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Bank Credit Rating Dynamics

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An increase in the credit rating on an organisation's debt is generally perceived positively, as higher credit ratings are, in the main, associated with lower perceived volatility in the market value of the assets of the entity that has issued the debt. If banks price their assets to realise a target return on economic capital, then a higher credit rating will result in higher loan rates if the fall in the bank's cost of capital, associated with the lower insolvency risk, is insufficient to offset the required additional net income on the loan. In this paper we develop a loan pricing model that assumes that banks price their assets on a risk- and cost-adjusted basis and with the aim of achieving a minimum required return on the bank's economic capital holding. We compare theoretically derived decreases in the bank's cost of funds to actual bank credit spread data from the European and the US markets in order to ascertain the extent to which the increase in credit rating is beneficial to the bank. We find that the minimum decline in the cost of funds in our model generally exceeds the empirical data, meaning that the reduction in funding costs is insufficient to offset the increase on loan rates associated with higher economic capital. The divergence increases as the proportion of retail funds increases. We further find that the hurdle rate on economic capital is a significant factor in determining the value of a bank increasing its solvency standard.

Field of Research: Banking, Credit Rating, Economic Capita

1. Introduction

An increase in the credit rating on an organisation's debt is generally perceived positively, as higher credit ratings are, in the main, associated with lower perceived volatility in the market value of the assets of the entity that has issued the debt. Lower asset volatility implies more stable and sustainable cash flows, and thus a lower likelihood of default and a resulting lower credit spread on the debt. If banks price their assets to realise a target return on economic capital, then a higher credit rating will result in higher loan rates if the fall in the bank's cost of capital, associated with the lower insolvency risk, is insufficient to offset the required additional net income on the loan.

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In this paper we develop a loan pricing model that assumes that financial institutions price their assets on a risk- and cost-adjusted basis and with the aim of achieving a minimum required return on the bank's economic capital holding. We establish that as a bank increases its economic capital relative to total assets, two opposing forces act to influence the minimum rate at which the bank can price its assets in order to achieve target profitability. A larger equity base increases the after-tax net income that the bank must earn in order to maintain the hurdle rate on equity. This higher net income results in a higher lending rate on the bank's assets, holding other parameters constant. Offset against this is the impact of a higher equity base on the external credit rating on the bank's publicly-rated debt securities. All else equal, a more highly capitalised bank should achieve a higher rating on its debt, which in turn should reduce the credit spread (margin above Treasury bond) that the bank pays on its debt.[1] The resulting lower cost of wholesale funds act to reduce the minimum rate at which the bank must price its loans in order to achieve the target return on equity.

We model these opposing forces using Standard & Poor's credit loss data (expected default rates) for borrowers of different credit ratings. We establish a fixed hurdle rate assumption for the return on target equity of the bank, and subsequently vary the hurdle rate in line with changes in the leverage of the bank. We establish that for a bank to gain from a higher credit rating, the reduction in funding costs associated with a higher credit rating must be greater than the increase in the price of loans arising from a higher target capital base. This in turn depends on the proportion of the bank funding book that is sensitive to changes in credit rating. While debt issued in capital markets may be sensitive to credit rating, this may not be the case for retail deposits unless changes in credit rating arise from severe financial distress in the bank. Consequently, we hold retail funding costs constant in our model, while we vary the costs of issued debt in accordance with changes in the bank's credit rating.

The paper proceeds as follows. In section 2 we provide a brief literature review, followed by an explanation of our loan pricing methodology based on a target return on economic capital and its limitations in section 3. In section 4 we apply our model and calculate the decrease in wholesale funding costs that is required in order to hold the loan rate constant under changing credit ratings. We compare our results with actual bank credit spread data from the US and the European markets. The final section concludes.

2. Literature Review

In the context of loan asset pricing, we can typically distinguish between two major types of approaches, option-based models (see, for instance, Asarnow 1994/1995 and Barnes et al 1996) and a more traditional approach in which the lending rate consists of two components, a base lending rate and a credit spread.

Typically, the size of the credit spread is dependent on the perceived riskiness of the borrower or the loan facility. Thus, the credit spread may vary according to the size of the credit facility or in accordance with the credit rating or other financial data of the borrower (see Saunders et al 2007, Penson 1998). While this approach considers the relative creditworthiness of the borrower, it neither accounts for the borrower's unique risks nor the risk tolerance and target profitability of the financial institution. Yet, it is essential for financial institutions to set asset prices sufficiently high to cover any risks and costs associated with the asset and to generate a target return on equity.

