

Introducing overnight indexed swaps

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Last year, a new type of financial instrument – the Overnight Indexed Swap (OIS) – was introduced to New Zealand. This article is intended as a primer, explaining what the OIS is and how it is used by market participants to manage interest rate risks and to take a view on the direction of the Official Cash Rate (OCR). From the Bank's perspective, we are most interested in using OIS yields to derive estimates of market expectations of the OCR. This article also highlights developments in the New Zealand OIS market to date.

1 Introduction

In February 2002, market participants began to trade Overnight Indexed Swaps (OIS) for the first time in New Zealand. OIS contracts have become one of the fastest growing – and in some countries, the most widely traded – derivative instruments globally since they were first introduced in the early to mid-1990s. For example, OIS turnover in Australia has grown quickly since the introduction of the instrument in October 1999, with the amount traded in the year to June 2002 more than doubling the corresponding figure a year earlier.²

This article explains the OIS instrument and reviews their early development in the New Zealand market.

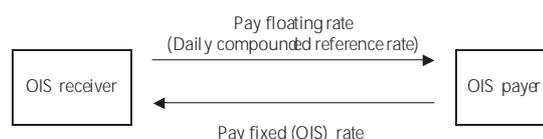
2 What an Overnight Indexed Swap is and how it is used

An interest rate swap is an agreement between two parties to exchange, or “swap”, for an agreed time period, a series of fixed interest rate payments for a series of variable (or floating) interest rate payments (or vice versa).³ An Overnight

Indexed Swap is a special type of interest rate swap in two respects. First, OIS contracts involve the exchange of obligations for relatively short periods – for example, from one week up to around one year – whereas standard interest rate swap contracts run for longer periods – for example, from one to 30 years. Second, the floating reference rate in the OIS is the *overnight* rate, whereas the floating rate for most interest rate swaps is generally set less frequently, with reference to a quarterly or semi-annual interest rate. A simple diagrammatic representation of an OIS is given in figure 1.

In an OIS transaction, the counterparties agree to exchange the difference between the interest accrued on the fixed (OIS) rate and the compounded floating amount at the conclusion of the contract.⁴

Figure 1
An overnight indexed swap



OIS as a risk management tool

The OIS allows financial institutions and companies to manage some of their interest rate risks better by matching the maturity of their assets and liabilities. While other

¹ The author thanks Kelly Eckhold and Michael Reddell for their extensive comments on this article. The author also thanks Grant Barnes, Michael Gordon, William Hill, Sean Keane, Leo Krippner, and Gareth Williams for ongoing discussions on the topic. Data used to produce charts in this article were provided by Commonwealth Bank of Australia, Credit Suisse First Boston, Fixed Interest Securities, Prebon Yamane and the Reserve Bank of Australia.

² AFMA (2002). *2002 Australian Financial Markets Report – Overview*, Australian Financial Markets Association. http://www.afma.com.au/afma/pdf/2002afmr_overview.pdf

³ For a more detailed discussion of interest rate swaps, see Hawkesby, C (1999). 'A primer on derivatives markets', *Reserve Bank of New Zealand Bulletin*, Vol 62, No 2, 24-43. http://www.rbnz.govt.nz/research/bulletin/1997_2001/1999Jun62_2Hawkesby.pdf

⁴ There is no exchange of any principal amount although the contract has an associated notional principal amount from which the interest payments are calculated.

financial instruments already available in the market, such as bank bills and bank bill futures, can protect against unexpected movements in short-term interest rates, the OIS helps protect against unfavourable movements in the *overnight* rate, which can move significantly even within periods as short as three months. While almost every firm or financial institution will have a positive (negative) cash balance, for which it faces the risk that the overnight cash rate will fall (rise), the OIS is likely to be used more actively by institutions operating in the wholesale financial markets.

To illustrate how an OIS can be used to manage interest rate exposures, imagine a bank that seeks to raise money by issuing three-month bank bills to enable it to on-lend the money on an overnight basis to its customers. On the one hand, the bank's customers are paying a floating overnight interest rate, which can rise and fall. On the other hand, the bank is paying a (three-month) fixed interest rate to its lenders. If market interest rates fall by a sufficiently large amount, the bank will lose money, since it is continuing to pay a (higher) fixed interest rate while receiving a (lower) floating interest rate.

