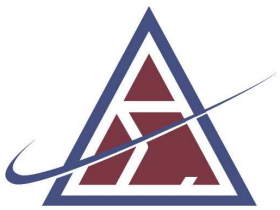

Institute of Actuaries of Australia

APS330 Home Lending Data - Application & Insights

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APS330 Home Lending Data - Application & Insights

1. Purpose

The purpose of this paper is to demonstrate how decomposing APS330 data into its constituent assumptions can be used to generate insights into Australian / New Zealand home lending credit risk.

Keywords: APS330, Banking, Home Lending, Credit Risk, Capital

2. Abstract

Since 2008, the 4 major Australian banks have regularly updated the market with detailed risk and capital reporting (APS330[i]) on their Basel 2 (B2) capital requirements. This is part of their responsibility of being accredited under the B2 regulation. This reporting amongst other things gives insights into the internal bank assumptions on their lending exposures, loan default probabilities and assumed losses in the event of loan default.

The collapse of the US housing market over 2008-09 has demonstrated the broader economic damage that a severe deterioration in home lending credit quality can cause. Given the national interest in the integrity of the $1.2 trillion Australian / NZ home lending credit system, home lending has been chosen as the focus for this paper.

By using the publicly available APS330 reporting produced by each major bank, a simple model has been developed that breaks down the home lending system into a series of simple relationships. Using this model, system wide insights have been drawn out in the form of 4 hypotheses:

1. Whilst the impact of pro-cyclicality on the home lending capital requirement has been relatively benign over 2009, the system remains susceptible to future adverse pro-cyclicality.
2. Leverage to credit risk on home lending is around 3.5 times the leverage on other types of lending under the B2 framework. This difference is wider than on the previous B1 framework.
3. A decomposition of actual and expected default rates across the 4 major Australian banks reveals consistent assumed level of losses in the event of default (LGD), but large variations in actual and expected (PD) default rates.
4. A plausible home lending credit risk downturn scenario over the next 2 years (downturn PD increasing to 1.5 times current PD, downturn defaults increasing to 2.5 times current PD), could increase the home lending capital requirement for the major banks by around 40% (or $7b), and require an additional $35b of funding to meet re-drawn home lending balances.

Whilst improved transparency around home lending system credit risk has been an important benefit of the Australian banks' B2 implementation, there are still some issues that need to be addressed around susceptibility to pro-cyclicality, home lending leverage, LGD transparency and coverage. It is suggested that the various data and insights into our housing market could be brought together into a single unified "early warning system" to provide a more granular monitoring of system wide credit risk. At a time when the global role of the B2 framework is under critical review, such a system would deliver an important case study on how our major banks "advanced" level of B2 compliance can be used to better monitor and protect Australian and New Zealand social and economic interests.

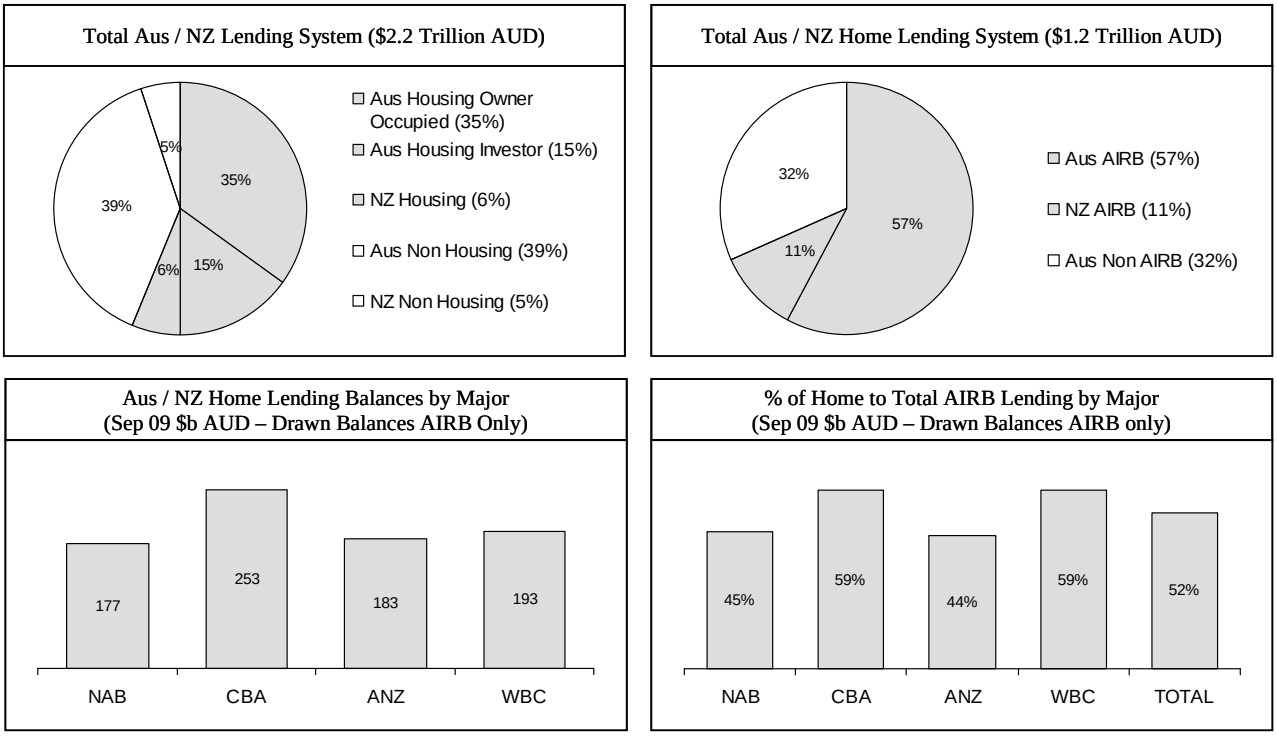
3. Sizing the Home Lending System (Australia / NZ)

At December 2009, the total Australian / NZ credit system stands at approximately $2.2 trillion AUD. Around $1.2 trillion, or 56%, of total credit relates to borrowing secured by housing. Of this 56%, around 70% is finance for owner occupied housing, with the remaining 30% for investment housing. Whilst both overall Australian credit and housing credit have grown[ii] at roughly the same rate of 13% pa over the last 10 years, it will be shown further on in Figure 9 that housing and business growth rates have followed very different trends over this time.

68% (or $0.8b) of the combined Australian / NZ home lending volumes are being managed through the 4 major Australian banks and their NZ owned franchises on an advanced internal ratings based (AIRB) credit management approach. This paper refers to this part of the home lending system as the AIRB home lending system and it is on this part of the lending system that the richest credit information is disclosed through regular APS330 reporting.

It is expected that the current 68% AIRB home lending coverage will further increase to around 80% over the next year or two as the home lending books of the recently acquired Bankwest and St George move to an AIRB status, and to the extent the 4 major Australian banks continue to grow home lending market share at the expense of the minor lenders. The AIRB home lending system has therefore become a good sample from which to better understand overall system home lending credit risk issues.

Figure 1 – Australian / NZ Credit System (AUD)



Source – APS330 Reporting, RBNZ, RBA, note AIRB excludes BWA (CBA), SGB (WBC), Challenger (NAB)

4. The Model

Key Concepts

The following concepts are key to the analysis conducted in this paper:

Basel 2 (B2) – Since 2008, the 4 large Australian Banks are endeavouring to comply with all 3 Pillars of the B2 regulation. For these banks, the new B2 regime represents an upgrade from the far less dynamic Basel 1

regime, which they previously complied with. Pillar 1 "Minimum Capital Requirements" outlines the regulatory capital ratio and risk weighted assets (RWA) to be calculated for credit, market and operational risk. Three options – foundation, standardised and advanced – are available to banks in the calculation of their RWAs. Pillar 2 "Supervisory Review" ensures banks maintain adequate capital, including for risks that are not adequately covered under Pillar 1. Pillar 3 "Market Discipline" requires banks to disclose capital requirements, risk exposures and assessments (APS330 reporting).

EAD - The expected exposure of the bank in the event of default. *Utilised EAD*, often described as the lending balance, is that part of the EAD that has been drawn down by the borrower, plus any un-drawn balances that the bank is choosing to fund. The residual EAD is defined as being *unutilised EAD*. When a borrower re-draws on their loan, they are increasing their utilised EAD, offset by an equivalent reduction in the unutilised EAD. Whilst the proportion of unutilised EAD does not impact on the capital requirement, it does impact on both leverage and product margins.

Default – A borrower is considered in default when either or both of the following have occurred (a) the bank considers the borrower unlikely to pay its credit obligations to the banking group in full, without recourse by the bank, or (b) the borrower is past due more than 90 days by a material amount on any credit obligation. For regulatory purposes, it is possible for a borrower to shift between being default or non-default over the lifetime of their loan. A borrower can also be in default, even if the bank expects no loss.

Probability of Default (PD) – A best estimate probability that a non-defaulted loan moves to a default state in the next 12 months. This is based on the long term "through the cycle" view[iii] and is therefore not a forecast, but rather a long term best estimate assumption. The *actual default % (D')* refers to the proportion of the current EAD that has been judged to be in default. Given the long tailed nature of the credit loss distribution (refer Figure 2), it is worth noting that it should be more common to observe defaults below the long term PD by virtue of the mode of the distribution falling somewhat behind the mean (PD).