In our model, we address both problems. We capture the unique riskiness of the borrower by estimating the value and volatility of expected losses on the loan. The expected losses will impact on loan profitability as the bank allocates provisions against these losses. The volatility of expected losses is one driver of the bank's economic capital holding against the loan. The second driver of economic capital is the bank's chosen solvency standard as reflected in its external credit rating. The product of both variables forms the basis for pricing the asset in order to achieve a target return on economic capital. We use economic capital rather than regulatory capital for two reasons. Firstly, though dependent on the regulatory approach used by the institution, it is assumed that regulatory and economic capital levels will converge under the most advanced approaches to Basel 2's risk capital calculations. In light of Basel 2, the use of economic capital seems to increase in importance in financial institutions. According to PWC (2005) an increasing number of financial institutions use economic capital with the aim of optimising capital adequacy, improving strategic planning, defining risk appetite and setting risk limits, and assessing risk-adjusted business unit performance although the use of economic capital is not compulsory in most jurisdictions. As economic capital is derived by banks using their own data and internally derived models, it should embody the unique risk and cash flow characteristics of individual banks.

While the literature has identified the importance of the borrower's credit rating in lending decisions, in particular in light of the Basel 2 capital requirements (see, for instance, Myers 2005 and Temes 1995), only a few studies assess the importance of the choice of credit rating for the lending bank. Jackson et al (2002) examine why banks may target a solvency standard that is more conservative than that implicit in the Basel Accord. They find that a major determinant of target credit rating is to obtain cost-effective access to unsecured credit markets, given interbank rates and counterparty credit limits are highly sensitive to credit rating. In particular, they find that banks that engage in significant swap volumes (relative to balance sheet size) are consistently and significantly more highly rated that those that do not.

Bhasin (1995) reaches a similar conclusion regarding all US over-the-counter derivatives participants. Importantly, these studies do not find that the potential for shareholders to accept lower required returns on bank equity is a major consideration in the banks' determination of target credit rating. While we expect that management will not significantly change the hurdle rate on economic capital (for pricing and resource allocation decisions) in response to relatively small changes in credit rating, we acknowledge that equity markets may revise required returns as ratings change and include in our simulations the impact of changes in hurdle rates.

Antony & Ragesh (2007) adopt a similar loan pricing approach to ours, in the context of the Basel 2 capital regulations. In their paper, they model interest rates for corporate, retail and residential mortgage loans for various levels of likelihood of default and loss given default. A major difference is that the authors base their cost of capital on a simple beta value, while we extend our analysis to a leverage-adjusted beta value. We further include the desired credit rating bank to prove that a higher credit rating might not be beneficial to the bank in terms of risk- and cost-adjusted asset prices.

The question of varying the hurdle rate in line with changes in the leverage of the bank is critical to our results. Zaik et al (1996) argue that a bank should maintain a fixed corporate-wide hurdle rate across different business lines, based largely on the difficulty of assessing betas for individual lines of business and the assumption that diversification benefits that across different business units can be captured in reduced capital allocations. In our model we hold the hurdle rate constant across different asset risk classes, but vary the hurdle rate in line with the leverage of the bank. That is, as the bank increases its target credit rating and its economic capital increases commensurately, we adjust the hurdle rate using a leverage-adjusted approach.

So far the literature has treated the aforementioned aspects in isolation. In our study, we combine the various variables, namely the impact a borrower's credit rating, the bank's target credit rating, the bank's funding mix and the choice of hurdle rate, have on the bank's asset price, and are thus able to determine a more complete picture about pricing loans on a risk- and cost-adjusted basis.

3. Loan Pricing Model

Economic capital is a statistical measure of a bank's capital base that is used to absorb unexpected losses for a chosen confidence level and time frame, generally one-year. The level of economic capital is dependent on a bank's solvency standard as reflected in its target external credit rating. Table 1 shows one and ten year historical default probabilities that apply to various target Standard & Poor's credit ratings.

Table 1
Cumulative Average Default Rates 1981-2005

Target Standard & Poor's Credit Rating	One Year Default Probabilities (%)	Ten Year Default Probabilities (%)
AAA	0.00	0.44
AA	0.01	0.81
A	0.04	1.83
BBB	0.27	5.82
BB	1.12	18.29
B	5.83	32.38
CCC	27.02	53.05

Source: Standard & Poor's (2006)

Our loan pricing model begins with the premise that the lending bank establishes its desired external credit rating, and accordingly allocates sufficient economic capital against its loans in order to maintain this rating. The minimum level of economic capital is measured as a multiple of the standard deviation of expected loss rates for the particular loan class, net of any diversification benefits attributed to the loan.[2] The expected loss rate is measured as the expected default frequency multiplied by the loss in event of default multiplied by the potential size of exposure at default. The multiple is a function of the target credit rating. The required net income on the loan, after tax, forms the basis of pricing the loan. This is determined by the economic capital allocated to the loan and the required rate of return (hurdle rate) on the loan. The hurdle rate on the loan, often known as the return on target equity, is typically determined using a market-based single factor model such as the capital asset pricing model.[3]