To insulate itself against a fall in the overnight interest rate, the bank has two options. First, the bank could choose instead to take a series of overnight loans and pay the floating overnight rate. In this case, the floating rate payments received from the customer and the floating interest rate paid to the lender will rise and fall together – the bank has successfully protected itself against adverse movements in the overnight interest rate. However, this would be inefficient and entail considerable transaction costs, as for a three month period, the borrower would have to renew up to 70 overnight loans. Furthermore, banks generally find it cheaper and more secure to raise money by borrowing for the whole three month period, for example by issuing three-month bank bills, compared to say, taking overnight loans.

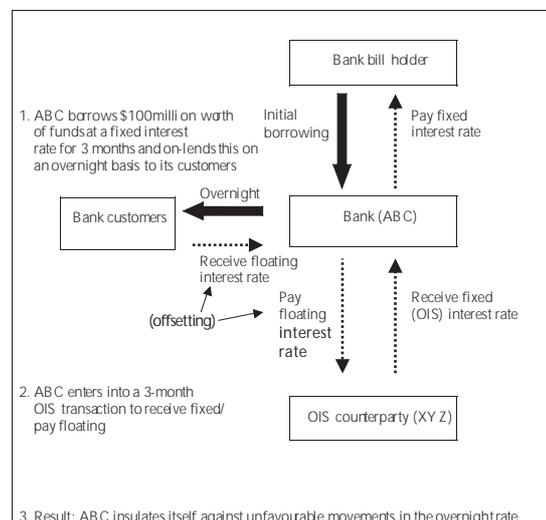
Another option is for the bank to borrow cash for the whole three month period (agreeing to pay a fixed interest rate) and simultaneously enter into an OIS transaction to exchange a fixed rate obligation for a floating rate obligation. The floating payments paid in the OIS contract cancel out the floating payments received from the bank's customers. While both options result in the bank successfully insulating itself

against unfavourable movements in the overnight interest rate, the second option is considerably more attractive because it involves only one derivative transaction, rather than a succession of overnight loans, and it allows the bank to have access to cheaper funding than otherwise.

As a specific example, consider a bank (ABC Ltd) that has raised \$100 million worth of funds from issuing three month bank bills (see figure 2). Under the bank bill transaction, ABC agrees to pay the bank bill holder a fixed interest rate. But given that ABC is exposed to potential unfavourable changes in the overnight interest rate that it receives from its customers, ABC decides to enter into a three-month OIS transaction on the notional amount of \$100 million with another OIS counterparty (XYZ Ltd). Under the OIS transaction, ABC (as the OIS receiver) receives a fixed interest rate and pays the sequence of overnight rates that occur over the three-month period, while XYZ (as the OIS payer) receives floating and pays fixed. From ABC's perspective, the floating leg of the OIS transaction effectively offsets the floating interest rate payments received from the customers. As a result, ABC has successfully insulated itself against adverse movements in the overnight interest rate.

An OIS allows an investor to lock in longer-term investment rates without committing to leave their money with one particular borrower for the whole term of the investment. For example, a standard way of investing at the current three

Figure 2
Protecting against unfavourable movements in the overnight interest rate



month rate is to take a three month deposit, leaving the investor with the risk that the deposit taker will default before the deposit matures.

Another way of achieving the same investment rate is for the investor to renew a sequence of overnight deposits – potentially with any number of borrowers – and simultaneously receive fixed/pay floating for three months with an OIS. Under this approach, the investor faces much less credit risk, since it can, in principle, consider on a daily basis (as the overnight loan matures) whether to withdraw its cash from one bank and reinvest at another bank. Furthermore, under the OIS, the three month exposure is only to the net difference in interest rate payments, whereas under the standard investment, the whole principal amount is at risk. The lower credit risk implied in turn requires the contract participants to allocate a relatively small proportion of their credit limits to the contract. Since this second approach involves some transaction costs, the OIS is particularly well suited to situations where the concerns over potential default risks, which are difficult to quantify, are regarded as quite large.