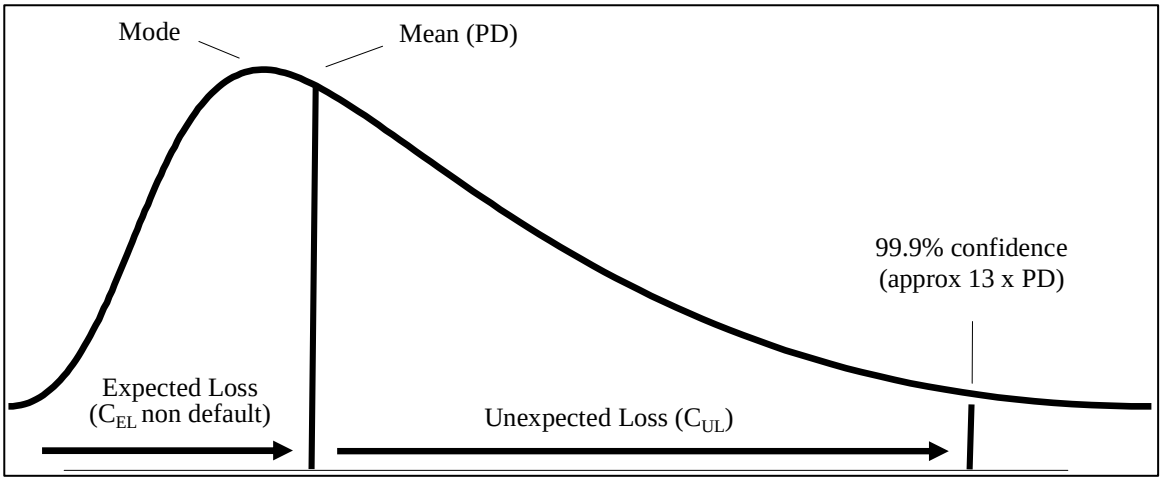
LGD - The expected loss in the event the loan defaults. The Australian regulator (APRA) requires this assumption to be calculated assuming a downturn[iv] environment, and also stipulate a minimum 20% floor on this assumption. Despite the traditionally well collateralised nature of the Australian and New Zealand home lending system, this assumption will therefore be internally calculated by each bank assuming property prices are somewhat depressed typical of the chosen downturn point in the credit cycle, and is therefore more conservative than prevailing property prices and LVR (loan to valuation) ratios might indicate. In the event of a downturn scenario, a property price correction[v] in excess of that assumed internally by the banks may result in an increase in the LGD (assuming internal bank calculations breach the APRA required 20% floor).

Credit Provisions – Reserves that the bank chooses to hold in the balance sheet, and therefore take to their P&L, against future credit losses. Generally reserves set against loans where a credit loss is expected to be taken are defined as specific provisions. Reserves set against the possibility that non-defaulted loans are written off and incur a loss are known as collective provisions.

RWA_{CR} – Credit Risk Weighted Assets are a measure defined by the regulator to assist banks in the calculation of *unexpected credit loss capital (C_{UL})* - the capital the regulator requires a bank to hold to ensure that 99.9% of the time it will have enough funds to cover any loan losses in excess of the long run expectation. This capital requirement is currently required to be a minimum of 8% of total RWAs. Implicit in the approach prescribed in APS113 for banks to derive RWAs is the assumption that non-defaulted home lending credit has a long tailed loss distribution. This is illustrated in Figure 2 below.

Tier 1 capital - The higher quality capital such as retained earnings or shareholders equity that is being held to cover banking capital requirements. APRA requires this type of capital to be held at a minimum of 4% of total RWAs. Any residual capital required to meet the overall 8% minimum will be comprised of lower quality *Tier 2* capital, such as subordinated debt. Currently the 4 major Australian Banks are collectively holding a Tier 1 ratio of around 8.6%[vi], well in excess of this 4% minimum requirement.

Figure 2 – Home Lending Credit Loss Distribution

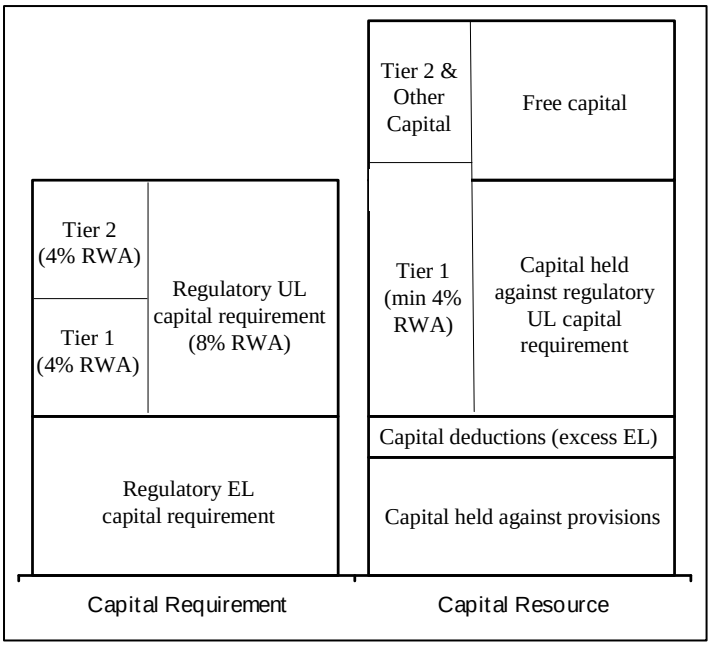


illustrative only for non-defaulted loans

Expected Credit Loss Capital (C_{EL}) – Capital the regulator requires to be held for expected levels of loan losses. In the event that this is higher than credit provisions, this capital requirement will be held as a combination of credit provisions and deductions required to be made from shareholder capital for the purpose of assessing capital adequacy. This is illustrated in Figure 3 below.

Regulatory capital requirement (C) - Represents the sum of both regulatory expected and unexpected loss capital. Expressing this as a % of EAD provides a proxy for risk, and as a % of balances provides a proxy for the cost of capital needed to be funded out of loan margins. *Regulatory capital resource* represents those shareholder assets available to meet the regulatory capital requirement. The relationship between capital requirement and resource is illustrated in Figure 3 below. *Pro-cyclicality*, discussed further in section 5 of this paper, is most easily described as the extent to which the capital requirement increases in the bad times (ie adverse pro-cyclicality), and / or reduces in the good times (ie favourable pro-cyclicality).

Figure 3 – Capital Resource vs Requirement (Home Lending – Illustrative Only)



Leverage (L) – Describes the maximum ratio of assets to equity permitted under the B2 framework. For example, leverage of 50 implies that to fund the assets required to support $49 of lending, only $1 of equity needs to be put in by the bank, with the residual to be borrowed or raised through customer deposits. For the purpose of this analysis we only consider the credit risk capital requirement in assessing lending leverage.

Model Construct

By combining the concepts above, data available from APS330 reporting, and the prescribed Pillar 1 (advanced) approach to capital calculation outlined in APS113, a series of simple relationships have been developed to represent the AIRB home lending system. The 5 key equations which form the basis of the model are shown in Figure 4 below. With regards to equations 1 to 3, these combine to provide a model of the Australian / NZ AIRB home lending system credit risk capital requirement. Equations 4 and 5 describe the relationship between PD, utilisation and leverage.

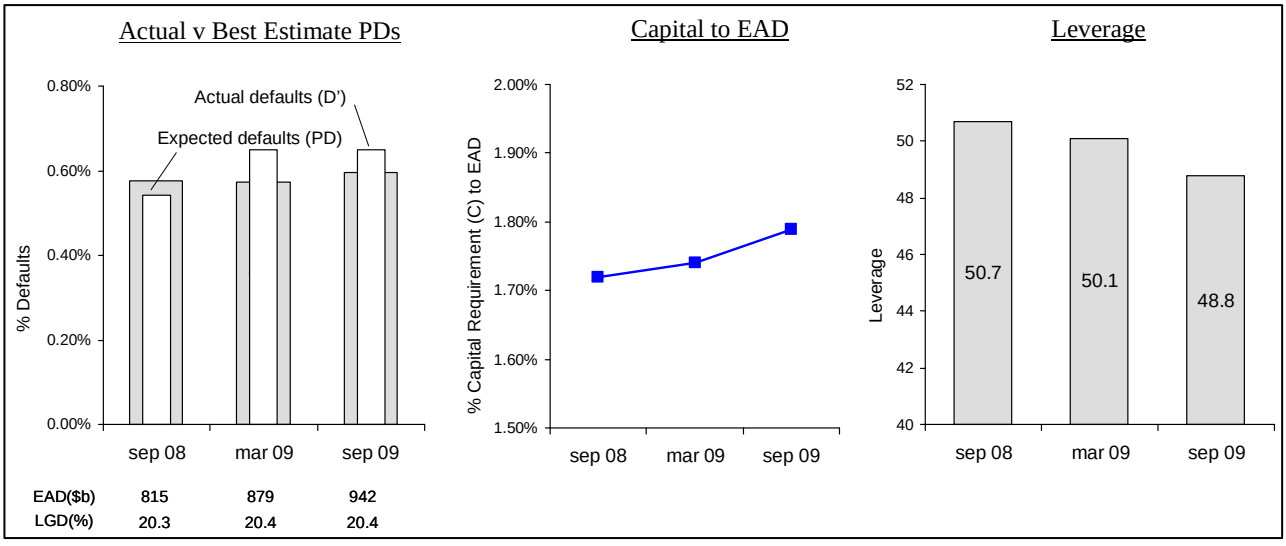
Appendix A details these equations in more detail. It also acknowledges several limitations with this approach. These include the impact of regulatory overlays, sample size, lack of data granularity, statistical assumptions, bank methodology differences, AIRB implementation issues and inconsistent reporting dates. Appendix B provides the data taken from the major banks' APS330 reporting used to populate this model.

Figure 4 – Key Inputs of Credit Capital Requirement for the AIRB Home Lending System

Equation 1 - Unexpected Loss Capital Requirement (non default only)	$C_{UL} = LGD_{ND} \cdot \left[N\left(\frac{G(PD) + \sqrt{15\%} \cdot G(0.999)}{\sqrt{1-15\%}} \right) - PD \right] . EAD_{ND} . 106\%$
Equation 2 – Expected Loss Capital Requirement	$C_{EL} = MAX\ [(LGD_{ND}.PD.EAD_{ND} + LGD_{D}.EAD_{D}).106\% , Provisions]$
Equation 3 –Derivation of Actual (D') and Expected (PD) Defaults	$D' = 1 - EAD_{D} / EAD$ And where PD is the value : $C_{UL} + C_{EL} = 8\%.RWA_{CR} + EL_{CR}$
Equation 4 – EAD Utilisation	$EAD_{UTILISED} = EAD_{ND}.[39/40 - (e^{-125.PD}) / 4] + EAD_{D}$
Equation 5 – Credit Risk Leverage	$L = (EAD_{UTILISED} + C) / C$

Figure 5 demonstrates the key outcomes including actual versus expected defaults, capital requirement and leverage that are explored in the following section of this paper.

Figure 5 – Key Model Outcomes 2H08-2H09 for the AIRB Home Lending System



5. Application and Insights

HYPOTHESIS 1 – Whilst the impact of pro-cyclicality on the home lending capital requirement has been relatively benign over 2009, the system remains susceptible to future adverse pro-cyclicality.

