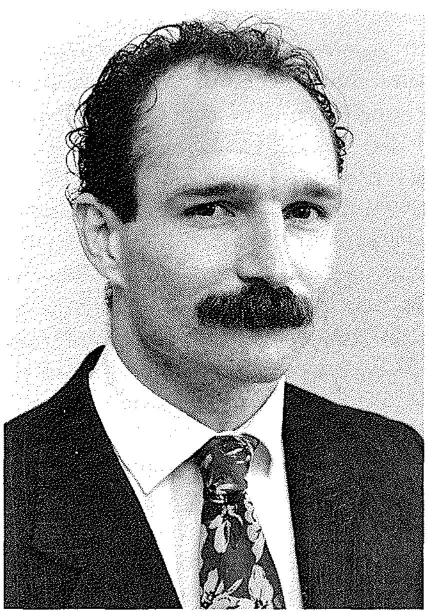
CREDIT EXPOSURE AND RETURNS FROM SWAPS

HOW TO GET 28.4% – AND PLEASE THE RBA



By DANIEL DAUGAARD

The Reserve Bank's capital-adequacy requirements seem to have cast a shadow over the attraction of swaps transactions. But banks can still make them pay.

The interest-rate swap market has undergone dramatic growth because of the instrument's flexibility as a risk-management tool and its off-balance-sheet nature. However, there is concern that the introduction of capital adequacy requirements for banks will cause the market to decline. Previously, no advances or borrowings were recorded on the balance sheet for swaps transactions.

While most banks have always recognised, and even quantified, the credit exposures associated with off-balance-sheet transactions, the capital adequacy requirements have provided a formalised and standard approach. Under these requirements banks must calculate a balance-sheet equivalent for any swap trade and maintain a specified level of capital against its credit exposure.

If the capital devoted to the credit exposure of a swap does not earn a satisfactory return, then banks may become reluctant to provide swaps. The swap market would thereby suffer costly price spreads, leading to a fall in liquidity and an erosion of its flexibility as a risk-management tool.

This article looks at the two standard methods of measuring credit exposure from swaps. These methods are then applied to the actual interest rates in Australia from 1988 to 1990. The credit exposures experienced during this period are of particular importance because of the high volatility of interest rates that prevailed. Under one of the standard methods, volatile interest rates can result in large credit exposures and tie up large amounts of capital. Finally, estimated returns on the capital tied up by the credit exposures occurring during that period are compared with similar results obtained in the US-dollar swaps market.

Measuring credit exposure

The first of the two main approaches to measuring the credit exposure of a swap is the *rule-of-thumb* method in which credit conversion factors are applied to the principal for each year of a swap's original maturity. The conversion factors required by the Reserve Bank of Australia (RBA) are shown in Table 1. They are part of the capital adequacy requirements enforced by the RBA in its supervisory role as Australia's central bank. The specific manner in which credit exposures are measured for the capital adequacy requirements will differ from the methods used by individual banks for their own internal management purposes.

Each bank will typically make

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modifications to these conversion factors to reflect the bank's general perception of the credit risk from swaps and the risks associated with counterparties of different credit classifications. However, the standard RBA method will be used in this article because it is easy to explain and its application should give results that generally reflect the variety of methods used internally by the banks.

As an illustration of the rule-of-thumb method, a swap with a maturity just greater than two years will require a conversion factor of 2 per cent (ie, from Table 1, 1 per cent for the first year plus 1 per cent for the second year). Where the swap has a principal value of $10 million, the value to be taken on to balance sheet will be $200,000 ($10 million x 2 per cent).

This value then needs to be weighted according to the risk classification of the particular swap counterparty. Low-risk counterparties have only a small proportion of their transactions requiring capital commitment, whereas high-risk counterparties require a higher proportion.

Semi-governments have a weighting of 10 per cent, banks have a 20 per cent weighting and corporates attract a weighting of 50 per cent (this is because of a 50 per cent cap level applying to off-balance-sheet transactions such as swaps).

For our example, the credit exposure will therefore be $100,000 ($10 million x 2 per cent x 50 per cent weighting).

Since the rule-of-thumb approach is simple to apply, it is inexpensive to use and easy to understand. It can also be used by organisations that do not have the computer technology usually available to banks and other professional market participants. However, the method suffers because of its inability to recognise changes in the amount of credit exposure following fluctuations in interest rates.

