend

[30] It should be noted that introduction of more junior bail-in securities could be expected to reduce required spreads on bank senior debt thus creating a potential endogeneity problem.

[31] Since the bail-in terms are generally the same for all Australian Basel compliant securities, there is no observable cross-sectional or time series variation in likely loss given bail-in. However, since not the entire stock of bail-in securities might be bailed in, it could be anticipated that loss given bail in may be less if, ceteris paribus, there is a larger stock of bail-in securities on issue. Thus a variable such as the ratio of bail-in securities on issue to common equity on issue is expected to be inversely related to yield (and will be examined in future work).

yield on bank equity should be positively related to yield, as should be straight bond yields of the issuer.

To these potential bank and security specific variables must be added a set of market controls. These include movements in the general level of interest rates and credit spreads.

These hypothesised determinants of the bail-in yield are summarized in Table 6, where the expected signs of coefficients are also given, as well as definitions of variables. Unfortunately, data is not currently available on all of these possible explanatory variables, such that the empirical work proceeds using those which are available.

Table 6: Hypothesised determinants of the bail-in yield

Variable	Expected Coefficient Sign	Definition and measurement
Bank specific		
CET1	-	Common equity tier 1 capital ratio - last available from quarterly bank Basel disclosures (expressed as difference from average CET1 ratio at each date)
PTS	+	Proximity to strike (current share price as multiple of 50% of issue date share price)
PtoB	-	Bank price to book value ratio (book value from last quarterly disclosure)
CR	-	Bank credit rating (AA = 0, AA- = 1, A+ = 2, etc
RelMat	+	Maturity – represented by time till first issuer call option (expressed as percentage difference from average maturity of securities on issue at each date)
Vol	+	Implied volatility of issuer's shares
Controls		
ITraxx	+	ITraxx index of Australian CDS spreads
SectorRisk	+	180 day bank bill swap rate minus 180 day Overnight Interest Swap rate

The time series behaviour of the traded margins, illustrated for the average margin in Figure 5 creates difficulties for regression analysis, since tests confirm that the variable is non-stationary. Consequently, the dependent variable used in panel data regressions on daily data is transformed to be the difference between the traded margin and ITraxx, for which the hypothesis of stationarity is not rejected. (Use of the variable (BBSW-OIS) rather than ITraxx for this transformation produced similar results). Consequently, the regression

results indicate the extent to which the explanatory variables explain movements in bail-in yields different to movements in credit spreads reflected in the ITraxx.

Another complication is that observations on key accounting variables including capital ratios are only readily available at infrequent (quarterly) intervals. Because CET1 ratios have trended upwards over the sample period, this variable is transformed to be the difference of each bank's CET1 ratio to the average of all banks at each date (RELCET1). Because the remaining maturity of each security declines with calendar time, this leads to a negative time-series correlation with bail-in yields (which have increased since mid-2014) inconsistent with theory. Consequently, this variable has been transformed to be the percentage difference of each security's maturity from the average of those on issue at each date (RelMat), in order to reflect cross-sectional differences. Bank Credit Rating has been omitted because of collinearity with other variables (and regression assumption of bank fixed effects).

These arguments lead to regression based tests applied to an unbalanced panel of secondary market yields, of the form

$$RiskSpread_{ijt} = \beta_0 + \beta_1 RELCET1_{jt} + \beta_2 PTS_{ijt} + \beta_3 PtoB_{jt} + \beta_4 BankVol_{it} + \beta_5 RelMat_{ijt} + \beta_6 SectorRisk_t + u_{ijt}$$

where i = 1 to 19 refers to security i, j=1 to 8 is the issuing bank, t is time, and the explanatory variables and predicted signs are as described in Table 6. The time period used is daily data from 1 July 2013 to 31 Mar 2016.

The Hausman test indicates that fixed effects regression is appropriate, and robust standard errors (clustered by bank) are reported. Results are shown in Table 7, where inclusion of bank price to book ratio reduces the available sample size (since holding company structures are excluded). (Multicollinearity between pts and PtoB (since both have share price in the numerator) mean that both cannot be included. Notably the bank risk measure (bank volatility) and the short term banking sector risk measure (BBSW-OIS spread) are significant explanators and with expected positive signs. But other variables which are more specifically related to the characteristics of the bail-in securities and their risk are insignificant, and in the cases of PTS (which reflects current bank share price relative to issue date share price), and RELCET1 (which reflects relative capital adequacy) of the incorrect sign. Bank Price to Book ratio is significant, however, and with the expected sign.

This suggests that there has, to date, been little additional signalling of individual bank risk in bail-in yields beyond that available from equity market volatility and money market credit risk information.

Table 7 Determinants of Bank Bail-In Risk Spread

Dependent Variable: Risk Spread = (bail-in yields – Itraxx).
Fixed Effects Unbalanced Panel Regression:
Daily data: 1 July 2013 – 31 Mar 2016, 19 securities, 8 bank issuers. Robust standard errors clustered by issuer.

