
Developments in New Zealand's overnight indexed swaps market

Raiko Shareef

New Zealand-dollar denominated Overnight Indexed Swaps (OIS) have been traded for just over a decade. Characteristics unique to OIS make them an ideal financial market instrument with which to hedge against a change in the Reserve Bank's Official Cash Rate. Market participants tend to use OIS to hedge against short-term interest rate risk, or to speculate on the direction of monetary policy. As a result, the Reserve Bank uses OIS prices to gauge market expectations of future monetary policy decisions. Our analysis suggests that market-implied expectations are an unbiased predictor of the Official Cash Rate for all forecast horizons out to six months.

1 Introduction

Overnight Indexed Swaps (OIS) have been traded in New Zealand for just over a decade and have become a widely traded financial instrument. The Reserve Bank of New Zealand is interested in this product as its pricing can give a clean measure of the market's expectations of future changes to the Official Cash Rate. Monitoring these expectations is important as they can have a strong bearing on the market's response to the Reserve Bank's actual monetary policy decisions. Moreover, the Bank seeks to avoid unnecessary instability in interest rates when implementing monetary policy, and expectations can reveal the scope for policy surprises.

Not long after their introduction, we presented OIS in a *Bulletin* article.¹ Ten years on, we highlight some developments in the OIS market. Furthermore, we test the information content of OIS pricing as a gauge of monetary policy expectations.

2 What is an overnight indexed swap?

As explained in Choy (2003), an interest rate swap is an agreement between two parties to exchange (or 'swap') a series of fixed interest rate payments for a series of variable (or floating) interest rate payments (or vice versa) over an agreed time period. An Overnight Indexed Swap is a special type of interest rate swap in two respects. Firstly, OIS contracts involve the exchange of obligations for relatively short periods – for example, from six weeks up

to about one year – whereas standard interest rate swap contracts run for longer periods – for example, from one to 30 years. Secondly, the floating reference rate in the OIS is reset overnight, whereas the floating rate for most interest rate swaps is reset less frequently – usually quarterly or semi-annually. In New Zealand, the floating rate in an OIS contract is the Reserve Bank of New Zealand's Official Cash Rate (OCR).

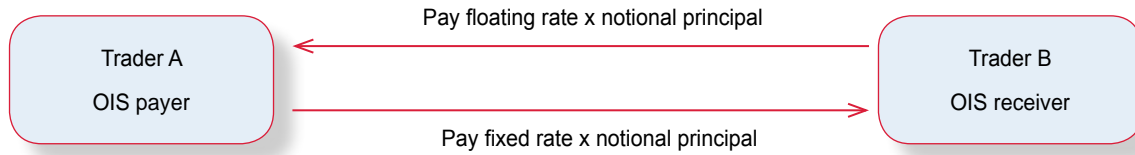
The parties also agree on a notional principal amount that determines the size of the settlement sum at the end of the contract. The fixed rate and the time period ('term') are agreed when the contract is traded between the two parties. No money is exchanged between the parties until the end of the contract.

The money transferred between the parties is just the difference between the two rates, multiplied by the notional principal. As a result, there is very minimal capital required to enter into a contract. This lowers the hurdle for participation, as the counterparty credit risk is much lower than if the notional value was exchanged.

OIS pricing can be used to measure market expectations of the future OCR. Take a simple example where Trader A and Trader B enter an OIS contract for a term of two days. Suppose that on the second day, the RBNZ is due to review the Official Cash Rate, currently at 2.50 percent per annum. Trader A agrees to pay a fixed rate of 2.60 in exchange for receiving the OCR. This trade reveals that Trader A believes there to be a good chance the OCR will be raised on the second day. More specifically, he believes that there is a better-than-80 percent chance

1 Choy, Wai Kin (2003)

Figure 1
A simple representation of an OIS contract



that the OCR will be raised to 2.75.² If Trader A and B were the only two participants in the market, then one could say that 'market pricing' implies an 80 percent chance of a 25 basis point hike at the next meeting. Trader B would not have entered the contract if she believed that there was a greater-than-80 percent chance of this rate hike.