Table 1: Rule-of-thumb approach

Original maturity	Conversion factors
Less than one year	0.5%
One year and less than two years	1.0%
For each additional year	1.0%

The second approach is the *mark-to-market method*. It reflects the changes resulting from interest-rate fluctuations by including an up-to-date value of the swap. The balance-sheet value of the swap is measured by combining the current swap value with a margin to cover potential credit exposure. In the context of capital adequacy requirements, the RBA expects all professional market-making banks to use this method rather than the rule-of-thumb approach.

The value of a swap can be established by breaking down the swap into two separate underlying transactions. A swap in which a fixed rate is paid and a floating rate received can be broken into a sold bond plus a purchased short-term asset.[1] These two transactions can be valued separately by using discounted cashflow techniques and then combined to give the swap's market value.[2]

For example, assume that a $10 million swap deal involves paying a fixed rate of 12.20 per cent for two years and receiving a floating rate with settlements occurring each quarter. Assume that in three months the market swap rate has moved up to 13.09 per cent. The swap's value can be calculated as follows:

	$
Sold bond value	(9,862,789)
plus	
Purchased short-term asset	10,000,000
Swap Value	137,211 profit

The sold bond value can be estimated using the RBA bond valuation formula. The value of the short-term asset has returned to its original value because the valuation date coincides with an interest settlement date. This will happen on each settlement date as the yield on the short-term asset is reset to reflect the current market rate. On dates between the settlement dates, the value will change as short-term interest rates fluctuate. A bill of exchange formula can be used to calculate the short-term asset value on these dates.

Table 2: Mark-to-market approach

Remaining swap maturity	Margin
Less than one year	nil
One year or longer	0.5%

The margin for potential credit exposure is included as an estimate of the maximum credit exposure likely over the remaining life of the swap. The margins required under the RBA guidelines are shown in Table 2.

Continuing the above example, the swap would attract a margin of $50,000 ($10 million x 0.5 per cent) for the first year and no margin in the second year. Three months after the commencement of the swap, it would have a balance sheet value of $187,211 ($137,211 profit plus $50,000 margin).

This balance-sheet value must again be weighted according to counterparty risk. If the swap were transacted with a corporate, it would have a weighted credit exposure of $93,606 ($187,211 credit exposure x 50 per cent risk weighting).

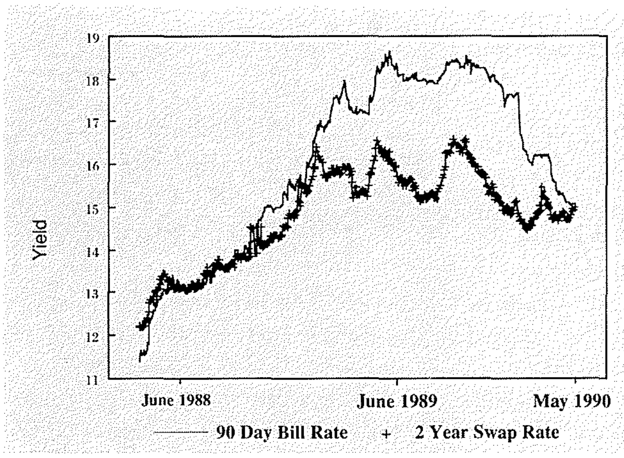
As mentioned previously, the mark-to-market approach recognises the changing credit exposure that will result from interest rate movements. This is especially important where interest rates are volatile and the swap value changes significantly.

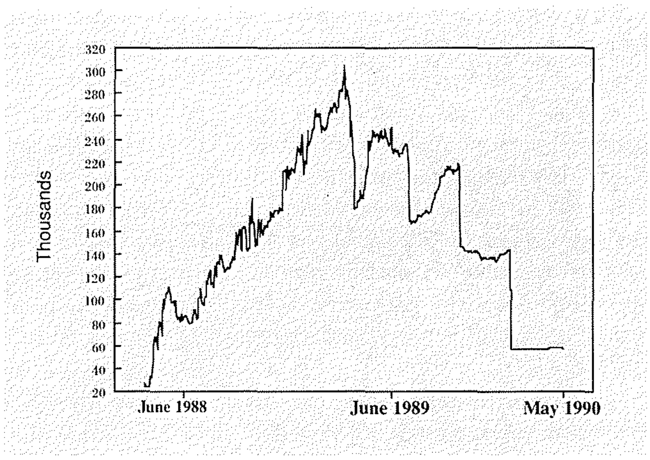
Australian interest rates

Australian interest rates rose significantly through 1988 and 1989. In the main, this was caused by the tight monetary policy introduced by the government to curb excessive economic growth and inflation.