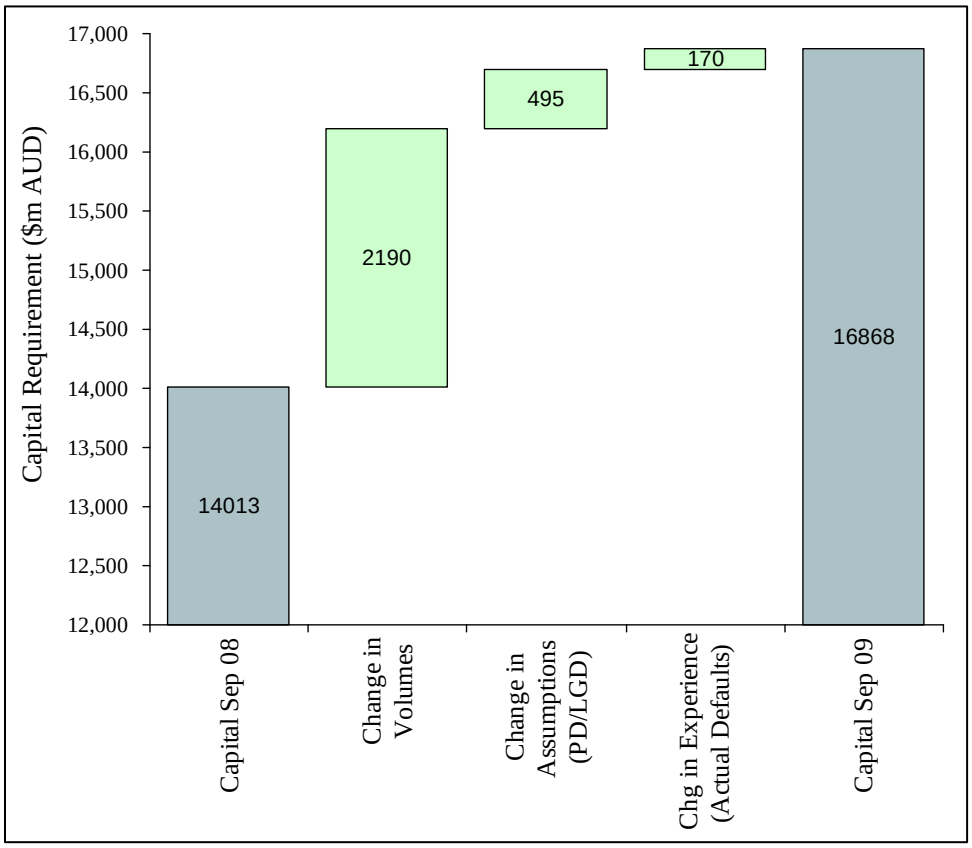
By applying equations 1-3 described earlier, we can decompose the change in capital requirement for the AIRB home lending system into expected and experience capital impacts (Table 6). *Best Estimate Credit Loss Capital (C_{BE})* represents the total capital requirement if the best estimate PD occurs in practice. The *Experience Capital Adjustment (C_{EA})* represents the impact of actual defaults varying from the PD.

Table 6 – Analysis of Change in Home Lending Capital 2H08-2H09 ($m AUD)

Analysis of Change	1H09	2H09	FY09	Derivation
Credit Loss Capital Start	**14,013**	**15,283**	**14,013**	Capital at Start
Experience Capital Adjustment Start	-60	140	-60	start C(EA) - refer Appendix A
Best Estimate Credit Loss Capital Start	14,073	15,143	14,073	start C(BE) - refer Appendix A
Change in Volumes EAD (old assumptions)	1,106	1,084	2,190	impact on start C(BE) of new EAD
Change in Expected Capital (new assumptions)				
- Change in expected PD's	-98	484	386	impact on C(BE) of new PD
- Change in LGD's	62	47	109	impact on C(BE) of new LGD
Credit Loss Capital End	**15,283**	**16,868**	**16,868**	Capital at End
Experience Capital Adjustment End	140	110	110	end C(EA) - refer Appendix A
Best Estimate Credit Loss Capital End	15,143	16,758	16,758	end C(BE) - refer Appendix A

The change in capital over the year is also shown somewhat more simply in Figure 7 below.

Figure 7 – Change in Best Estimate Capital Requirement (2009) ($m AUD)



Key observations on the 2009 analysis of change:

Volume growth - explains almost $2,190m (77%) of the $2,855m increase in the AIRB home lending system capital requirement over 2009. It is important to note that this will include system growth, market share that has been taken by the major banks at the expense of the minor banks, and also any major bank lending transitioned to an advanced (AIRB) B2 approach over the year.

Relatively stable best estimate assumptions – The overall home lending system PD has increased marginally from 0.58% to 0.60% over 2009, adding $386m in capital requirement. The LGD for non-defaulted and defaulted loans increased by 9 and 73 basis points (bps) respectively, adding $109m in capital requirement.

Deterioration in actual defaults - Actual % defaults finished the year 0.05% above the best estimate PD, after starting the year 0.04% below. This difference in actual over expected PD explains an additional $110m of capital requirement (pro-cyclicality impact) at Sep 09, compared to ($60m) at Sep 08.

Drivers of Australian / NZ home lending pro-cyclicality

In the context of the model, I define adverse pro-cyclicality as any tendency for PD and/or LGD assumptions to move upwards in the event of deterioration in either actual observed default rates, or losses on default. As mentioned, the capital requirement is particularly sensitive to any changes in PD or LGD (eg either a 5 bps increase in PD, or 125 bps increase in overall LGD, will increase capital by around $1b), but far less sensitive to any short term default rate over and above the long term PD. The real driver of adverse pro-cyclicality for the system is therefore any upward movement in the PD and LGD assumptions, further demonstrated in Figure 16. With regards to the AIRB home lending system, I have outlined four reasons for adverse pro-cyclicality in the event of any broader macroeconomic deterioration.

Structural shift to first home buyers - 2009 has seen a structural shift in the home lending system towards Australian first home buyers. Spurred on by government incentives, first home buyer appetite to borrow increased substantially over 2009[vii]. It may take a little time before the long term default rate for this new cohort of borrowers can be empirically settled, but it is likely to result in an upward shift in system PD.

Credit cycles redefined - it is likely that internal bank PD models set up at the inception of the B2 framework for the broader lending system are still largely relying on the last decade of relatively benign Australian / NZ default rates. It is also unclear the extent to which the "through the cycle" PD has recognised the occasional extreme event like the sort of housing credit events currently seen in the US and UK. I expect a higher future long term expected loss assumption for the system as banks begin to update their PD models for both the higher level of defaults experienced over the last couple of years (refer Figure 15), and a new appreciation of the potential frequency and impact of risk in the tail of the home lending loss distribution.

Bank credit rating systems (CRS) - it is important to reflect on how banks determine the PD for each loan. CRS[viii] ratings are set dynamically and subject to regular adjustment based on account behaviour. For example, if the system detects that a borrowers' current account is being depleted, or is receiving fewer or less frequent cash deposits, the system will automatically adjust that borrowers' CRS rating upwards. In the event of a significant macro downturn, the consequence of a large rise in interest rates and/or unemployment triggering a material migration of borrowers along internal credit scales would be significant upward pressure on the overall PD. This is even if the PDs assigned to the various credit scores are held stable.

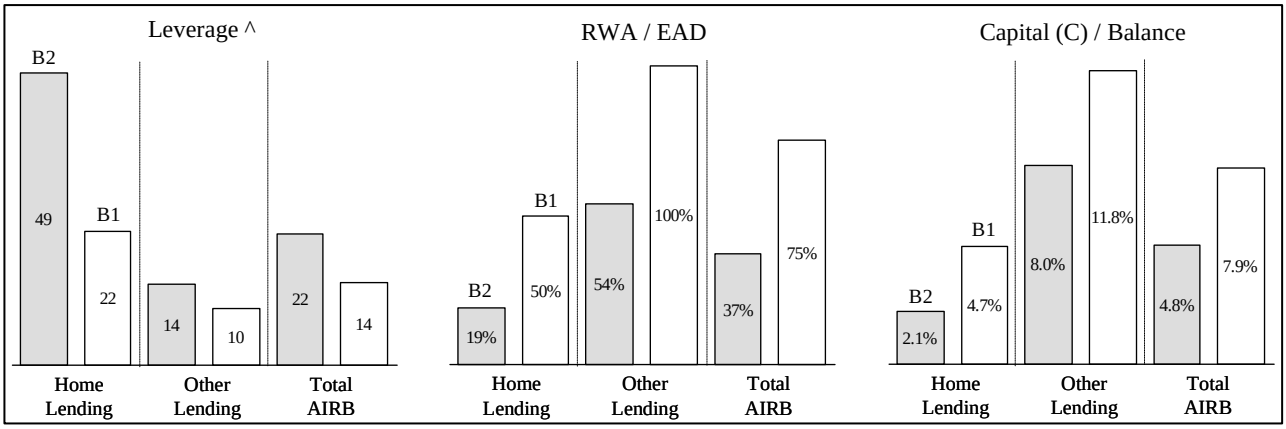
LGD "breach" – The LGD floor appears to have acted as an important stabiliser in limiting the impact of any adverse pro-cyclicality over 2009, despite a slight increase in LGD observed over 2009. It is however unclear from current bank reporting what might be the signposts for the internal bank calculated LGD breaching the APRA floor, as even a relatively minor jump in LGD can have a material impact on the capital requirement. At what point might a fall in house prices trigger an internal bank calculated LGD in excess of 20%? What are the downturn assumptions currently being used by banks in their LGD calculations? How close are these internal bank calculations currently to the 20% floor? This could be made more transparent.

HYPOTHESIS 2 – Leverage to credit risk on home lending is around 3.5 times the leverage on other types of lending under the B2 framework. This difference is wider than on the previous B1 framework.

For the large Australian banks, overall leverage[ix] reduced from around 21x to 19x between 2008 and 2009, mainly driven by capital raisings to respond to heightened investor and ratings agency scrutiny on balance sheet strength, plus the need for an internal buffer against potential adverse pro-cyclicality impacts on credit capital and losses. The regulator has also acted to constrain leverage including the use of a transitional floor on overall B2 RWAs (not to fall below 90% of the existing B1 level) and other "conservative" overlays currently applied to the calculation of B2 RWAs.