There are a number of ways a bank or trader could hedge themselves against changes in monetary policy, including through the use of bank bill futures, interest rate swaps, or forward rate agreements. In New Zealand, the cleanest way to hedge against a change in the policy rate would be through the New Zealand dollar-denominated OIS market (NZD OIS hereafter). The reasons are threefold.

Firstly, the floating rate in an NZD OIS contract is the RBNZ's OCR, whereas the floating rate on an interest rate swap (IRS) is usually the three-month Bank Bill Market (BKBM) rate, which is a weighted-average interest rate for unsecured lending between contributing New Zealand banks. The BKBM rate can be affected by the risk of floating interest rates moving adversely during the term of the contract, due to liquidity and credit considerations in the interbank market. Even putting aside these risks, it is clear that the interest rate that would most accurately reflect changes in the OCR is the OCR itself.

Secondly, the floating reference rate on an OIS contract is reset every night, which means that any change in the OCR will be reflected in the floating rate by the next working day. By contrast, the reference rate on an IRS is reset on a quarterly or even semi-annual basis. As a result, an investor receiving the floating rate in an OIS contract will receive the benefit of rising interest rates more quickly than an investor receiving the floating rate on an IRS.³

² $(2.50 + (2.50 \times 20\% + 2.75 \times 80\%)) / 2 = 2.60$. This simplified calculation ignores compounding effects, which are negligible over two days.

Thirdly, OIS contracts tend to be made for shorter terms, maturing between six weeks and one year from when the contract is struck. This means that a trader can take a position on any upcoming RBNZ policy decision, including the one that will be less than six weeks away.⁴ It has become common for OIS contracts to be struck specifically for RBNZ policy decisions dates (a development discussed later in this paper). As a result, if an investor wanted to take a position on a meeting two days away, there will be a price available to trade on.

3 How does the market operate?

Participants

Large banks, both onshore and offshore, are the main participants in the NZD OIS market. Offshore hedge funds are regular participants, often through global investment banks. Local hedge funds and institutional clients of local banks are rare participants. While no formal price-making mechanism exists, traders at large banks will almost always give a price for an OIS contract upon request. Some publish these prices on the Bloomberg and Reuters financial market platforms. While these 'market makers' are the most regular participants, offshore hedge funds tend to put on larger trades when they do choose to participate. That is, they enter into contracts with larger notional principals, on occasion as large as NZ\$4bn.

³ This applies to an investor holding the instrument to maturity. Note that the mark-to-market value of the IRS and OIS will both change immediately following a change in the OCR.

⁴ While the decision may be less than six weeks away, an OIS contract struck specifically for that meeting will mature immediately before the next meeting i.e. the contract term will be at least six weeks.

Box 1

OIS in other jurisdictions

The NZD OIS market is unique in that the OIS floating rate is the announced policy rate, rather than a realised overnight cash rate. Here we examine the conventional OIS floating rates in comparable jurisdictions.

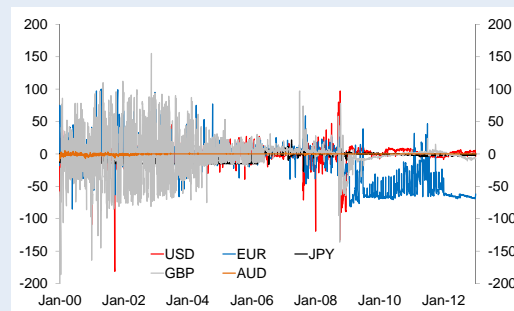
In the United States, Japan, and Australia, the reference rate is a volume-weighted average of interest rates on unsecured lending between financial institutions that hold reserve balances at the central bank. In the United States, this rate is known as the daily effective federal funds rate. In Japan, it is called the uncollateralised overnight call rate, and in Australia, it is the interbank overnight cash rate. The central banks of all three nations use open market operations to try to match these overnight rates with their policy target rates.