During this period a "paying fixed" swap should have experienced healthy profits because of the trend to higher interest rates. As rates moved higher, a paying fixed swap would suffer if the counterparty defaulted and the swap had to be replaced by a new swap at the higher rates.

Graph 1 shows the two-year swap





rate and the 90-day bill rate for 1988 to 1990. In the short term, the rising bill rate may cause losses to the purchased short-term asset component of the swap value. However, as discussed earlier, the short-term asset will be repriced to its original value when its yield is reset on each settlement date. In contrast, the gains experienced on the bond will endure through the settlement dates.

Actual credit exposure

If the two-year paying fixed swap illustrated above had commenced in April 1988, its weighted credit exposure would look like that shown in Graph 2. The significant rise in credit exposure shown in the chart corresponds to the rise in interest rates shown in Graph 1. The maximum credit exposure was $303,000 (for a $10 million principal) reached in mid-1989. This was calculated by subtracting a bond value of $9,664,567 from a short-term asset value of $10,026,222, adding a $50,000 margin and giving a 50 per cent weighting (again assuming a corporate counterparty).

The credit exposure fell sharply after one year because the $50,000 margin was no longer required as the swap is now in its final year of maturity. Sharp falls can also be observed at quarterly intervals over the final year. These are primarily due to the cash settlements occurring on these dates. Because the bill rate being received was much higher than the swap rate paid, the swap value reflects these receipts and falls after each one is actually received.

The same effect can be explained in terms of repricing the short-term asset and the elimination of coupons from the bond. This pattern is obscured in the first year of the swap because of the strong rise in rates.

The general pattern of the credit exposure is similar to those achieved by Katerina Simons in her analysis of market values.[3] Through the generation by computer of thousands of possible interest-rate scenarios she obtained expected credit exposures for swaps of various maturities.

The general pattern of credit exposure is characterised by low values at the beginning and the end of the swap's term, but higher values near the middle of the term. This is due to interest rates generally remaining around a particular range to begin with but moving further away from that level as time proceeds. The level of interest rates then gradually becomes less significant as the maturity of the swap draws near.

An average credit exposure can be calculated by discounting each daily value back to the commencement date and finding the average. The average credit exposure for the 1988 to 1990 example was calculated as $135,691. The rates used to discount each daily value were the market rates experienced over that period.

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Return on capital

A bank typically seeks to earn a profit by basing its swap rates on the rates achieved from available hedges.[4] These hedges will generally be futures, FRAs or offsetting swaps. For example, a futures strip may lock-in a fixed return of 12.25 per cent. If the bank pays 12.20 per cent to a swap counterparty, the bank earns five points (0.05 per cent).

The profits achieved by a bank will depend on how aggressively it prices the swap; how competitive other market professionals are; and what form of hedge can be constructed. Every point of profit a bank earns on a $10 million swap deal amounts to approximately $2,000 over a two-year maturity. Discounted back to the commencement of the swap, every point of profit would give a value of $1,693 (using 1988-1990 interest rates).

This profit is the gross return on committing the bank's capital to the swap's credit exposure. The amount of capital tied up for the two-year swap example is $10,855 ($135,691 average credit exposure x 8 per cent RBA capital requirement). Every point of profit therefore represents a 15.6 per cent return on the capital employed ($1,693-$10,855) for two years or 7.8 per cent per annum.

With this level of return for one point of profit it is obvious that a bank would only need to earn three points or more to achieve a reasonable return on the capital employed.

The return would have been higher if the credit exposure had not been as large. This would be the case if interest rates had not risen as dramatically or the swap had been "receiving fixed". Where the swap was receiving fixed there would be no positive market value and the mark-to-market credit exposure would be made up entirely by the margin ($50,000 if the swap is of a similar maturity and value). The average credit exposure occurring over the period 1988 to 1990 amounts to $11,602 (again discounted back to the commencement date). This is a very low value, as there will be no margin for potential exposure in the final year.

As mentioned above, swaps can be hedged with futures and FRAs. However, a large swap book will contain a proportion of roughly off-setting swaps. These swaps might not always perfectly match in terms of maturities, values and reset dates but, nevertheless, the book will comprise both receiving and paying swaps.