Let L represent the principal on a loan facility. Our objective is to determine the minimum interest rate (r_a) on this loan that allows the bank to achieve its hurdle rate on economic capital. The marginal balance sheet of the bank that arises from the funding of this loan is as follows:

$$L + S = EC + D_r + D_d$$

where S are liquid securities deemed necessary to support the loan, EC is the economic capital allocated to the loan, D_r are retail deposits and D_d are debt securities issued by the bank. Liquid securities are calculated as a fixed percentage (ℓ) of the loan:

$$S = \ell L$$

The economic capital (EC) required to support the loan is the product of the standard deviation of the expected loss rate (UL), commonly known as the unexpected loss rate, and a capital multiplier (CM):

$$EC = UL \times CM$$

The capital multiplier reflects the target risk tolerance level of the bank and the shape of the distribution of loan losses.

The expected losses on the loan (*EL*) are the product of the expected default frequency (*EDF*), the loss given default (*LGD*) and the expected credit exposure at the time of default (*L*)[4]:

$$EL = EDF \times LGD \times L$$

If the expected credit exposure (*L*) and the *LGD* are considered fixed factors[5], then unexpected losses (*UL*) can be calculated as follows:[6]

$$UL = \sigma = \sqrt{EL(LGD - EL)}$$

The key to the pricing model is the bank must price the loan to earn the target profit (*TP*) and cover interest expenses, operating costs, expected losses and taxes. The target before-tax net income for the bank (*TP*) on the loan facility is the product of the economic capital allocated to the loan and the target hurdle rate (r_h), adjusted for taxes where t is the tax rate paid on bank profits[7]:

$$TP = (r_h\ EC) / (1 - t)$$

Interest expense on deposits (*ID*) depends on the proportion of total deposits that are retail deposits (p_r), the marginal cost of retail deposits (r_r) and the marginal cost of debt securities (r_d) at the credit rating on the debt securities[8]:

$$ID = (L - S - EC)\ [(p_r\ r_r) + ((1 - p_r)\ r_d)]$$

Operating costs (*OC*) for the bank are calculated as a percentage (c) of the face value of the loan[9]:

$$OC = c\ L$$

Interest income on the incremental liquid securities (*IS*) required to support the loan is based on an earnings yield of r_s:

$$IS = S\ r_s$$

The required rate of return on the loan (r_a), being the interest rate on the loan that achieves the target hurdle rate on economic capital, is expressed as follows:

$$r_a = [\ TP + EL + OC + ID - IS\ ] / L$$

Our model implies that the interest rate on a loan should be driven by the minimum net income required on the loan, which is determined by economic capital multiplied by the return on target equity. In order to derive the interest rate on the loan, we take the minimum net income and add back any costs or risk charges and subtract any earnings that arise from the transaction. The non-equity funding component is measured as the difference between the assets arising from the position and the economic capital holding. We account for the proportion of funding arising from retail deposits and debt securities issued in the capital market.

In order to estimate the capital multipliers needed to calculate economic capital we use a beta distribution for the loss distribution on the loan portfolios.[10] Ong (1999) shows that the density function of the beta distribution requires two constants, α and β, where α controls the steepness of the distribution β controls the fatness of the tail. The cumulative distribution function of the beta distribution, denoted pbeta (x, α, β), is the probability that a quantity which follows a beta distribution with parameters α and β will be less than or equal x (Ong, 1999:166). We use the BETADIST function on Excel to determine the value for x that gives the desired cumulative density function.

Our results for capital multipliers for BBB-rated borrowers and for bank target credit ratings of BBB, A, AA and AAA are presented in Table 2.

Table 2
Capital Multipliers for Unexpected Losses
(Fit to beta distribution)

Asset profile	*Borrower rating: BBB*
Expected default frequency (EDF)	0.27%
Loss given default (LGD)	33.00%
Expected loss (EL)	0.089%
Unexpected loss (UL)	1.712%
Target rating of bank	*Capital multipliers*
BBB	2.296
A	14.197
AA	23.891
AAA	40.534

If a bank wants to increases its external credit rating, the economic capital that it must hold will increase, as a higher external credit rating requires a larger multiple of the standard deviation of the expected losses on the loan class. Our model indicates that, all else equal, the interest rate on the loan will increase given the larger economic capital base and a fixed target return on equity. This means that in order to obtain a higher credit rating a bank must increase its loan price, which might put competitive pressures on the bank. However, all else is not equal. One of the main objectives in targeting a higher credit rating will be the expectation by the bank of a lower cost of funds on its debt securities. Thus an increase in the solvency standard for a bank has opposing effects on bank loan prices: a larger economic capital allocation has an upward effect on loan rates in a given risk class, but this is offset by the downward impact on loan rates arising from a lower cost of funds on its rated-debt securities. An additional potential downward impact on the loan price will arise if the bank lowers the hurdle rate on economic capital. This will arise if management believe that the increase in economic capital relative to the bank's assets will result in bank equity holders requiring a lower return on their investment.