Whilst there has been public discussion around the possibility of new international banking regulations that will constrain overall Group level banking leverage, the analysis in Figure 8 suggests that consideration might first be given to addressing the high underlying level of home lending leverage inherent under the B2 framework. By applying equation 5 to APS330 data, we are able to calculate leverage across home and other lending. At Sep 09, the AIRB home lending system had an implied leverage of around 49, 3.5 times that of the broader AIRB lending system[x]. This gap was closer to 2 before the introduction of B2 in 2008.

Figure 8 – AIRB^^ Home Lending System B1 versus B2 (Leverage, RWA/EAD, Capital/Balances)



^ B1 ignores EL and implicitly recognises credit, market and operational risk, ^^AIRB excludes specialised lending

Retail Banking returns … "Rivers of Gold"

A low capital requirement, as evidenced by high leverage, will flow through as a much lower cost of capital to be funded out of product margins. Figure 8 shows that as a percentage of balances, overall AIRB home lending system capital requirements are around 2.1% of balances, compared to around 8.0% for non home lending. As a rule of thumb[xi], every 1% of capital requirement costs around a 10 bps drag on pre tax margins. Therefore under B2, *home lending requires a relatively small 20 bps of margin to fund its capital costs*, versus around 80 bps for non-home lending. Note that these capital costs are indicative only, and will in practice be influenced by such things as the capital allocation basis chosen by the bank (eg regulatory vs economic capital), the extent to which any surplus capital held at an overall Group level is being allocated down, the type and cost of capital being held, actual earnings on capital and tax.

In addition to the low capital costs discussed above, retail banking returns are further supported through (i) the size of the home lending system leading to *cost economies of scale*, (ii) *low home lending credit losses* (annual losses typically less than 10 bps of the overall portfolio) driven off well secured portfolios, historically low default rates, and the use of lenders' mortgage insurance (LMI), (iii) *ability to reprice* over and above the RBA rate change cycle, (iv) *ability to fund lending growth* through customer deposits (particularly low yield transaction account balances), and (v) *ability to cross sell* other high return products like credit cards and insurance along with a home loan.

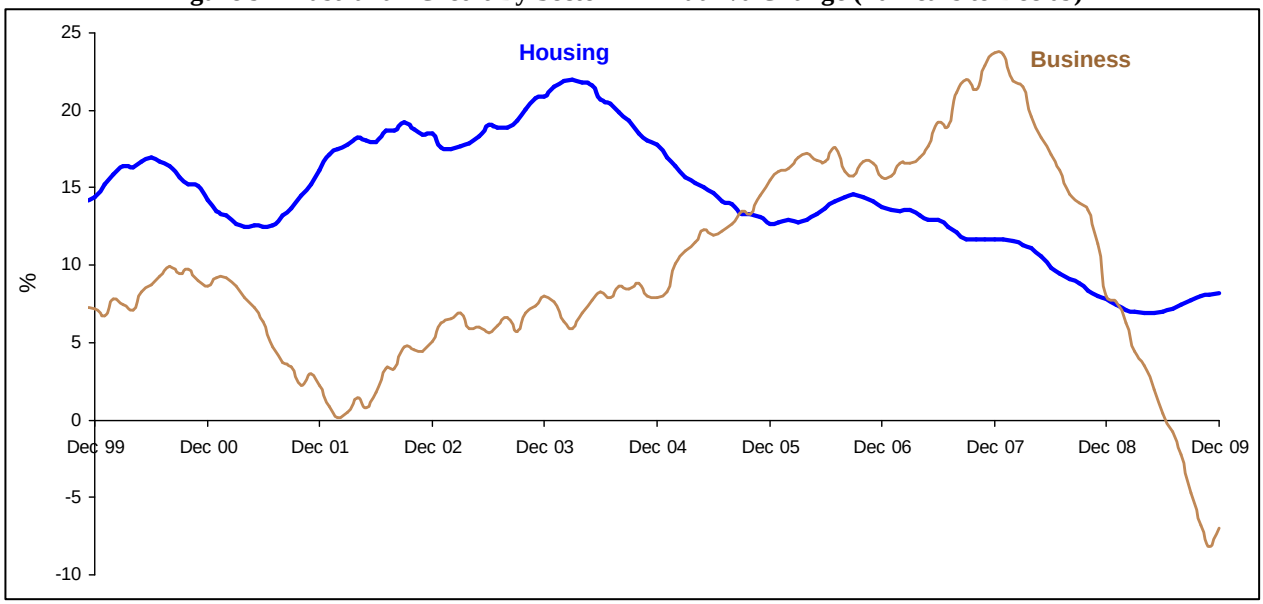
Recent Australian Credit System Growth Trends (Figure 9)

Demand side factors - With regards to business lending, it is recognised[xii] that macro economic factors have led to businesses actively seeking to lower the gearing in their balance sheets over the last couple of years, and that such demand led declines in the business lending system have been observed in the past. At the same time low interest rates, strong employment, government 1st home buyer stimulus and a resilient housing market (demand exceeding supply) have led to continued strong demand for housing credit.

Supply side factors - Bank capital has been aggressively redirected into the higher return / lower risk retail banking segment over the last couple of years in response to both a lower appetite for credit risk and a far more challenging environment for banks to raise the necessary funds needed to lend. This funding challenge is still persisting today as a function of both a super-competitive deposit market, longer term funding costs that are still well above pre-2008 levels and the looming threat of international banking regulatory changes to improve the quality of bank funding. A risk in these conditions is that business and institutional lending becomes restricted to those funds that have not already been loaned out through a retail banking channel, in turn distorting the optimal allocation of credit throughout the economy. On the business lending side, this will manifest itself in banks more aggressively re-pricing up their existing business customers and tightening up considerably on lending to new customers. Indeed the RBA has recently confirmed[xiii] that upward bank repricing has been more aggressive in the business segment than the housing segment, partly explained by the greater reliance by business lenders on expensive overseas term funding, a greater deterioration in business lending loss rates relative to home lending since 2008 and a more general strategy of lenders to reshape their balance sheet more towards retail banking assets.

Linking the transition to B2 with credit system growth trends – It is clear both demand and supply factors independent of the B2 framework have all played a strong role in the relative system trends around business and home lending. Nonetheless this paper has demonstrated that the move to B2 has further enhanced returns on an already very profitable retail banking segment by lowering the cost of capital required to be funded out of margins. This has no doubt had an influence on the more recent lending strategies of our major banks. With regards to the impressively low historical losses from home lending, that such high leverage has been calculated by the banks for the home lending system is not unreasonable. However in the context of possible systemic "tail" risks such as the contagion to the broader economic system in the event of any future extreme home lending asset quality deterioration, or the long term economic impacts of a persistent restriction in business lending, the level of home lending leverage permissible might be too high. This is an important national issue that requires further research and examination.

Figure 9 – Australian Credit By Sector – Annual % Change (10 Years to Dec 09)



Source – RBA - Dec 09 (D01 Growth in Selected Financial Aggregates)

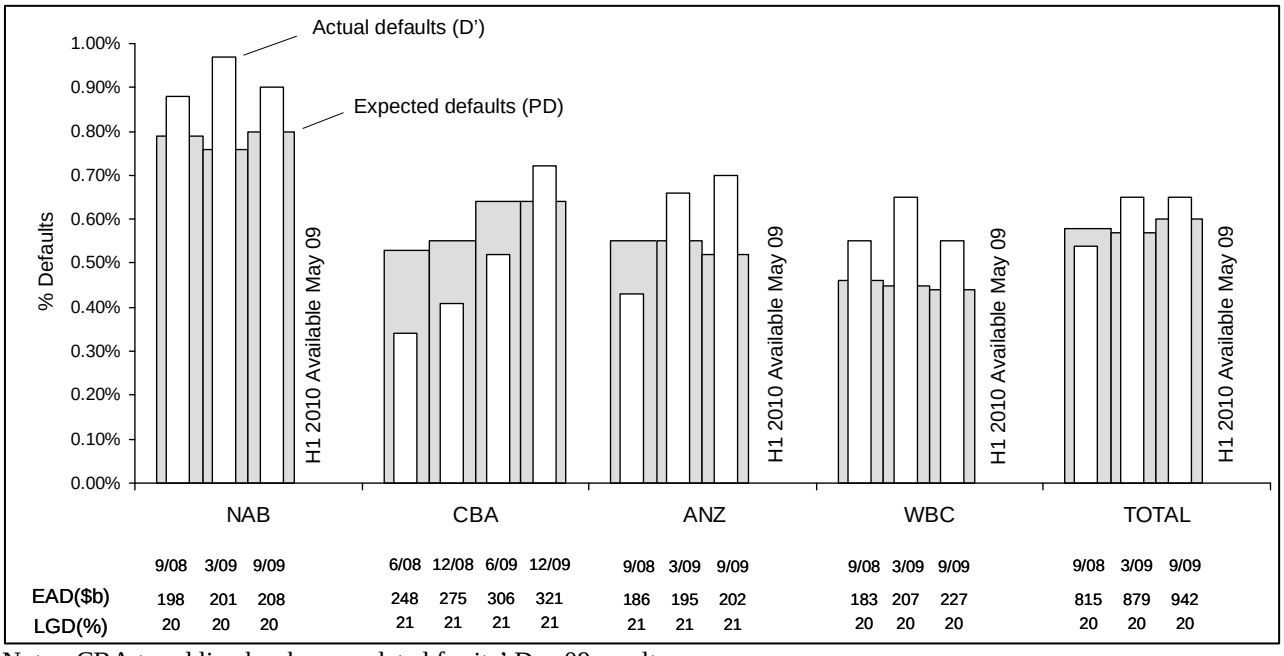
HYPOTHESIS 3 – A decomposition of actual and expected default rates across the 4 major Australian banks reveals consistent LGDs, but large variations in actual and expected default rates.