In the euro area and in the United Kingdom, the reference rate is again a volume-weighted average of interest rates, but of unsecured lending between approved contributor banks, known as 'panel' banks. In the euro area, the reference rate is known as the European OverNight Index Average (EONIA), while in the United Kingdom, it is the Sterling OverNight Index Average (SONIA). Neither the European Central Bank nor the Bank of England explicitly targets these with open market operations, although changes in monetary policy will, to an extent, be reflected in these reference rates.

Figure 2 shows that large and persistent differences can occur between the floating rate used in OIS and

the central bank policy rate. This can be expected in jurisdictions that do not target the OIS reference rate, such as EUR and GBP. But differences can also be large in jurisdictions which attempt to minimise them. This is particularly pronounced in the US. On the other hand, the difference between Australia's policy rate and the OIS reference rate has been zero nearly every day since the early 2000s, and the rare differences since then have been in the order of 1 to 2 basis points.

Figure 2
OIS floating reference rate minus central bank policy rate
(basis points)



NB: USD – given Federal Reserve Board's target for the federal funds rates has been a band of 0 to 25 basis points since 16 December 2008, the target policy rate is assumed to be 12.5 basis points. EUR – main refinancing operation rate is used.

Sources: RBNZ, Federal Reserve Board, European Central Bank, Bank of Japan, Bank of England, Reserve Bank of Australia, Reuters

Consequently, New Zealand and (in practice) Australia are two of the only nations in which a change in the policy rate will be passed on one-for-one to an investor receiving the floating rate in an OIS contract.

Volumes

Market participants confirm that trading in NZD OIS is dominated by shorter contracts, with 90 percent of OIS contracts made in 2012 due to mature within six months. A small proportion of contracts mature between six and 12 months, and very few contracts are struck for longer than one year. Participants note that practically no market for NZD OIS exists past the one-year mark.

NZD OIS is an over-the-counter derivative instrument, and as such, trading volumes are not publicly available. Market sources suggest that the average daily notional

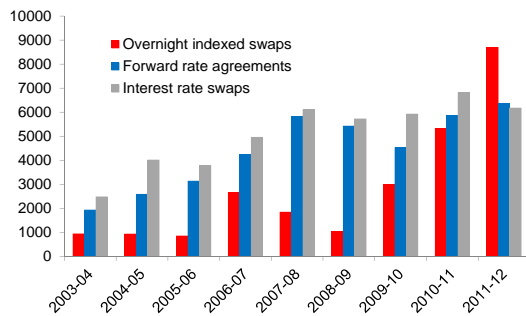
value of NZD OIS traded was roughly in the region of \$500 million over 2012, nearly seven times larger than the estimated average daily turnover of \$71 million in 2003 noted by Choy (2003).⁵ In terms of liquidity relative to other instruments, OIS is generally not as liquid as bank bill futures or shorter-term IRS, but more liquid than forward rate agreements (FRAs). Note that these relative liquidities change very frequently, depending on market conditions and events.

⁵ Choy used a monthly average of \$1.5 billion. Assuming 21 trading days a month, this works out to be \$71.43mn per day.

Research by the Federal Reserve⁶ suggests that notional trading volumes in OIS can be larger than volumes in similar derivative instruments like IRS or FRAs. The data, collected over the three months to 31 August 2010, showed that trading in OIS market represented 39 percent of the daily average volume in interest rate derivative transactions, compared to 34 percent represented by IRS and 14 percent represented by FRAs.

OIS has also seen increasing popularity in Australia. Results from an annual survey by the Australian Financial Markets Association (AFMA) show that OIS turnover in the Australian market increased to A\$8.7 trillion in the year to 31 May 2012, up 64 percent from a year earlier. That year also marked the first time that OIS turnover volume was larger than that for IRS or FRAs.