	Restricted Sample (15 securities)		Full Sample (19 securities)	
	Coefficient	t-value	Coefficient	t-value
pts			0.0003	0.28
bankvol	0.0411	7.37	0.0487	7.43
bankptob	-0.0034	-2.83		
spread180	0.0195	10.36	0.0206	10.81
relmat	-1.1151	-0.7	0.0305	0.02
relCET1	0.0572	0.7	0.0667	0.99
Constant	0.0175	5.7	0.0093	2.54
Number of obs	8482		10675	
Number of groups	15		19	
Observations per group				
Min	260		260	
Average	565.5		561.8	
Max	690		690	
R-squared				
Within	0.6932		0.6403	
Between	0.0395		0.7549	
overall	0.4386		0.6108	
	F(5,5) = 706754.84		F(5,7) = 977.81	

Since bank credit rating could not be used as an explanatory variable in the panel regressions, Table 8 reports results of a regression of issue date yields from a regression of the form:

$$Margin_{it} = \beta_0 + \beta_1 Rating_{it} + \beta_2 Spread_t$$

where $Margin_{it}$ is the issue margin (over BBSW) for bank i's issue at time t of a bail-in security, $Rating_{it}$ is the bank i's senior debt credit rating at time t, and $Spread_t$ is the average

credit spread on 10 year bonds at time t. Rating takes the value: AA- = 0; A+ = 1; A = 2; A- = 3. The spread variable is the value in the month of issue for average spread on non-financial A- rated corporate bonds provided by the Reserve Bank of Australia.

Table 8: Regression results: Dependent variable is Bail-in bond issuance spread

	Coefficients	*t Stat*	*P-value*
Intercept	1.515373	2.618624	0.014783
Rating	0.330785	3.481621	0.001849
Spread	1.269133	3.1242	0.004472
R Square	0.48184		

It is apparent from these indicative results that the rating of the bank is reflected in issue spreads with a 33 basis point increase in spread for each notch decline in ratings. Issue spreads also vary over time with the general level of credit spreads. However, in contrast to the panel data regressions it is not possible from this exploratory analysis to reject the hypothesis that $\beta_2 = 1$ at normal levels of significance, ie that issue spreads move in line with market changes in average corporate spreads. This is possibly due to much of the new issuance occurring prior to the increase in spreads after mid-2014.

Conclusion

This paper has argued that the characteristics of bail-in securities issued by Australian banks makes valuation and thus calculation of a "fair" bail-in risk premium (BIRP) through common contingent claim modelling techniques which rely on assumptions of quantifiable risk problematic. Rather the potential range and likelihood of outcomes for investors in such securities are subject to uncertainty in the Knightian sense. However, to the extent that sophisticated investors determine market prices using common risk indicators, issuance and traded yield margins of these securities could be expected to be related to such indicators. While there is evidence of such risk sensitivity, this does not provide evidence on the size of the BIRP or its risk sensitivity – since traded margins also reflect other factors such as normal credit risk. But significantly, other than general indicators of bank or banking sector risk, specific characteristics of the bail-in securities and bank capital strength do not appear to have been reflected in bail-in yields.

This finding suggests that one of the arguments advanced for use of bail-in provisions, that of additional market signalling of risk perceptions via bail-in security yields, does not find reflection in the Australian experience to date. To what extent that is a sample specific result reflecting the upward trend in bail-in yields from mid-2014 to 2016, and perhaps due to increasing retail investor familiarity with bail in risk (and demand for a higher BIRP), or the effect of a vastly increased supply of such securities, remains an outstanding issue.

The main approach used to attempt to measure the size of the BIRP involves comparison of yields on bail-in and non-bail-in securities which are otherwise largely comparable. These comparisons suggest that there is some evidence of a BIRP in the order of 50 – 230 basis points p.a. in shorter maturity securities held by domestic retail investors. These comparisons are yields relative to those on non-bail-in T2 securities. The lower end of this range relates to otherwise comparable Tier 2 instruments (where bail in risk is lower) and the upper end reflects differences between otherwise comparable AT 1 bail-in and Tier 2 non-bail-in instruments. (If it is assumed that domestic retail investors do not fully value the tax credits paid on the Tier 1 instruments, which seems unlikely, that estimate of the BIRP would decline in size). There is also some slight evidence of a lower BIRP in domestic retail-oriented securities relative to those issued into international/wholesale markets, suggestive of better informed, sophisticated investors demanding a higher premium for bail-in risk. While there is a positive term premium in traded margins on bail-in securities, dividing that between a BIRP component and a standard credit risk component is problematic.

The existence of a BIRP is also suggested by graphical comparisons (Figure 5) of bail-in yields relative to other indicators of credit risk such as margins on bank floating rate senior debt. These suggest that there is an average BIRP in the order of 200 -300 basis points (relative to bank senior debt) as at early 2016 (and which had increased since the second half of 2014).

The research questions examined in this paper are particularly relevant to regulators for at least two reasons. First, regulators have expressed concerns about whether retail investors can have adequate understanding of the range and likelihood of outcomes of such complex securities. Hence identifying whether a BIRP of adequate size for risks involved is observed may mitigate concerns about “fair pricing” somewhat (although not concerns over whether some investors understand the risks involved). Second, demonstrating risk sensitivity of BIRP pricing may mean that market prices of such securities provide an additional form of

market discipline on banks as well as being useful indicators for prompting regulatory action. However, on the evidence available to date which suggests a significant re-rating of bail-in securities occurred after mid-2014, there is little sign of a stable relationship between bail-in pricing and relevant security-specific risk characteristics.

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