The analysis represented in Figure 10 highlights that whilst the overall system has only seen a mild deterioration in default rates, and has held a reasonably constant PD over this time, there is much more variability across the individual banks. LGD assumptions are far more consistent indicating that all banks have assessed their LGD to be at or below the APRA 20% minimum. Figure 11 shows how these assumptions come together in the form of an overall AIRB home lending capital requirement for each major bank. With regards to default rates, some headlines for the 4 major banks might be:

- NAB has the highest default rate, but has been relatively stable over the last 12 months. NAB is required to hold the most capital, relative to exposure, of all the 4 majors.
- CBA is showing the most rapid deterioration in both actual and expected default rates. Having recently grown share to around 1/3rd of the AIRB system, this has a material impact on the overall system trend.
- ANZ has shown a stable to slightly improving outlook on default rates, better than their current default experience and trend actually indicates.
- WBC has the best long term outlook on default rates, again better than their current default experience actually indicates.

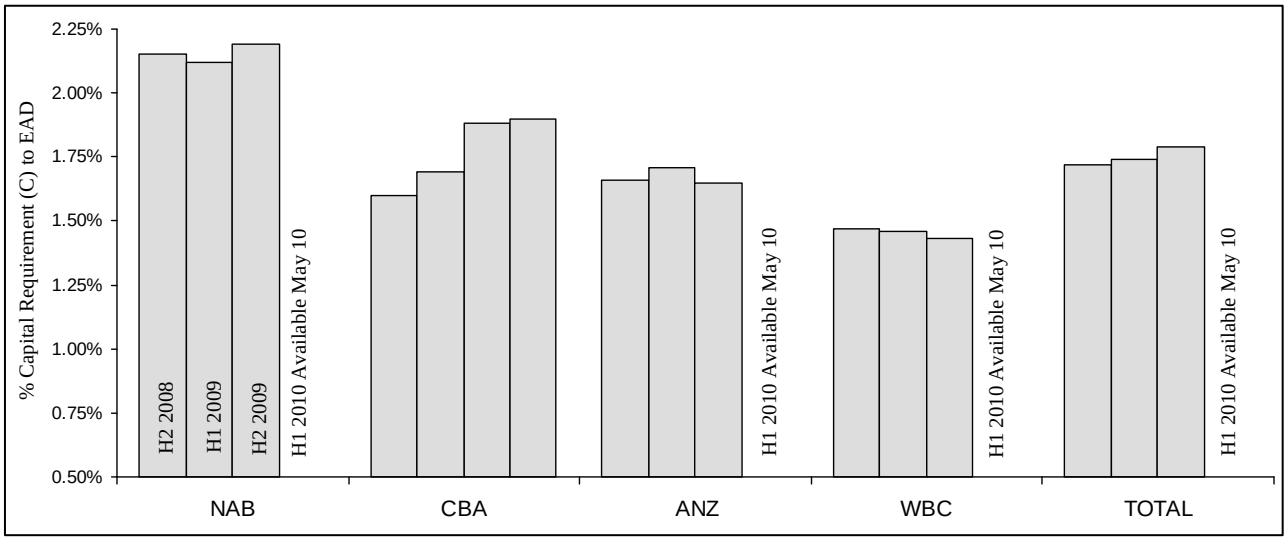
A banks' PD will move as a result of the "front book" migration of market share into a banking lender that has an asset quality profile different to their "back book". Indeed this may be completely acceptable if risk is being appropriately priced. I have already commented on the potential impact of the recent influx of first home buyers to drive up PD rates. The PD can also move as a result of regulatory overlays being applied for different banks or geographies. All these factors can result in much more dramatic movements in individual bank actual and expected defaults from period to period, relative to what might be observed in the overall system result.

Figure 10 – Actual vs Expected Defaults Across the 4 Major Banks (2H08, 1H09, 2H09)



Note - CBA trend line has been updated for its' Dec 09 result

Figure 11 – Capital Requirement as a % of EAD (2H08, 1H09, 2H09)

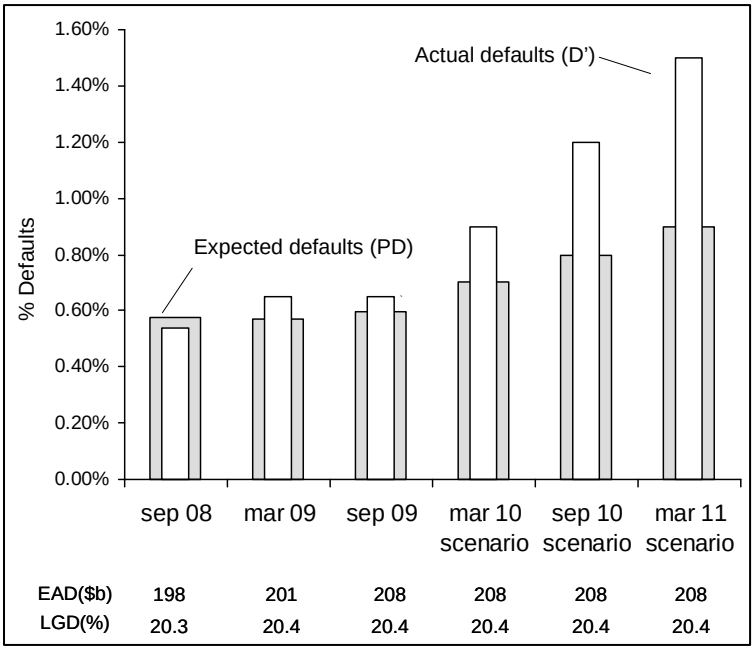


Note - CBA trend line has been updated for its' Dec 09 result

HYPOTHESIS 4 – A plausible home lending credit risk downturn scenario over the next 1-2 years (downturn PD increased to 1.5 times current PD, downturn defaults increased to 2.5 times current PD), could increase the home lending capital requirement for the major banks by around 40%, or $7b, and require an additional $35b of funding to meet re-drawn home lending balances.

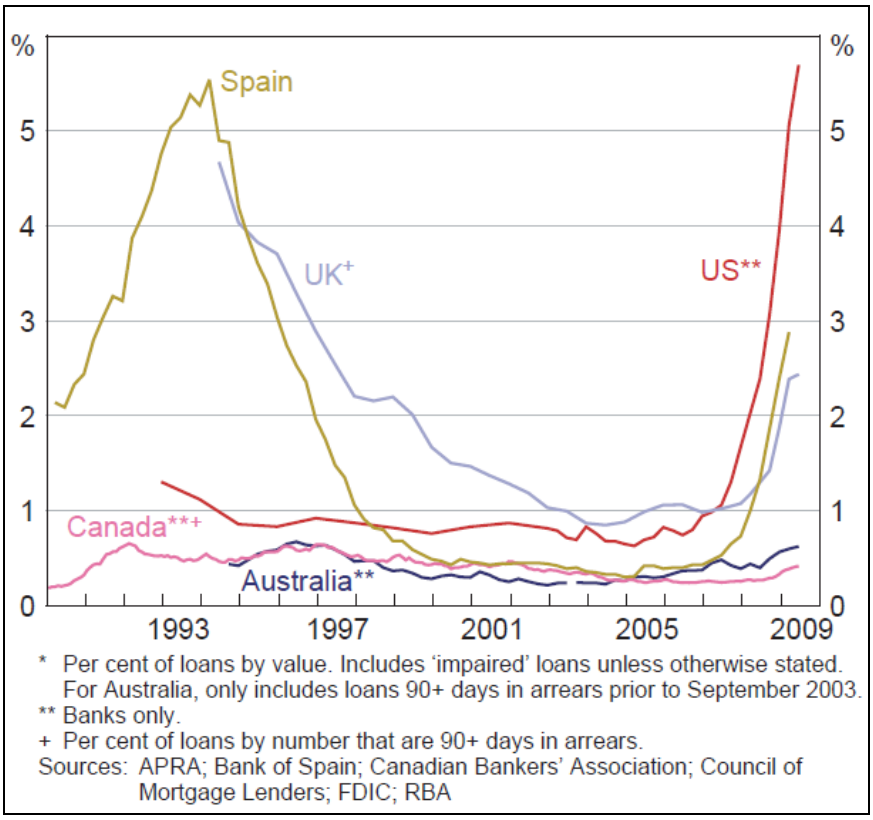
I have defined a plausible downturn scenario as AIRB home lending default rates increasing to around 1.50% by the middle of 2011 (or 2.5 x current PD). This corresponds very roughly to a 90% confidence interval "downturn" event on the current expected PD of 0.60%. I have also assumed the 1st hypothesis by modelling a migration in the PD to 0.90% (or 1.5 x current PD) in tandem with this deterioration with the actual default rate, ie assuming adverse pro-cyclicality would emerge in the event of a rise in actual default rates. This assumed deterioration in actual and expected defaults is shown in Figure 12 below.

Figure 12 – Downturn Scenario – Actual and Expected Defaults



In the context of the broader international home lending system, a downturn default rate of 1.5% still compares favourably with the UK, currently around 2.5%, and the US in excess of 5%, as indicated in Figure 13. The RBA recently described[xiv] the much stronger recent home lending asset quality in Australia relative to the US as amongst other things originating from historically tighter local credit standards, differences in consumer regulation, higher local interest rates, and a more proactive regulator. I agree that these features of our local jurisdiction should continue to limit the impact of any future housing downturn scenario relative to that currently being experienced in the UK and US.