Figure 3
Annual turnover in Australian financial markets (A\$bn)



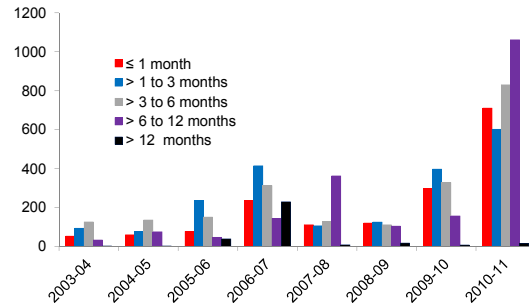
Source: AFMA

The AFMA data also allocates turnover volume in the AUD OIS market by term of contract. Figure 5 shows that the AUD OIS market is dominated by contracts maturing within 12 months, and that the majority of AUD OIS contracts mature within six months. This is consistent with the idea that OIS is used mainly for short-term balance sheet hedging, or for speculation on upcoming monetary policy decisions.

It is important to note that comparing trading volumes of different instruments by the notional value traded can be misleading. Such a comparison can overstate or understate the relative risk taken on by an investor. In general, the risk taken on by an OIS investor is much smaller than that taken on by an IRS investor. This is

⁶ Fleming, Jackson, Li, Sarkar and Zobel (2012)

Figure 4
Overnight indexed swaps outstanding at 31 May (A\$bn)



Source: AFMA

because OIS contracts are almost always struck for a shorter duration than IRS contracts.

One way of characterising this risk is to determine the paper gain (loss) made by an OIS or IRS payer (receiver) when the floating reference interest rate rises by one basis point. For example, the investor paying the fixed rate on a six-month OIS contract with \$500 million notional will make a paper gain of (roughly) \$24,600 from a one basis point rise in the OCR. On the other hand, the investor paying the fixed rate on a two-year IRS contract with the same notional would make a paper gain of (again, roughly) \$96,500 from a one basis point rise in BKBM.

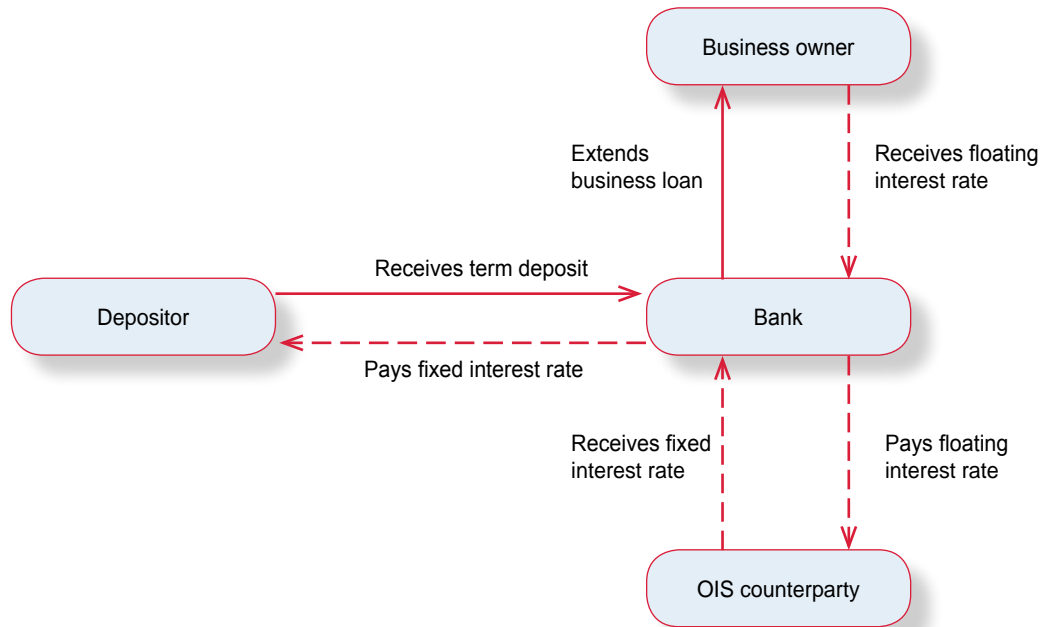
Balance sheet hedging

Local banks use OIS to hedge interest rate risk on their balance sheets. In particular, banks tend to receive fixed OIS interest rates at three-month and six-month tenors to match fixed interest rates paid to customers on term deposits at those terms.