We assert that the flow of retail deposits into banks is largely insensitive to credit rating. Retail depositors typically rank ahead of rated-debt securities. Retail call deposits are also highly interest rate insensitive, with depositors accepting lower rates in return for high liquidity and the perceived credit strength of the bank.

Thus our test of the benefits of an upgrade in a bank's credit rating lies with the impact of the upgrade on the cost of wholesale funds, the bank's equity hurdle rate and the proportion of the funding book that comprises retail funds. We propose that a bank with a high proportion of retail funds may find that the benefits of a higher credit rating are minimal, and that, indeed, the benefits may be outweighed by the costs (in terms of the competitive consequences of the impact of higher loan rates).

The current version of our loan pricing model is limited due to its static nature. In our analysis we focus on a one-year time horizon, which is not representative of the typically longer maturities of loans. It would be essential to expand the model to capture longer asset maturities, which would require determining an average neutral loan price under the consideration of capital depletion over time.

We further evaluate loans on a stand-alone basis. To more realistically capture the nature of banking institutions, the model would need to be adjusted to allow for diversification benefits across loan portfolios. These benefits would obviously impact on the economic capital holding of the bank and thus on the neutral asset price the bank can offer.

A last limitation refers to the assumed static nature of the borrower credit rating, which impacts on the loan loss provisions held against the loan and further the volatility of expected losses and thus the economic capital holding of the bank. The probability of a borrower rating migration, i.e. an upward or a downward movement on the credit rating scale, increases in line with a lengthening loan maturity. Either movement will impact on the costs and risks associated with the loan transaction and thus the neutral loan price.

4. Results

In this section we use our model to measure the extent to which progressive upgrades in the credit rating of a bank from a base rating of BBB impact on the price of a BBB-rated loan, and the minimum (breakeven) change in the wholesale cost of funds that would be required to produce a neutral impact on the loan rate. In order to assess the impact of retail/wholesale funding mix and leverage on the breakeven cost of funds, we also vary the proportion of retail funding and the return on target equity, and measure the results. We then compare the minimum required change in the cost of wholesale funds against the credit spreads on bank debt using Standards and Poor's data, shown in Tables 3 and 4. We note that the empirical credit spread data may not fully refect credit risk differentials. The spread will also be impacted by the volume of securities issued and rated at each credit rating, demand for the securities in capital markets, and market perceptions of the liquidity of the bank paper.

To measure the impact of a change in a bank's credit rating on loan pricing, we incorporate the following assumptions:

- Loans are written for one year and the credit rating of the bank is based on a one year probability of default;

- Estimates of loss given default (LGD) for each credit rating are for private debt and based on Carey (1998)[11];
- A retail cost of funds of 4% and a wholesale cost of funds of 8.50% for the base case. Operating costs are equal to 2% of the loan size. The retail cost of funds is invariant to leverage.
- The bank holds liquid assets equivalent to 3% of the loan exposure, and these earn a fixed return of 7%.
- The corporate tax rate is 30% and taxes are paid when incurred.

Table 3
U.S. Bank Credit Spreads, October 2004

Tenor (years) / S&P Rating	1	2	3	5	7	10	30
AAA	0.003951	0.003377	0.004516	0.004888	0.006548	0.007500	0.006891
AA+	0.004021	0.003652	0.005086	0.005683	0.007237	0.007727	0.006961
AA	0.004051	0.003769	0.005331	0.006026	0.007535	0.007825	0.006991
AA-	0.004349	0.004002	0.005526	0.006208	0.007761	0.008166	0.007607
A+	0.004946	0.004468	0.005916	0.006573	0.008215	0.008853	0.008867
A	0.005544	0.004936	0.006307	0.006940	0.008672	0.009546	0.010166
A-	0.006293	0.005702	0.007080	0.007702	0.009409	0.010243	0.010899
BBB+	0.007794	0.007242	0.008635	0.009243	0.010904	0.011664	0.012415
BBB	0.009300	0.008791	0.010204	0.010806	0.012428	0.013123	0.014002
BBB-	0.012398	0.011853	0.013232	0.013767	0.015328	0.015938	0.016612
BB+	0.020225	0.019668	0.021034	0.021544	0.023078	0.023649	0.024206
BB	0.024978	0.024469	0.025882	0.026484	0.028106	0.028801	0.029680
BB-	0.026473	0.025964	0.027377	0.027979	0.029601	0.030296	0.031175
B+	0.029477	0.028968	0.030382	0.030983	0.032605	0.033300	0.034179
B	0.032501	0.031992	0.033406	0.034007	0.035629	0.036324	0.037203
B-	0.040347	0.039838	0.041251	0.041853	0.043475	0.044170	0.045049
CCC	0.048309	0.047800	0.049214	0.049815	0.051437	0.052132	0.053011

Source: RiskMetrics Group (2004a).