Figure 13 – Global Non Performing Housing Loans (% of Loans)



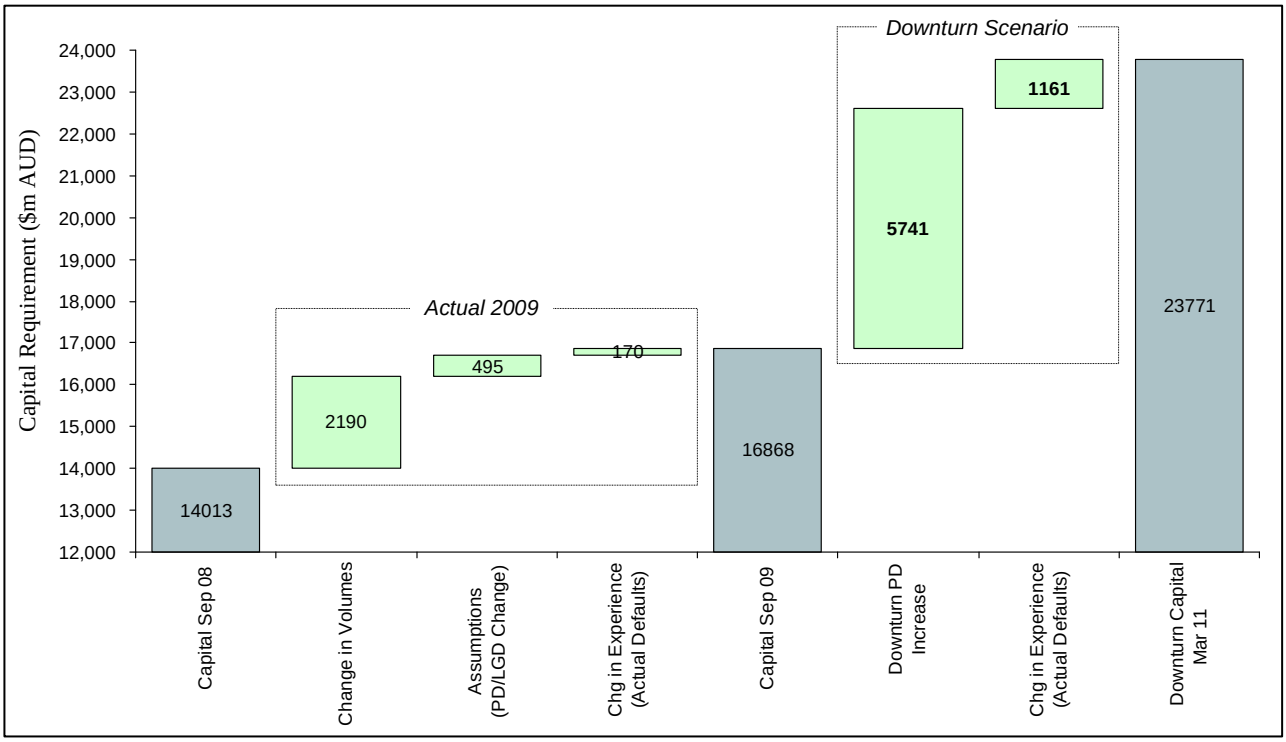
Source – RBA Financial Stability Review Sep09 (Graph 35)

A lack of transparency around the downturn assumptions currently being used by banks in their internal derivation of their LGD (eg assumed fall residential property values, or costs associated with realising security) makes it difficult to predict how / if the system LGD might deteriorate in a downturn scenario. For this reason, I have decided to assume the LGD assumption remains unchanged. Again I will point out the high sensitivity of the capital requirement to an increase in the LGD assumption (a 125 bps increase in overall LGD would increase the total capital for the AIRB home lending system by around $1b).

Downturn Scenario Outcomes

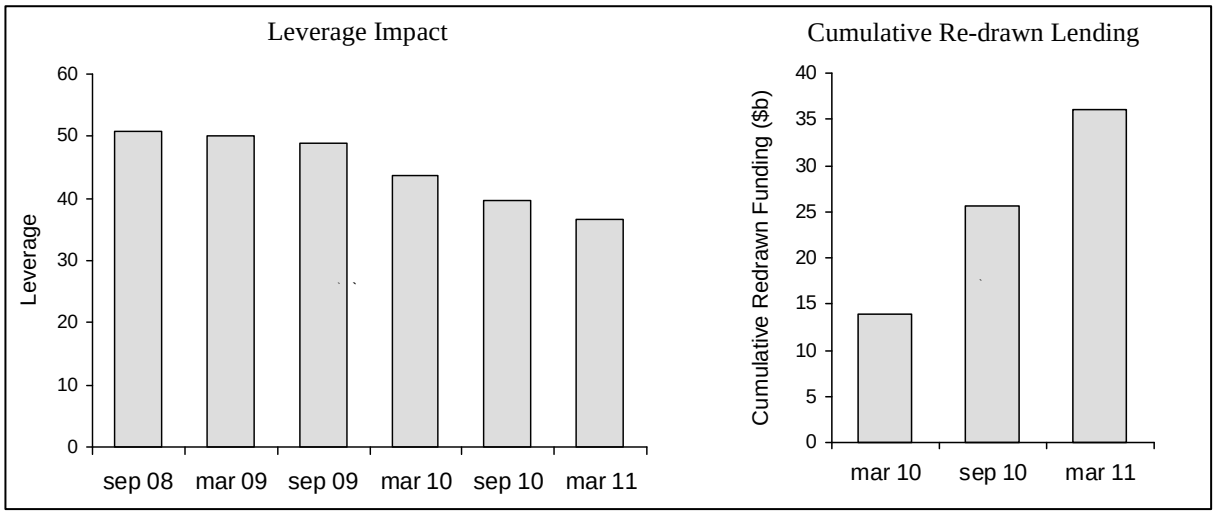
The scenario focuses on the impact on total capital requirement, which in practice would emerge as a combination of increased provisions (and losses thereon), expected loss capital deductions and RWAs. Figure 14 shows the $7b (or 40%) increase in required capital that would result from our downturn scenario. This equates roughly to 0.6% of the current RWAs of the combined 4 major banks, which in the context of current banking T1 capital resource at Sep 09 of approximately 8.6% of RWAs, would likely be well within their current balance sheet capacity. Note that for simplicity, volumes are assumed to be held constant. The scenario will also somewhat understate the potential capital impact by ignoring those parts of the major banks' home lending portfolio not currently on an AIRB status (namely St George and Bankwest).

Figure 14 – Downturn Scenario – Change in Capital Requirement (AIRB Home Lending)



As shown in Figure 15, leverage reduces as more capital is raised to meet the higher capital requirement, and around $35b of funding is assumed to be re-drawn as borrowers become more challenged to meet their loan repayments. With regards to this additional $35b of lending balances requiring funding by our major banks, 2008-09 has shown that that a highly stressed credit environment will challenge the ability to raise funds when credit is either unavailable (ie credit markets frozen) or prohibitively expensive and / or requiring direct government support.

Figure 15 – Downturn Scenario – Credit Leverage and Cumulative Redrawn Balances (AIRB Home Lending)



6. Conclusion - Enhancing the system wide management of credit risk

The collapse of the residential real estate market in the US has been commonly cited as the epicentre of what became the Global Financial Crisis[xv]. Early evidence that something was awry included both a large run up in US property prices since the mid-90s[xvi] and a noticeable rise in default rates seen to emerge around 2007 (refer Figure 13). What started as a downturn event in the US home lending market quite quickly turned into broad based global economic distress.

Whilst it is understandable the B2 framework has come under criticism[xvii] since these global events unfolded, we need to be careful not to throw the B2 baby out with the dirty GFC bathwater. US home lenders largely manage credit risk outside the B2 framework adopted by our major Australian banks. It is further clear in hindsight that the US home lending system lacked the necessary transparency required to facilitate an informed fact-based public discussion *prior* to the build up in credit risk growing out of control. This was further worsened by the prevalence of complex securitisation transactions used to shift the underlying credit risk around the global financial system.

Within Australia and NZ, the ability to publicly compare an expected level of home lending credit defaults against an actual rate has only emerged as a result of the big 4 banks implementing an advanced B2 framework. Our ability to monitor our system wide credit risk has been further enhanced by the much lower pre-crisis use of complex securitisation arrangements whose risk might have potentially slipped through the Pillar 3 reporting net. Notwithstanding my advocacy for the greater transparency that has emerged through our major banks' transition to B2, there are several issues that should be addressed. For example:

- The AIRB home lending *system seems susceptible to future adverse pro-cyclicality*. A lesson from 2008-09 was that extra capital required from adverse pro-cyclicality might need to be raised at a time when it is either unavailable or prohibitively expensive.
- It is quite possible that the *significant difference between home and other lending leverage* implied under the B2 framework has distorted the efficient allocation of lending across the economy since 2008. Addressing these high levels of home lending leverage should be considered before the application by banking regulators of more punitive leverage limits at an overall banking Group level.
- *Transparency around internal bank LGD calculations*, somewhat masked by the 20% LGD floor being applied by APRA, could be improved. If the sign posts that might push system wide LGDs above the APRA floor are better understood, it will be easier to anticipate the potentially material run up in capital requirement that will result from this floor being breached.
- Ensuring *coverage and "line of sight" around the 32% non AIRB* home lending system. Whilst this will improve once the St George and Bankwest home lending books migrate, the other smaller lenders need to be assisted and encouraged to improve transparency around their home lending books.

Finally, consideration should be given to the central pooling of more granular home lending credit data to build a national system for monitoring credit risk. By integrating this data with the lead indicators of emerging mortgage stress into a *single unified system*, the ability for a targeted early detection of any future domestic credit risk catastrophe would be enhanced. Whilst this paper has shown there is a richness of high level system wide data now available through APS330 reporting, there is still a need for ongoing research into the link between longer term Australian and New Zealand social and economic interests and the overall credit system.

Tim Gorst, March 2010

Note that the views expressed in this paper are entirely my own and in no way reflect the views of my employer. I would also like to thank Phillip Everett for his extremely helpful input and peer review.

Appendix A – Model derivation, inputs and outputs

Equation 1 – Unexpected Loss Capital Requirement (non-default only)

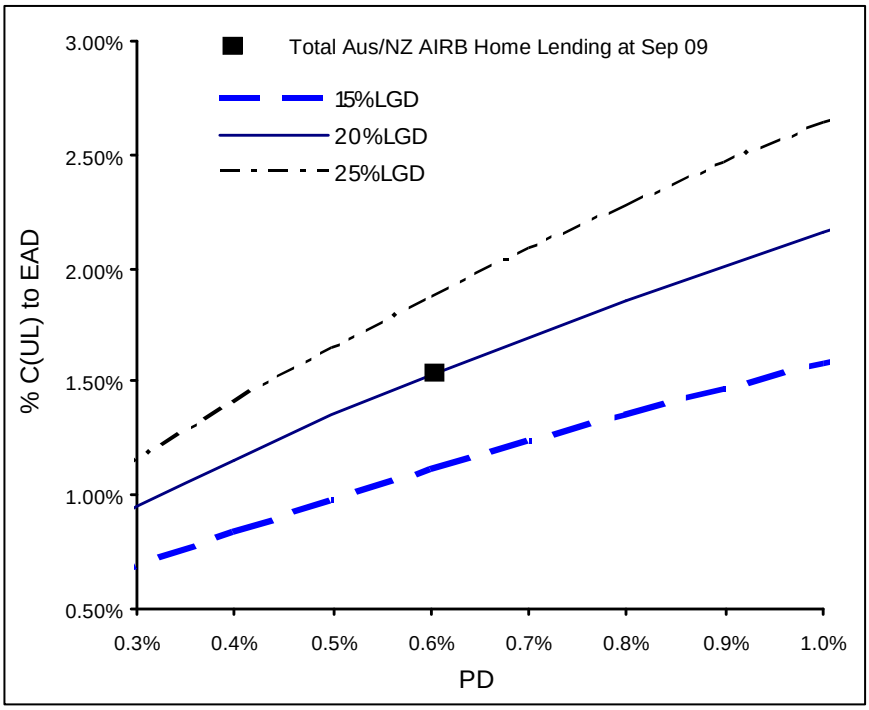
Equation 1 represents the calculation prescribed by the regulator in APS113[xviii] for the purpose of calculating non-default credit RWAs for unexpected losses corresponding with a 99.9% confidence interval. This equation was originally derived by O. Vasicek[xix]. It assumes the credit loss distribution is inherently long tailed, and has been adopted globally for use in the B2 framework. Figure 16 shows the sensitivity of unexpected losses to changes in the PD and LGD assumptions.