Figure 5 is adapted from Choy (2003), and shows how this hedging strategy might work. In this example, a bank extends a six-month variable rate loan to a business, receiving a floating interest rate in return. The bank funds this loan with a six-month term deposit, on which it pays a fixed interest rate. To protect itself from an unfavourable movement (in this case, a fall) in the floating rate, the bank enters into an OIS contract. In this contract, the bank receives a fixed rate and pays floating. As a result, the fixed leg of the OIS contract offsets the fixed interest rate paid on the term deposit.

Figure 5
Protecting against unfavourable movements in floating interest rates

Erratum: this chart replaces an earlier version published with incorrect arrows.



NB: The bank extends a 6-month business loan at a floating interest rate, funded by a 6-month term deposit. The bank then enters into a 6-month OIS contract to receive a fixed interest rate.

In the past, balance sheet managers have used FRAs to hedge term deposits. However, a relatively illiquid market for FRAs means that the balance sheet is exposed to greater liquidity risk. The market for OIS can be more liquid, so some banks have moved to using OIS instead.

Monetary policy speculation

Hedge funds and proprietary trading desks use NZD OIS to speculate on the direction of monetary policy, and tend to participate more when there is some uncertainty about the Official Cash Rate decision. To cater for these participants, OIS market makers offer contracts tailored to RBNZ OCR decisions. This facility is popular for two reasons. Firstly, an investor asking for an OIS price for a particular decision date would be quoted the implied OCR for that announcement. That is, the fixed rate to be paid or received between that announcement and the next. As a result, the investor can instantly see what the market expects for that OCR announcement. This is slightly harder to achieve if one is quoted a standard term OIS price, which might encompass more than one announcement. Secondly, announcement date contracts

are easier to trade. While a six-month contract is fairly liquid, after two weeks, this becomes a 5.5 week contract, which can be hard to divest. Contracts for announcement dates tend to be more liquid, as market participants look to directly express an opinion on that announcement.

To illustrate why investors (both onshore and offshore) might be interested in the NZD OIS market, it is useful to recall events in June 2012, when financial markets feared that Greece might exit the euro area. If realised, that result would have deepened the European debt crisis, and central banks around the world may have decided to ease monetary policy further. Indeed, some market participants judged it to be worth hedging against policy rate cuts. However, major central banks already had interest rates close to zero, and were more likely use unconventional tools to loosen policy. On the other hand, both the Reserve Bank of Australia and the Reserve Bank of New Zealand still had room to cut interest rates, allowing those investors receiving OIS a higher potential payoff.

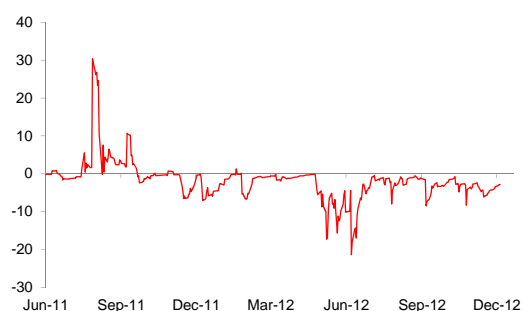
Note that overseas investors may place positions in NZD OIS out of a need to hedge another global position, and not necessarily out of a strong belief that the OCR

would be cut. In other words, an investor who might have had conviction that Greece would stay in the euro area (and expressed it, say, by buying European equities) may have also entered into a contract to receive NZD OIS, as an insurance measure.