Table 4
EU Bank Credit Spreads, October 2004

Tenor (years) / S&P Rating	1	2	3	5	7	10
AAA	0.001276	0.001591	0.001952	0.001463	0.002016	0.002530
AA+	0.001984	0.002312	0.002704	0.002360	0.002878	0.002839
AA	0.002288	0.002622	0.003028	0.002746	0.003250	0.002973
AA-	0.002368	0.002795	0.003249	0.002981	0.003474	0.003228
A+	0.002528	0.003141	0.003693	0.003452	0.003925	0.003742
A	0.002688	0.003487	0.004137	0.003925	0.004378	0.004260
A-	0.003344	0.004142	0.004793	0.004580	0.005034	0.004915
BBB+	0.004657	0.005455	0.006106	0.005893	0.006347	0.006228
BBB+	0.005973	0.006771	0.007422	0.007210	0.007663	0.007545
BBB-	0.006800	0.007598	0.008248	0.008036	0.008489	0.008371
BB+	0.008871	0.009670	0.010320	0.010108	0.010561	0.010443
BB	0.010118	0.010917	0.011567	0.011355	0.011808	0.011690
BB-	0.011565	0.012364	0.013014	0.012802	0.013255	0.013137
B+	0.014471	0.015270	0.015920	0.015708	0.016161	0.016043
B	0.017394	0.018192	0.018843	0.018630	0.019084	0.018965
B-	0.021902	0.022701	0.023351	0.023139	0.023592	0.023474
CCC	0.026450	0.027248	0.027899	0.027686	0.028140	0.028022

Source: RiskMetrics Group (2004b).

4. 1 Base Case: Fixed Hurdle Rate and BBB Rated Exposure

In our base case we assume a BBB-rated bank with an exposure to a BBB-rated borrower. We further assume a fixed 15% after-tax hurdle rate. The results are presented in Table 5. The BBB-rated loan carries an expected loss rate of 8.9 basis points, based on an EDF of 27 basis points and a LGD of 33%. The unexpected loss rate is 1.712%. At a target credit rating of BBB for the bank, this loan requires economic capital equal to 8.00%[12] of the credit exposure. Based on the 15%-after tax hurdle rate and retail funding of 25% of total deposits, the minimum interest rate on this loan is 10.60%.

As the bank increases its credit rating to A, the economic capital required to support this loan rises to 24.31% of the credit exposure. The minimum interest rate on the loan rises from 10.60% to 12.89% and we find that the wholesale cost of funds would need to fall by 6.71% in order for the loan rate to remain unchanged at 10.60%. Empirical data shows that the difference in the credit spread between BBB and A-rated bank debt is only 39 basis points for debt rated in the US and 33 basis points for debt rated in the EU– a divergence of 3.50 and 3.56 percentage points respectively. This indicates that, ceteris paribus, an increase in credit rating from BBB to A for a bank that holds BBB-rated loans would not be in the best interests of the bank.

Table 5
Impact of Increasing Solvency Standard
(Fixed hurdle rates and BBB-rated asset)

Target bank rating	BBB	A	AA	AAA
Borrower data				
Internal credit rating	BBB	BBB	BBB	BBB
Expected default frequency (EDF)	0.27%	0.27%	0.27%	0.27%
Loss given default (LGD)	33.00%	33.00%	33.00%	33.00%
Expected loss (EL)	0.089%	0.089%	0.089%	0.089%
Unexpected loss (UL)	1.712%	1.712%	1.712%	1.712%
Beta distribution data				
Cumulative function pbeta (x,α,β)	99.73%	99.96%	99.99%	100.00%
Max (x)	4.02%	24.40%	41.00%	69.50%
α	0.018%	0.018%	0.018%	0.018%
β	4.034	4.034	4.034	4.034
Capital multiplier (CM)	2.296 (4.672[13])	14.197	23.891	40.534
Bank data				
Proportion of non-rated debt	25.00%	25.00%	25.00%	25.00%
Economic capital	3.93% (8.00%[14])	24.31%	40.91%	69.41%
Regulatory capital minimum	8.00%	8.00%	8.00%	8.00%
Hurdle rate	15.00%	15.00%	15.00%	15.00%
Leverage (debt/equity)	25.20x (11.88x[15])	3.24x	1.52x	0.48x
Results (rounded to 2 decimals)				
Asset price	10.60%	12.89%	15.22%	19.23%
Breakeven Δ in cost of rated-debt		-3.88%	-9.93%	-34.26%
Change in credit spread from BBB (US data)		-0.39%	-0.52%	-0.53%
Divergence – US data		-3.50%	-9.41%	-33.72%
Asset price	10.60%	12.89%	15.22%	19.23%
Breakeven Δ in cost of rated-debt		-3.88%	-9.93%	-34.26%
Change in credit spread from BBB (EU data)		-0.33%	-0.37%	-0.47%
Divergence – EU data		-3.56%	-9.56%	-33.79%