$$C_{UL} = LGD_{ND}.\left[N\left(\frac{G(PD) + \sqrt{15\%}\cdot G(0.999)}{\sqrt{1-15\%}} \right) - PD \right].EAD_{ND}.106\%$$

Where:

- N(x) = normsdist (x) = probability of a standard normal variable <= x
- G(n) = normsinv(n) = the number x such that N(x) = n
- 106% represents an overall regulatory[xx] overlay applied to AIRB Credit RWAs
- 15% represents the prescribed correlation for a normal home loan[xxi]
- EAD_{ND} = assumed exposure at default for non-defaulted loans
- LGD_{ND} = loss given default assumption for non-defaulted loans (subject to 20% LGD floor)
- PD = best estimate probability of default derived in equation 3

Figure 16 – Sensitivity of Unexpected Loss Capital (C_{UL}) to Changes in PD & LGD



assumes Actual Defaults (D') = PD

Equation 2 – Expected Loss Capital Requirement

Equation 2 represents the calculation, a derivation on that prescribed by the regulator in APS113[xxii], for the purpose of calculating regulatory expected losses. It assumes that no RWAs are being held against defaulted loans with the capital requirement rather being taken as a capital deduction in excess of provisions[xxiii]. This practice differs across the major banks.

$C_{EL} = MAX [(LGD_{ND}.PD.EAD_{ND} + LGD_{D}.EAD_{D}).106\% , Provisions]$

Where:
- LGD_D = loss given default assumption for defaulted loans
- LGD_{ND} = loss given default assumption for non-defaulted loans
- EAD_D = assumed exposure at default for defaulted loans
- EAD_{ND} = assumed exposure at default for non-defaulted loans
- PD = best estimate probability of default derived in equation 3
- Provisions = total credit provisions created as a charge against the P&L (specific and collective)
- 106% = an overall regulatory overlay applied to AIRB Credit RWAs

Equation 3 – Derivation of Actual (D') and Expected (PD) Defaults

The ability to derive PD is fundamental to enable a comparison of actual v expected defaults for the AIRB home lending system.

Actual defaults (D') are defined as:

$D' = 1 – EAD_D / EAD$

Expected defaults (PD) are defined as that number that calibrates modelled total capital (as per equations 1 and 2) to published total capital:

$C_{UL} + C_{EL} = RWA_{CR} . 8\% + EL_{CR}$

Where:
- EAD_D = assumed exposure at default for defaulted loans
- EAD = overall exposure at default
- RWA_{CR} = the RWAs published in APS330 reporting.
- EL_{CR} = the EL published in APS330 reporting.
- 8% = minimum capital required as a % of RWAs

Total Capital can also be defined as $C = C_{BE} + C_{EA}$

Best Estimate Credit Loss Capital (C_{BE}) - represents the total capital requirement if the best estimate PD occurs in practice. C_{BE} is found by substituting EAD_{ND} for EAD.(1- PD), and EAD_D for EAD.PD in equations 1 and 2.

Experience Capital Adjustment (C_{EA}) - represents the impact of actual defaults varying from the PD. It is simply the difference between C and C_{BE}. If it is positive it implies actual defaults are currently running above the best estimate PD, and / or provisions are being held over and above the long term EL requirement. If it is negative it implies actual defaults are currently running below.

C_{BE} and C_{EA} are useful for performing analysis of change in capital requirement as demonstrated in Table 6.

Equation 4 – EAD Utilisation

Equation 4 represents the relationship between PD and utilised exposure, and has been fitted against observations derived from APS330 reporting over the last 12 months. The riskier the home loan, empirically a borrower is far more likely to be fully utilising their available credit facility as demonstrated in Figure 17. This curve is necessary for conducting scenario testing on the impact of a changing PD on leverage.

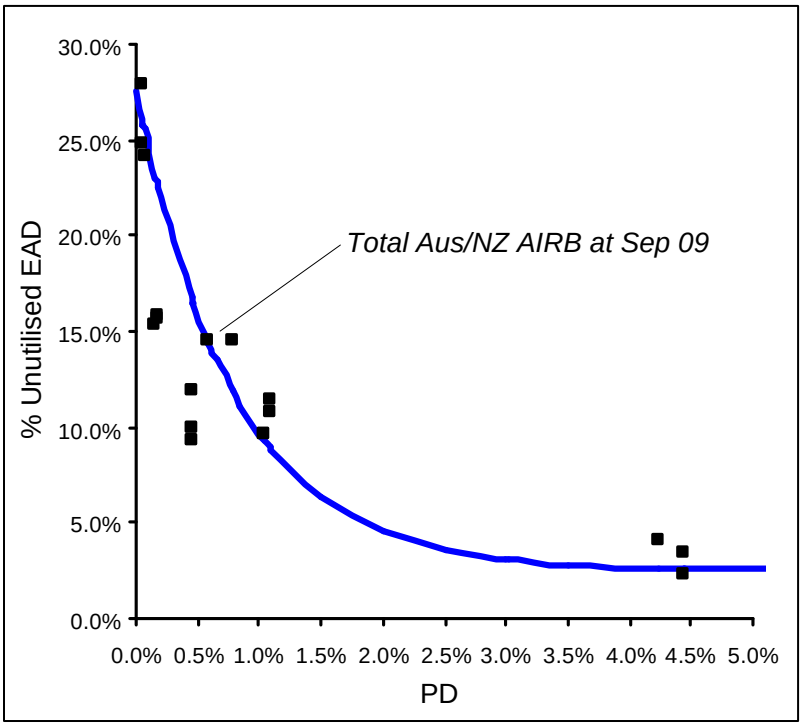
For 0<PD<10%, within which the majority of non-defaulted lending arrangements will lie:

$EAD_{UTILISED} = EAD_{ND} .[39/40 – (e^{-125.PD}) / 4] + EAD_{D}$

And for the far less likely PD>=10%, (where PD = 100% for those loans in default), lending limits can be assumed to be largely utilised and gradually converging to 100% as a loan moves towards default:

$EAD_{UTILISED} = EAD_{ND}.(35/36 + PD.1/36) + EAD_{D}$

Figure 17 – Sensitivity of Unutilised EAD to Changes in PD (Home Lending)



Curve fitted to 2009 industry observations

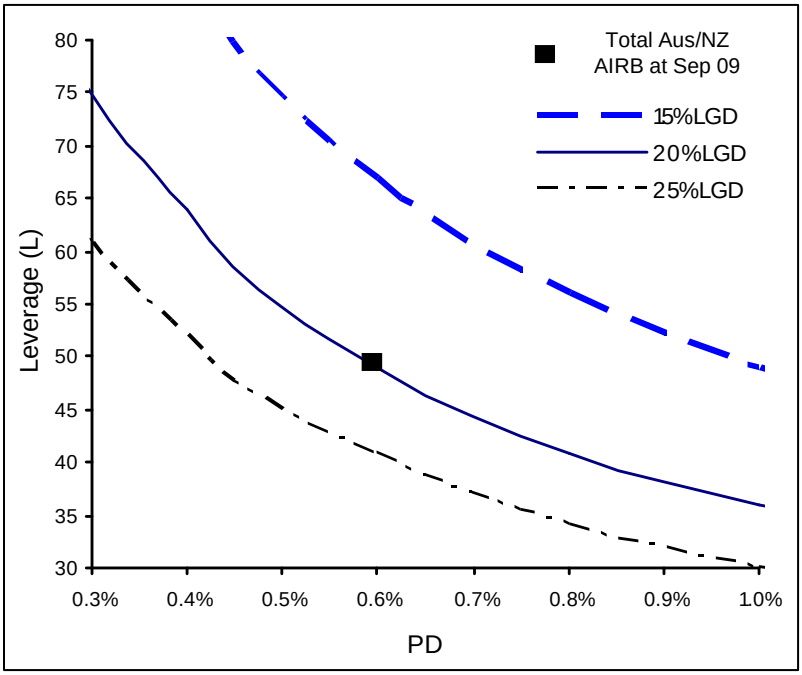
Equation 5 – Leverage (L)

Leverage is a measure for the maximum ratio of assets to equity permitted under the B2 framework. For example, where leverage of 50 implies that to fund the assets required to support $49 of lending, only $1 of equity needs to be put in by the bank, with the residual able to be borrowed or raised through customer deposits. For the purpose of this paper we only consider credit risk capital. As shown in Figure 18, the higher the assumed PD or LGD, the lower the implied credit risk leverage under the B2 AIRB framework.

Leverage is calculated as:

$L = (EAD_{UTILISED} + C) / C$

Figure 18 – Sensitivity of Leverage (L) to Changes in PD & LGD (Home Lending)



assumes Actual Defaults (D') = PD

Limitations

Key limitations with this model and approach include:

Distortion of Regulatory overlays – We have discussed regulatory overlays such as the 20% LGD floor and the 6% factor being used to gross up AIRB RWA calculations. The use of the implied regulatory capital confidence interval of 99.9% is another prescribed overlay and most likely inconsistent with the confidence interval being used in the internal Economic Capital models used by the banks. The RBNZ has[xxiv] in some cases applied prescriptive PD assumptions for use in NZ based AIRB models, resulting in the overall system PD used in this model being less responsive to changes in underlying risk.