Distortionary behaviour

Large flows by speculative investors (although rare) can sometimes push OIS prices to the point where market-implied OCR expectations diverge from 'true' OCR expectations (however those might be measured). This is most likely to occur in times of increased economic uncertainty, and especially when investors attempt to hedge against large and unexpected 'tail risk events'. This behaviour was particularly apparent in the lead-up to the 14 June 2012 OCR announcement. As figure 3 shows, hedging flows were the dominant force, pushing the price to imply 21 basis points of cuts. In contrast, 15 out of 16 surveyed market analysts expected no change to the OCR at that announcement.

Figure 6
Market-implied expectation of change to OCR
at next meeting
(basis points)



NB: The OCR remained at 2.50 percent over this period

Interestingly, one cannot tell whether the market was pricing in a (roughly) 80 percent chance of a 25 basis point cut, or a 20 percent chance of a 100 basis point cut, or indeed any combination between. Market contacts suggest that at least some market participants were hedging against the second possibility i.e. the very small chance of a very large cut.

On occasion, a lack of liquidity can also move market-implied pricing out of line with 'true' expectations of future monetary policy. Such a scenario tends to occur when there is little disagreement about the direction of monetary policy, so that OIS trading becomes thin. As such, we have to apply judgement when interpreting market-implied pricing.

What is the information content?

The Bank is interested in market expectations for various reasons. Market participants are looking at much the same data as the Bank itself, so market expectations can provide a useful cross-check. But market expectations, as reflected in market prices, also provide useful insight into how markets are likely to respond to the Bank's OCR decisions and monetary policy communications. At times, the Bank may judge it appropriate for monetary policy settings to be different to those the market is expecting, which could cause a significant reaction in interest rates and the exchange rate. Sometimes those reactions will be desired, and consistent with the intended stance of policy. At other times, we might be wary of the risk of over-reaction. Either way, the Bank takes market expectations into consideration when it drafts communications regarding monetary policy.

Market participants interested in measuring market-implied policy expectations are likely to have models which use OIS prices. These may differ from the Reserve Bank's own model, based on the method used to estimate market expectations from financial market prices. As a result, the implied expectations may vary slightly. For example, when different instruments are available for the same term, market participants may use their judgement to choose which instrument's price to use in their model.

NZD OIS prices are an important input into the internal RBNZ model.⁷ OIS prices are relied upon to provide all the information on market expectations out to the six-month forecast horizon, and are used along with other instruments to provide expectations beyond that.

More specifically, the Reserve Bank's model calculates short-run expectations (i.e. up to six months) directly from OIS prices, and calculates the longer horizons by fitting

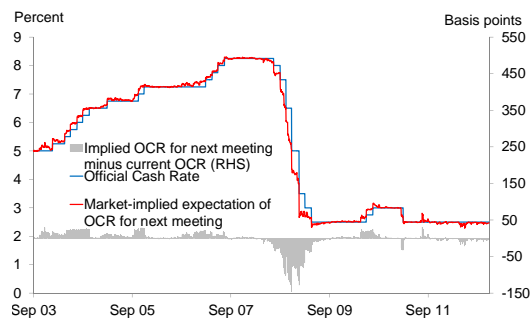
⁷ Krippner, L. (2012)

a model to a forward yield curve, using OIS, IRS, FRAs, and physical bank bill prices. When multiple instruments are available at the same term, the model systematically uses the prices of all of them to produce a market-implied expectation of the OCR.

We have used the model to investigate how well market expectations implied from NZD OIS prices predicted past OCR decisions, based on 74 RBNZ OCR announcements from 23 October 2003 to 6 December 2012. The sample period captures the tightening cycle through the mid-2000s, the dramatic easing in response to the global financial crisis, the gradual removal of stimulatory policy in 2010, and the rate cut in response to the Canterbury earthquake.