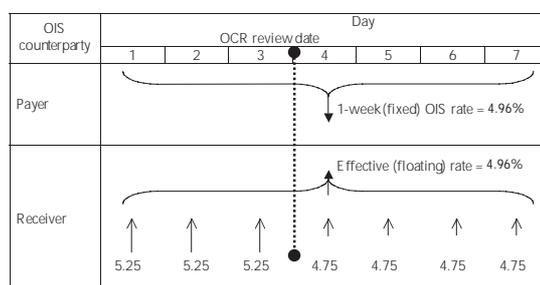
Taking a view on policy rates

OISs are also a convenient tool for expressing a view on the future direction of official interest rates, such as the Official Cash Rate (OCR). For example, a bank that has a relatively strong expectation that the cash rate will increase, can pay the fixed OIS rate now and receive the (floating) actual cash rate over the period of the swap. The main advantage for using the OIS for this purpose, as opposed to other money market instruments or derivatives, is that the OIS is directly linked to the cash rate (however defined), which is the rate most directly tied to changes in official monetary policy settings. Therefore, expectations of a rate rise or cut can be directly exploited. In technical terms, this means the *basis risk* of an OIS contract (the risk that the movement in the policy rate will not be reflected in the contract rate) is very low. This is especially the case in New Zealand, as the reference rate is the OCR itself, rather than the traded market cash rate.

Because the OCR almost always remains the same between scheduled OCR review dates,⁵ if an OIS contract expires before the next OCR announcement date, the OIS rate should equal the current OCR.⁶ In contrast, if the term of an OIS contract does encompass an OCR announcement date, market participants may expect the OCR to be altered on the date, in which case the quoted OIS rate should be different from the current OCR.

To give a simple (though unrealistic) numerical example for a one-week OIS, let's suppose the OCR at the outset is 5.25 per cent, and market participants know with certainty that the OCR will be cut by 50 basis points at a review scheduled for three days into the transaction (see figure 3). Since this combination of OCR outcomes gives an effective expected floating rate of 4.96 per cent,⁷ the quoted OIS rate at the outset should also be 4.96 per cent.

Figure 3
One week OIS (encompassing an OCR announcement date)



In reality, market participants can never be *certain* what the OCR will be after a review date. However, they will have some *expectation* of where it is likely to be. Since the observed OIS rate should equal the currently expected OCR over the life of the contract, one can deduce the market's implicit expectation of the OCR. In the example in figure 3, if the observed one-week OIS rate had been 5.05 per cent (instead of 4.96 per cent), the "average" market expectation of the OCR following the scheduled review in three days' time would have been 4.90 per cent (rather than 4.75 per cent). Put differently, and since the Bank tends to move the

⁵ The one exception to date was the 50 basis point cut to the OCR on 19 September 2001, in the wake of the 11 September 2001 terrorist attacks.

⁶ Adjusted for compounding effects.

⁷ In simple terms, $(3/7 \times 5.25) + (4/7 \times 4.75)$.

OCR in multiples of 25 basis points, the implied probability of a 50 basis point cut would have been 70 per cent (rather than 100 per cent). If the “average” market expectation for what will happen at the upcoming OCR review changes, so should the observed one week OIS rate.⁸

Although it is possible to derive the “average” market expectation, it is difficult and often impossible to derive the distribution of expectations. To illustrate, in the last example it is possible that *all* market participants put the chances of a 50 basis point cut at 70 per cent, or that 70 per cent of market participants fully expect a 50 basis point cut, while the other 30 per cent expect the OCR to be unchanged. There are obviously many other combinations of interest rate, probabilities and proportions of the market that could be consistent with an “average” expectation of 4.90 per cent for the OCR.

3 A developing New Zealand OIS market

Given the popularity of the OIS around the world, in particular in the Australian market, a number of Australian investment banks and fixed-income brokers introduced the OIS into New Zealand markets in February 2002. The New Zealand OIS market is still in its early stage of development. Unlike the more mature bank bill or Forward Rate Agreement (FRA) markets, there are no formal price-making arrangements in the OIS market.⁹ A range of onshore and offshore counterparties can be contacted for quotes, although they

only have to do so on a “best efforts” basis. The majority of OIS deals (between 65 and 75 per cent) are currently transacted via one of the two main fixed-income brokers, with the balance dealt directly between the interbank players. Trades between banks and their institutional clients are almost non-existent at this stage.