The divergence between the required change in the cost of rated debt and empirical data on bank credit spreads widens as the bank targets higher credit ratings. The minimum rate on the loan should the bank move to a target credit rating of AA rises to 15.22%. This is driven by an increase in economic capital to 40.91% of the credit exposure. In order to maintain the loan rate at the base case rate of 10.60%, we find that the cost of rated debt would need to fall by 9.93 percentage points. This is significantly higher than the empirical result on credit spreads for a bank that moves from BBB to AA, being 52 basis points for debt rated in the US and 37 basis points for debt rated in the EU. In fact, already in this scenario it is not possible for the cost of the bank's wholesale debt to fall to maintain the base lending rate of 10.60% because the required fall in the cost of debt exceeds the actual interest rate on the debt used for the simulation. This finding is exacerbated if the bank targets an AAA credit rating.

We conclude that *at a fixed hurdle rate*, there should be no incentive for a BBB-rated bank that carries BBB-rated loans to seek to increase its solvency standard. The required decline in the wholesale cost of funds significantly exceeds the change in empirically observed credit spreads. This means that the choice of a BBB-rated bank with a BBB-rated exposure to increase its solvency standard is not economical in terms of asset pricing, but might be driven by other factors, such as signalling or better access to capital or derivative markets. We now examine the impact of changing the hurdle rate in line with changes in the leverage of the bank.

4.2 Leverage-adjusted Hurdle Rate and BBB-rated Exposure

Table 6 presents the results for the BBB-rated exposure when the bank's hurdle rate is reduced as the leverage of the bank decreases. The basis for adjusting the hurdle rate is that equity investors would be willing to accept a lower risk premium as the bank becomes more highly capitalised. This would particularly be the case where the higher capital base is more finely aligned with the risk profile of the bank's assets. We derive the hurdle rate by starting with the base case of 15% and adjusting the rate in line with a beta-adjusted leverage factor.

Table 6
Impact of Increasing Solvency Standard
(Leverage-adjusted hurdle rates and BBB-rated asset)

Target bank rating	BBB	A	AA	AAA
Borrower data				
Internal credit rating	BBB	BBB	BBB	BBB
Expected default frequency (EDF)	0.27%	0.27%	0.27%	0.27%
Loss given default (LGD)	33.00%	33.00%	33.00%	33.00%
Expected loss (EL)	0.089%	0.089%	0.089%	0.089%
Unexpected loss (UL)	1.712%	1.712%	1.712%	1.712%
Beta distribution data				
Cumulative function pbeta (x,α,β)	99.73%	99.96%	99.99%	100.00%
Max (x)	4.02%	24.40%	41.00%	69.50%
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Capital multiplier (CM)	2.296 (4.672[16])	14.197	23.891	40.534
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Proportion of non-rated debt	25.00%	25.00%	25.00%	25.00%
Economic capital	3.93% (8.00%[17])	24.31%	40.91%	69.41%
Regulatory capital minimum	8.00%	8.00%	8.00%	8.00%
Hurdle rate	15.00%	9.64%	8.52%	7.85%
Leverage (debt/equity)	25.20x (11.88x[18])	3.24x	1.52x	0.48x
Results (rounded to 2 decimals)				
Asset price	10.60%	11.03%	11.44%	12.14%
Breakeven Δ in cost of rated-debt		-0.73%	-1.80%	-6.12%
Change in credit spread from BBB (US data)		-0.39%	-0.52%	-0.53%
Divergence – US data		-0.34%	-1.28%	-5.59%
Asset price	10.60%	11.03%	11.44%	12.14%
Breakeven Δ in cost of rated-debt		-0.73%	-1.80%	-6.12%
Change in credit spread from BBB (EU data)		-0.33%	-0.37%	-0.47%
Divergence – EU data		-0.40%	-1.43%	-5.65%

The results show a considerable narrowing of the divergence between the required change in the cost of rated-debt and the empirical change in credit spread for bank rated debt. As the bank increases its target credit rating from BBB to A the divergence narrows to 0.34 and 0.40 per percentage points for debt rated in the US and in the EU respectively, and 1.28 and 1.43 percentage points for a move from BBB to AA. The gap has also narrowed substantially for a move from BBB to AAA, but remains large given the high level of capitalisation required to support an AAA solvency standard. The gap is negative for all scenarios, indicating that the fall in the cost of funds is insufficient to enable the bank to maintain a neutral lending rate on its assets. Nonetheless, the gap is relatively narrow for an A or AA credit rating, suggesting that the hurdle rate on economic capital – and more specifically, the decision to decrease the hurdle rate as leverage decreases – is likely to be a major factor in the choice of the optimal credit rating and funding structure for a bank.