While the paying-fixed swaps suffer large credit exposures when interest rates rise, the receiving-fixed swaps will benefit from a low mark-to-market credit exposure. By assuming that a paying fixed swap is conveniently matched with an offsetting swap, we can obtain returns on capital that generally reflect those encountered in a swap book. This recognises that the low return on a swap with a high credit exposure can be subsidised by the high return on the offsetting swap (that is, experiencing a low credit exposure).

Continuing the 1988-1990 scenario, the capital required for an offsetting swap (ie, receiving fixed) is only $928 ($11,602 average credit exposure x 8 per cent RBA required capital). Every one point of profit on this swap represents a 182.4 per cent return on capital ($1693 _ $928) for two years or 91.2 per cent per annum.

The return on capital achieved on this matched pair of swaps would therefore be 49.5 per cent per annum (ie, the average of 7.8 per cent and 91.2 per cent) for every point earned on each swap.

Although extraordinarily high, this figure is comparable to the returns on capital calculated by Steve Myers.[5] He estimated the return on capital for $US interest-rate swaps of various fixed rates and maturities using a scenario of cyclical movements in interest rates. His results for matched swaps were as follows:

Return on capital
for five basis points

	%
3 year at 10% fixed rate	96.64
3 year at 12% fixed rate	62.95
10 year at 10% fixed rate	37.85
10 year at 12% fixed rate	26.37

Each basis point profit on a three-year US dollar swap with a 10 per cent fixed rate would be a return on capital of 19.3 per cent (96.64 _ 5 points). This compares with our return of 24.8 per cent (49.5 _ 2, because one point was earned on each swap). Notice that the three-year swap has a lower return on capital because it is a longer-term swap.

It must be noted that there are shortcomings with this form of generalised analysis. First, the return on capital has not taken into account the costs of running a swaps desk. The heavy expenditure required in providing sophisticated computer technology and trained dealers has been ignored.

Second, the results do not suggest what will happen in the future. Australian interest rates are dynamic and future movements may be very different from historic patterns. However, the period analysed was one of high volatility and resulted in larger than normal credit exposures.

Note also that the return on capital was calculated by supposing that the bank has earned basis points through hedging the swap immediately. The return ignores those gains and losses made through taking open positions on interest-rate movements and basis positions on movements between bond and swap yields.

Comparing methods

The conversion factors used under the rule-of-thumb approach are based on a portfolio of swaps — assuming some swaps will be suffering losses when others are profitable. The credit exposure calculated for our example was $100,000. To compare this amount with that obtained under the mark-to-market approach, it is necessary to average the credit exposures calculated for the profitable and the unprofitable swaps. The average is $68,310 (ie, [$928 + $135,691] _ 2).

The rule-of-thumb measure, while more conservative than the mark-to-market method, is useful as a rough estimate of credit exposure. It is especially useful at commencement of the swap; this is because the mark-to-market method will give a very low value (because rates will not have moved) and an estimate of the credit exposure may be necessary for pricing purposes.

However, the rule-of-thumb method is an inaccurate estimate when the continuing exposure is to be monitored. In our example it understates the maximum exposure that occurred during the period analysed ($303,000 as in Graph 2). This is because it does not reflect the impact of interest-rate movements on the credit exposure of the swap.

Where the mark-to-market approach is applied on a two-year swap, the returns on capital committed appear to be satisfactory. The gross returns (ignoring operational costs) calculated over the 1988-1990 period were approximately 24.8% for each point of profit achieved. Despite the concerns that the capital adequacy requirements would affect banks' willingness to trade swaps, these returns should enable banks to continue providing the capital to support swaps trading.

NOTES

1. This process is detailed in chapters 4 and 5 of Daniel Daugaard, *Swaps Handbook* Financial Training and Analysis Services, Sydney, 1991.
2. Such as those explained in Harvey Crapp and John Marshall, *Money Market Maths*, Allen & Unwin, Sydney, 1987.
3. Katerina Simons, *Measuring Credit Risk in Interest Rate Swaps*, New England Economic Review, November-December 1989.
4. Methods of hedging individual swaps and a swaps book are explained in chapter 5 of Daniel Daugaard, op. cit.
5. Steve Myers, "Basle Faulty", *Risk*, Vol. 3, No. 7, July-August 1990.

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