At present, a couple of offshore investment banks (operating from Australia) dominate the market, and domestic commercial banks are not particularly active. This means the market is not as liquid as it might be. This can be expected to improve over time as domestic banks (with large exposures to New Zealand interest rates) become more active.

Activity in the OIS market has been reasonably steady since its inception in February 2002, with average monthly traded volumes estimated to be around \$1.5 billion. Market sources suggest that turnover in the OIS market is between only five and ten percent of the turnover in the more established FRA and bank bill futures market. However, traded volumes in OIS seen around certain OCR announcement dates – where there have been particularly marked divergences of view on the direction of the OCR (for example, as with the March and August 2002 *Monetary Policy Statements* and ahead of the January 2003 *OCR Review*) – have been noticeably higher, exceeding \$3.5 billion. This suggests that, to date, a majority of OIS trades in New Zealand have been made for taking a view on the direction and magnitude of changes in the OCR. This is consistent with the fact that the market is currently dominated by wholesale investment banks, rather than companies and commercial banks with an interest in hedging.¹⁰

The bulk of the contracts traded have been concentrated in relatively short maturities, with around 60 per cent in maturities out to three months. An exception to this pattern was in August 2002, when most of the deals were in the four to six month maturities, because that was the horizon where there was the greatest divergence in views among market participants on the future track of the OCR after the August *Monetary Policy Statement*.

⁸ This procedure can be applied to infer market expectations for longer horizons, although more iterations would be required. For an illustration of one technique the Bank uses to derive OCR expectations at various horizons from observed bank bill rates, see Krippner, L (2002). “Extracting expectations of New Zealand’s Official Cash Rate from the bank-risk yield curve”, *Reserve Bank of New Zealand Discussion Paper 2002/01*. http://www.rbnz.govt.nz/research/discusspapers/dp02_01.pdf

For a preliminary analysis of how OCR expectations can be derived from OIS rates in New Zealand, see Choy, W K (2003). “The New Zealand Overnight Indexed Swap Market: An Introduction”, Paper presented at the 7th New Zealand Finance Colloquium, Massey University, Palmerston North, February 2003.

⁹ A formal price-making arrangement is said to exist for a particular financial instrument when there are players (known as price-makers) who agree to quote bid and offer prices for a typical transaction size for each security. These price-makers are obligated to deal at these quoted rates if the customer so wishes.

¹⁰ If there were a large proportion of non-financial companies participating in the OIS market, most trades would be undertaken to hedge underlying exposures (rather than taking views on policy rates), and hence one would expect to see relatively more stable traded volumes.

The OIS market in Australia

A possible guide to the future development of the OIS market in New Zealand is to look across the Tasman. The Australian OIS market began in October 1999 and there has been a noticeable rise in the level of activity in the market through to 2002. For example, according to Australian Financial Markets Association (AFMA, 2002) data, average monthly turnover in the Australian OIS market rose by around 130 per cent from \$42.3 billion in the year to June 2001 to \$97.0 billion in the year to June 2002. This makes the OIS the fastest growing Australian money market instrument, though still not the dominant one. Although figure 4 below shows the estimates from only a subset of the market, market contacts indicate that the pattern is nevertheless indicative of the aggregate market's pace of growth.

Market contacts report that a number of market participants now commonly use OISs to manage interest rate risks, as distinct from taking a view on policy rates. This is quite a

Figure 4
OIS Activity in Australia (estimated monthly turnover)

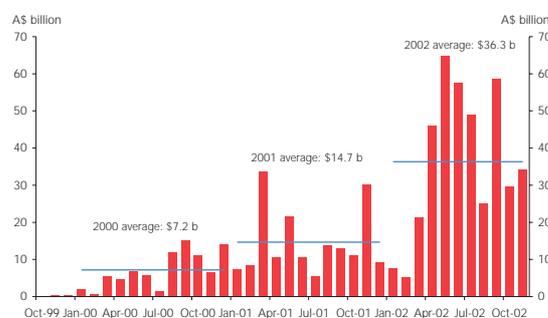


Table 1

Forecasting errors in Australian bank bill and OIS markets (in basis points)¹¹

Horizon (months)	Australian bank bill		Australian OIS	
	Mean	Standard deviation	Mean	Standard deviation
1	8.5	6.4	0.3	5.8
2	8.9	14.3	1.2	13.6
3	11.5	22.5	3.6	20.0
4	14.2	26.4	6.5	26.4
5	20.7	36.1	12.9	35.7
6	25.4	46.5	20.6	45.5

Sources: RBA, Prebon Yamane, RBNZ calculations

contrast to New Zealand at present and reflects the much more developed state of the Australian OIS market.