4.3 Leverage-adjusted Hurdle Rate, BBB rated Exposure and Zero Retail Funding

In Table 7 we show the impact of varying the proportion of retail funding to zero for the bank – in other words, the bank funds its loans entirely with rated-debt securities. This represents an extreme scenario where no retail deposits are available to fund the loans, and is more representative of an investment bank.

The impact of reducing the retail funding component of deposits is to increase the minimum loan rate and to reduce the divergence between the theoretical and empirical change in the credit spread on the debt of the bank. The increase in the loan rate arises because low interest-rate retail deposits are replaced with higher interest-rate debt securities. In order to cover for the higher cost of funds, the loan rate must rise – in the base case the loan rate increases from 10.60% to 11.67% when retail deposits are reduced from 25% to 0% of total deposits. The divergence between the theoretical change in the cost of rated-debt and the empirical data on credit spreads narrows because the required change in the cost applies to a larger volume of rated-debt.

Table 7 shows that the divergence is positive for both, the US and EU market, if the bank moves from a BBB to an A rating. Thus, for a BBB-rated bank with a high proportion of debt funding it might be beneficial to target a higher credit rating of A, as the resulting decrease in funding costs is sufficient to offset the higher required return on economic. This, however, is only the case if we assume that shareholders downgrade their return expectations in line with higher bank capitalisation.

Yet, even with zero retail funding there is a negative divergence for targeting a higher rating than A. It should be noted, however, that in both cases the divergences have narrowed significantly compared to the base case. Even in comparison to the leverage-adjusted base case, the divergences are narrower in case of a higher proportion of debt funding. This is not surprising considering that retail investors are generally insensitive to changes in a bank’s credit rating.

Table 7
Impact of Increasing Solvency Standard
100% funded by rated-debt
(Leverage-adjusted hurdle rates, BBB-rated asset)

Target bank rating	BBB	A	AA	AAA
Borrower data				
Internal credit rating	BBB	BBB	BBB	BBB
Expected default frequency (EDF)	0.27%	0.27%	0.27%	0.27%
Loss given default (LGD)	33.00%	33.00%	33.00%	33.00%
Expected loss (EL)	0.089%	0.089%	0.089%	0.089%
Unexpected loss (UL)	1.712%	1.712%	1.712%	1.712%
Beta distribution data				
Cumulative function pbeta (x,α,β)	99.73%	99.96%	99.99%	100.00%
Max (x)	4.02%	24.40%	41.00%	69.50%
α	0.018%	0.018%	0.018%	0.018%
β	4.034	4.034	4.034	4.034
Capital multiplier (CM)	2.296 (4.672[19])	14.197	23.891	40.534
Bank data				
Proportion of non-rated debt	00.00%	00.00%	00.00%	00.00%
Economic capital	3.93% (8.00%[20])	24.31%	40.91%	69.41%
Regulatory capital minimum	8.00%	8.00%	8.00%	8.00%
Hurdle rate	15.00%	9.64%	8.52%	7.85%
Leverage (debt/equity)	25.20x (11.88x[21])	3.24x	1.52x	0.48x
Results (rounded to 2 decimals)				
Asset price	11.67%	11.92%	12.14%	12.52%
Breakeven ∆ in cost of rated-debt		-0.31%	-0.76%	-2.53%
Change in credit spread from BBB (US data)		-0.39%	-0.52%	-0.53%
Divergence – US data		0.07%	-0.23%	-2.00%
Asset price	11.67%	11.92%	12.14%	12.52%
Breakeven ∆ in cost of rated-debt		-0.31%	-0.76%	-2.53%
Change in credit spread from BBB (EU data)		-0.33%	-0.37%	-0.47%
Divergence – EU data		0.01%	-0.39%	-2.07%

Overall, these results support our argument that banks carrying a high level of retail deposits in their funding mix which seek a higher solvency standard are likely to find little value from doing so.

5. Conclusions

If banks price their assets to realise a target return on economic capital, then a higher credit rating will result in higher loan rates if the fall in the bank's cost of capital, associated with the lower insolvency risk, is insufficient to offset the additional net income that the loan must be priced to cover. It is through this mechanism that the credit rating of the lending institution impacts on the price of its loans.