Sample size – whilst the sample size is large (68%) it still excludes almost a third of the home lending system. For this reason a rough scale up of 3/2 might need to be applied to some of the outcomes of this model to calculate overall $ home lending system impacts.

Lack of Data Granularity – APS330 reporting provides only limited ability to use the approach outlined in this paper to drill deeper into the lending portfolio (eg separate out across Aus / NZ geographies, states, new book vs back book analysis, etc). The inability to split out NZ (15% of AIRB home lending system) and Australia is a constraint, and can be further distorted by movements in the AUD to NZD exchange rate.

Statistical Assumptions – the model approach assumes the shape of the loss distribution for the system is the same as the loss distribution being applied to each individual loan. This is probably not the case in practice, and may result in potential differences between the bottom-up (published) and top down (modelled) derivation of EL and UL capital.

Bank Methodology Differences - Differences in approach to classifying overall capital requirement between home lending UL and EL has also been observed across the major banks. There are possibly differences in the treatment of securitised home lending, though it should be noted the proportion of home loan volumes that have been securitised within Australia and NZ has declined over the last couple of years. Methodology

differences have the potential to create differences between the bottom-up (published) and top down (modelled) derivation of EL and UL capital.

AIRB Implementation Issues – The advanced B2 approach to credit risk capital management has only been recently adopted for use by the Australian Banks. On recently transitioned AIRB lending, data quality issues can take a little time to work through. As discussed in section 2, there are still significant parts of their home lending portfolio yet to be migrated (eg St George and Bankwest home lending books). To the extent that any model implementation issues impact on disclosed capital requirements, this could distort the results of this model.

Inconsistent Reporting Dates – CBA reports on a June year end, versus the other major banks who are on a September year end. The model has used June 09 CBA data to compare to Sep 09 for the other majors to define the end of 2009. Whilst each major also produces a quarterly APS330 reporting, these abridged reports do not contain actual default EAD (D') rates and are therefore not used for updating the model.

Appendix B – Model inputs and outputs for each major bank

Key Model Inputs – September 2009 AIRB Home Lending Capital Model ($m AUD)

	Sep-08	Sep-08	Jun-08	Sep-08	Sep-08	Mar-09	Mar-09	Dec-08	Mar-09	Mar-09	Sep-09	Sep-09	Jun-09	Sep-09	Sep-09	Dec-09
Input	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Sep 08**	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Mar 09**	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Sep 09**	**CBA**
EAD	186,287	197,884	247,573	183,376	815,120	195,432	201,362	275,345	207,052	879,191	201,581	208,419	305,613	226,514	942,127	320,800
EAD_{ND} (Non Default)	185,488	196,142	246,721	182,362	810,713	194,141	199,411	274,222	205,707	873,481	200,171	206,542	304,017	225,265	935,995	318,498
EAD_{D} (Default)	799	1,742	852	1,014	4,407	1,291	1,951	1,123	1,345	5,710	1,410	1,877	1,596	1,249	6,132	2,302
EAD (Utilised)	169,518	168,762	204,854	153,961	697,095	177,178	171,271	226,504	175,872	750,825	182,917	176,533	252,920	193,448	805,818	268,153
LGD_{ND} (Non Default)	20.5%	20.0%	20.6%	20.1%	20.3%	20.5%	20.0%	20.8%	20.1%	20.4%	20.5%	20.2%	20.8%	20.1%	20.4%	20.6%
LGD_{D} (Default)	21.3%	20.0%	20.5%	21.0%	20.6%	21.4%	20.0%	21.1%	21.0%	20.8%	21.8%	21.1%	21.3%	21.0%	21.3%	20.6%
RWA (Credit)	33,754	44,932	41,620	29,362	149,668	35,932	44,449	47,945	32,553	160,879	36,725	47,924	58,131	35,313	178,093	60,324
EL (Credit)	391	655	640	354	2,040	470	711	809	423	2,413	391	734	1,080	416	2,621	1,267

source - APS330 reporting

Key Model Outputs – September 2009 AIRB Home Lending Capital Model ($m AUD)

	Sep-08	Sep-08	Jun-08	Sep-08	Sep-08	Mar-09	Mar-09	Dec-08	Mar-09	Mar-09	Sep-09	Sep-09	Jun-09	Sep-09	Sep-09	Dec-09
Modelled Output	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Sep 08**	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Mar 09**	**ANZ**	**NAB**	**CBA**	**WBC**	**TOTAL Sep 09**	**CBA**
Capital (C)	3,091	4,250	3,970	2,703	14,013	3,345	4,267	4,645	3,027	15,283	3,329	4,568	5,731	3,241	16,868	6,093
Capital / EAD (%)	1.66%	2.15%	1.60%	1.47%	1.72%	1.71%	2.12%	1.69%	1.46%	1.74%	1.65%	2.19%	1.88%	1.43%	1.79%	1.90%
Unutilised EAD	9.0%	14.7%	17.3%	16.0%	14.5%	9.3%	14.9%	17.7%	15.1%	14.6%	9.3%	15.3%	17.2%	14.6%	14.5%	16.4%
Actual Defaults (D')	0.429%	0.880%	0.344%	0.553%	0.541%	0.661%	0.969%	0.408%	0.650%	0.649%	0.699%	0.901%	0.522%	0.551%	0.651%	0.718%
PD	0.549%	0.788%	0.531%	0.462%	0.577%	0.551%	0.762%	0.554%	0.448%	0.572%	0.517%	0.796%	0.637%	0.443%	0.595%	0.638%
Unexpected Loss Capital C_{UL}	2,689	3,553	3,499	2,297	12,044	2,819	3,531	4,058	2,531	12,945	2,778	3,797	4,944	2,750	14,278	5,146
Expected Loss Capital C_{EL}	402	697	471	406	1,969	526	736	587	496	2,338	551	771	787	491	2,590	947
Best Estimate Capital C_{BE}	3,138	4,215	4,064	2,668	14,073	3,300	4,186	4,729	2,939	15,143	3,249	4,523	5,805	3,189	16,758	6,041
Experience Capital C_{EA}	-47	35	-94	35	-60	45	81	-85	88	140	80	45	-74	52	110	52
Leverage (L)	55.8	40.7	52.6	58.0	50.7	54.0	41.1	49.8	59.1	50.1	55.9	39.6	45.1	60.7	48.8	45.0

source - home lending model

Note – The total is being modelled as a separate model point, not as the sum of the 4 majors. This results in a small difference between the total and the sum of the 4 majors.

[i] Prudential Standard APS 330 – "Capital Adequacy: Public Disclosure of Prudential Information" – January 2008
[ii] RBA Statistics - Growth In Selected Financial Aggregates
[iii] APS 113 – paragraph 82 – "When estimating the average PD for each obligor grade, an ADI must use information and techniques that take appropriate account of long-run experience." And paragraph 83 requires "….the length of the underlying historical observation period used must be at least five years from at least one source. If the available observation period spans a longer period from any source, and the data are relevant and material, this longer period must be used."
[iv] APS113 – paragraph 91 - "An ADI must take into account the potential for LGD to be higher than the default-weighted average during a period when credit losses are substantially higher than average. That is, LGD estimates must reflect economic downturn conditions, where necessary, to capture relevant risks."
[v] IMF –Aug 2009 – AUSTRALIA Selected Issues – section 11 - "House price appreciation has been the single largest contributor to the growth in Australian household wealth over the last decade. The metrics examined suggest overvaluation in house prices as of March 2009 in the range of 0–20 %."
[vi] At Sep 09 (June 09 for CBA), the average T1 ratio for the 4 major banks was approximately 8.6% of spot RWAs, representing around $100b of T1 capital.
[vii] RBA Financial Stability Review – Sep 09 – Page 46 "Since late 2008 first-home buyers' share of total owner-occupier loan approvals, currently at 35 per cent, has been around 10 percentage points higher than its average over the previous 15 years"
[viii] A typical bank will have a CRS scale that contains a couple of dozen possible scores that can be assigned to a borrower. Each score has a corresponding PD. The higher the internal credit score, the higher the probability of default, with the highest score reserved for those loans that have entered a default status (PD = 1). Importantly a typical PD/CRS curve is not linear, with PDs moving up sharply at the higher (riskier) end of the CRS scale.
[ix] Proxy only, calculated as : (ROE/ROA) for the 4 banking majors combined.
[x] Credit leverage is currently as high as 60 for WBC, and as low as 40 for the NAB – refer Appendix B.
[xi] A pre-tax cost of capital of 10% of capital / balances is estimated by assuming a 12% post tax cost of capital, 5% post tax investment earnings and 30% tax rate [(12% - 5%) / 70%]
[xii] RBA Financial Stability Review – Sep 09 – Page 9 "Given shocks to balance sheets and operating conditions, many firms are looking to raise equity and reduce their leverage rather than take on debt."
[xiii] RBA Bulletin March 2010 "Recent Developments in Banks' Funding Costs and Lending Rates"
[xiv] RBA Financial Stability Review – Sep 09 – Page 21
[xv] David Hale – The Monthly May 2009 edition – page 30
[xvi] "From 1995 to the bubble's peak in 2006, house prices outpaced demand inflation by more than 70 percentage points, creating $8 trillion USD in housing-bubble wealth" Dean Baker – The Monthly May 2009 edition – page 32
[xvii] In his February 2009 essay in the Melbourne based Monthly magazine, Prime Minister Kevin Rudd stated that the B2 guidelines "… have now been demonstrated to be inadequate because they left the determination of risk to flawed credit-ratings processes and the banks' own "self regulated" internal assessment models."
[xviii] Refer APS 113 (January 2008) sections 35 and 38
[xix] See Vasicek, Oldrich. (2002) - Loan portfolio value RISK, December 2002, 160-162 for a summary explanation
[xx] Not applied in practice for EL but used for model simplicity - impact not material.
[xxi] Note that alternative correlations may apply in practice to the RWA calculation of some alternative "non standard" forms of home lending
[xxii] Refer APS 113 (January 2008) section 17
[xxiii] This is in fact the approach currently taken by CBA, but not by the other 3 major banks who split the capital requirement for defaulted lending between RWAs, EL deductions and provisions
[xxiv] Refer Reserve Bank of New Zealand: Financial Stability Report, November 2009 – Section 6.3 "In accrediting the banks, the Reserve Bank applied a number of transitional overlays which were intended to remain in place until the banks had strengthened their capital modelling."