How accurate are OIS rates in predicting policy rates in Australia?

Given that the Australian OIS market has been around longer, it is worth examining how accurate OIS rates are in predicting policy rates in Australia, compared with the more developed bank bill market. Table 1 below summarises the forecast errors over various forecast horizons for both the Australian bank bill and OIS markets since January 2000. The means represent the average difference between the implicit "expected" cash rate, derived from the relevant bank bill or OIS rates (in the first, second, etc month ahead), and the actual cash rate in each of those future months. A positive forecast error implies that the bank bill or OIS rates "over-predicted" the future cash rate.

Four points are worth noting here. First, it is clear that the forecast errors have tended to be positive on average, showing that markets have on average over-predicted the RBA cash rate through time. Since it is unlikely that markets should have a consistently biased forecast of the cash rate, it is more likely that this systematic error reflects a *term premium*, compensating investors for things such as credit risk or basis risk.¹² If a term premium does in fact exist, we need to adjust down market rates in order to obtain unbiased estimates of the true underlying OCR expectations. Put differently, without allowing for a (positive) term premium, estimates of underlying OCR expectations are likely to be

¹¹ The data used to calculate these forecast errors only go to the beginning of December 2002.

¹² For more details, see Krippner, L and M Gordon (2001), 'Market expectations of the official cash rate', *Reserve Bank of New Zealand Bulletin*, Vol 64, No 2, 25-39. http://www.rbnz.govt.nz/research/bulletin/1997_2001/2001jun64_2KrippnerGordon.pdf

overstated. Therefore, a good term premium estimate is key to obtaining precise estimates of OCR expectations.¹³

Second, average forecast errors are generally larger for longer-horizon expectations. In other words, interest rates implied by longer-horizon contracts (bank bills or OIS) on average have tended to overestimate future interest rates to a larger extent than shorter-maturity contracts. This suggests that estimates of the term premium should also increase with time. For example, for a six-month "prediction", a larger adjustment will be required than for a one-month "prediction".

Third, average forecast errors for Australian cash rate expectations derived from OIS rates have been substantially smaller than those derived from bank bill rates, particularly for shorter horizons. A relatively higher term premium for bank bill rates reflects the relatively higher basis risk and credit risk inherent in a bank bill compared to an OIS contract. This finding is consistent with market participants' sense that OISs are likely to provide the "cleanest" market-based measure of cash rate expectations. The potentially more precise forecast of cash rate expectations in turn is why the Bank and other market participants are seeking to monitor the OIS market in New Zealand more closely.

Finally (and unsurprisingly), the standard deviations show that the range of forecast errors has been much greater over longer horizons.

4 Concluding remarks and future work

The New Zealand dollar Overnight Indexed Swap market began in February 2002. Although turnover in the OIS market is still relatively low compared to that in other money market instruments, our market contacts suggest that general interest in the market is picking up. To the extent that the development of offshore OIS markets is any guide, the OIS market in New Zealand is likely to become increasingly important to domestic market participants. OIS rates are widely regarded as providing the "cleanest" market-based measure of cash rate expectations because of the smaller term premium embedded in OIS yields. The superiority of OIS rates in this respect is likely to be reinforced as the New Zealand OIS market becomes more liquid and more actively used by a wider range of market participants. However, more data are required before we can formally estimate a term premium for New Zealand OIS yields.

¹³ There is ongoing work at the Bank in this area. In addition to the studies already mentioned, see also Gordon, M (2003). "Kalman filter estimates of time-varying term premia for New Zealand and Australia", Paper presented at the 7th New Zealand Finance Colloquium, Massey University, Palmerston North, February 2003.