The main proposition of this paper is that the proportion of retail funding held by a bank will be a major determinant of the benefits that accrue to a bank as a result of a change in credit rating. If retail deposits are largely insensitive to credit rating, a bank holding a large proportion of retail deposits in its funding book may find that the benefits of a higher credit rating, in terms of a reduction in the cost of funds, are insufficient to offset the increase in net income that must be achieved to earn a target return on economic capital. In this case, the bank will find a net increase in the interest rate that must be earned on its loans as its credit rating increases. This may impact on the competitive position of the bank in the loan markets in which it operates. We provide arguments to support the case that retail deposits are largely insensitive to credit rating on the bank's debt securities[22].

Applying our loan pricing methodology, we find that the theoretically derived minimum decline in the cost of funds generally exceeds the empirical data, meaning that the reduction in funding costs is insufficient to offset the increase on loan rates associated with higher economic capital. The divergence increases as the proportion of retail funds increases. We further find that the hurdle rate on economic capital is a significant factor in determining the value of a bank increasing its solvency standard. Hurdle rates form the basis upon which banks price their products and services in order to earn minimum acceptable returns. Little research has been undertaken to date on the relationship between hurdle rates and the leverage of the bank. If hurdle rates are linked to required returns to equity, then some form of adjustment for changes in credit rating (leverage) appear warranted. Banks and their analysts may have focused little on this issue in the past, possibly driven by constraints on bank leverage inherent in the Basel Accord of 1988. While the notion of minimum regulatory capital constraints remain under the revised Basel II capital framework, the combination of an increasing focus on economic capital and target credit rating on the part of banks and ratings agencies on the one hand, and the greater scope for banks to use their own models for the determination of capital requirements under the revised capital framework on the other suggest the relationship between bank capital and hurdle rates on bank capital will remain high on the research agenda.

Endnotes

[1] This is supported by empirical data on bank credit spreads, which we present in Table 4 in this paper.
[2] Note the economic capital allocated to the loan may also incorporate operational risk and market risk attributed to the position. The dynamics of pricing these risks into a loan portfolio are yet to be fully explored in the literature, although Sundmacher (2004) provides an overview of the issues as they apply to operational risk.
[3] Ford (2003) argues that the capital asset pricing model may not be an appropriate basis for determining the hurdle rate in banks. Economic capital takes into account a bank's concern with total risk that makes a bank behave as if it were risk averse. If we accept that capital invested by shareholders should earn a return driven by systematic considerations, the return on economic capital should capture the additional costs associated with firm-specific risk in the bank's portfolio.
[4] We estimate the potential credit exposure at default to equal the face value of the loan.
[5] Matten (2000), p.193. Matten states that most credit models use this measure, which assumes default on a single loan is a binomial event. A more sophisticated approach would incorporate volatility in the LGD.
[6] Matten (2000:1933) states that most credit risk models use this measure, which assumes that default on a loan is a single binomial event. A more sophisticated approach would incorporate volatility in the LGD.
[7] The tax adjustment $1/(1 - t_c)$ applies in this case given our one-period pricing assumption. This adjustment is widely used in finance and works for perpetuities and one-period cases.
[8] Given the whole-of-bank perspective we take, the pricing model does incorporate funds transfer prices for the retail deposits. We assume that the duration of retail deposits and debt securities matches that of the loan facility, implying that there is no interest rate risk margin to be factored-into the price of the loan.
[9] We do not distinguish between direct and indirect costs and assume the bank apportions its indirect costs using an acceptable activity-based methodology.
[10] Most portfolio credit risk models, including KMV Portfolio Manager, Portfolio Risk Tracker and CreditMetrics, assume a beta distribution (Servigny and Renault, 2004).
[11] Matten (2000) claims that while LGD rates are around 30-40% for most commercial lending portfolios, professional say all-up recovery costs can be around 60-80% when recovery expenses and time value of money factors are taken into consideration. The data used in our simulations, which is based on Carey (1998), finds recovery rates in the region of 24-39% for the borrower ratings selected for this study.
[12] Note that in this scenario the theoretical level of economic capital for the bank is 3.93% - this capital level, however, does not satisfy the regulatory minimum requirement of 8%.
[13] The higher capital multiplier reflects minimum capital requirements.
[14] The higher economic capital level reflects minimum capital requirements.
[15] The lower leverage reflects the required higher level of capitalisation in fulfilment of minimum capital requirements.
[16] The higher capital multiplier reflects minimum capital requirements.
[17] The higher economic capital level reflects minimum capital requirements.
[18] The lower leverage reflects the required higher level of capitalisation in fulfilment of minimum capital requirements.
[19] The higher capital multiplier reflects minimum capital requirements.
[20] The higher economic capital level reflects minimum capital requirements.
[21] The lower leverage reflects the required higher level of capitalisation in fulfilment of minimum capital requirements.
[22] We do not take deposit insurance into consideration given such a system does not exist in Australia.

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