Figure 7 gives an insight as to how closely implied pricing can track the OCR. It shows market-implied expectations of the OCR for the upcoming announcement, using information derived exclusively from NZD OIS. Two observations are worth making. Firstly, the market has almost always correctly picked the direction of the next OCR move. Secondly, the market's prediction for the upcoming decision generally improves as the announcement date approaches. One would expect this to be the case, as data releases and other information revealed in the lead-up to an announcement might impact on the policy decision, and the market will incorporate this into its pricing.

Figure 7
Market-implied OCR expectations for next policy meeting



Source: RBNZ

The former observation is relevant for the Reserve Bank's mandate to seek to avoid unnecessary instability while implementing monetary policy.

Figure 7 strongly suggests that the RBNZ's written and verbal communication⁸ at the previous meeting is generally consistent with its policy moves at the next meeting. In other words, the RBNZ does not appear to have surprised the market with a rate hike (cut) after communicating an easing (hiking) bias at the previous meeting.

A forecast error is defined as the difference between the market-implied expectation of the OCR at a particular horizon and the realised OCR. Figures 8 and 9 show the mean forecast errors over the full range of forecast horizons studied, from one day to one year, and every day falling between. The figures also show confidence bands, centred on the mean forecast error. The interpretation is that 90 percent of the forecast errors fell between these two lines.

Figure 8
Average forecast errors and 90 percent confidence bands – whole sample

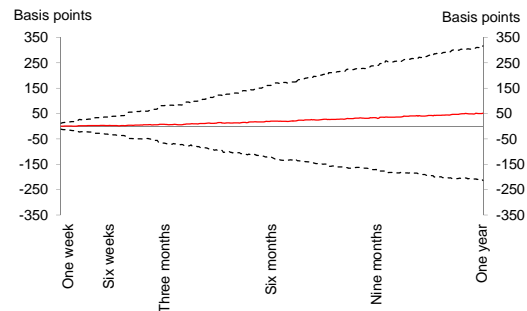
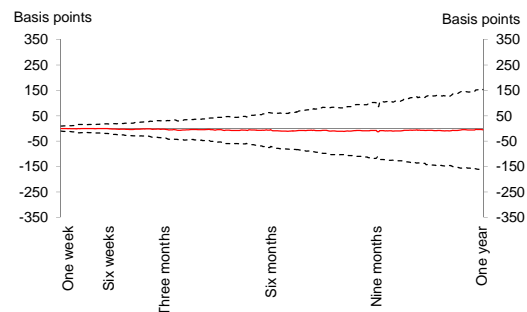


Figure 9
Average forecast errors and 90 percent confidence bands – ex-GFC



⁸ In the form of a news release at every announcement, and a full *Monetary Policy Statement* and press conference at every second announcement.

The mean forecast error was remarkably small, suggesting that OIS market pricing offered an unbiased estimate of the actual OCR. Six weeks before a Reserve Bank announcement, the model predicted an OCR three basis points higher than was actually realised. In other words, immediately following an OCR decision, the model (on average) correctly predicted the next OCR within 0.03 percent. If one (somewhat wishfully) excludes the global financial crisis,⁹ this forecast performance improved dramatically. In this case, at a six-week forecast horizon, the model predicted an OCR just one basis point (0.01 percent) lower than realised. At a six-month horizon, the average error was just five basis points (0.05 percent)

Three other observations are worth making. Firstly, forecast errors were larger as the horizon increased. This is not surprising. Much more market-moving information can be released in the six months before an announcement than can be released the day before. At a six-week forecast horizon, 90 percent of the forecast errors fell between 38 basis points above and 33 basis points below the actual OCR. At a six-month horizon, this band widened to 161 basis points above and 120 basis points below the actual OCR.

Secondly, for the sample excluding the global financial crisis, the confidence bands were roughly half as wide at every forecast horizon. This implies, again unsurprisingly, that the forecast errors for announcements during the GFC were significantly larger than those for announcements outside of that period, due to higher-than-usual uncertainty.

Thirdly, the two sets of forecast errors show different biases. Over the whole sample period, market pricing, on average, implied a higher OCR than what actually came to pass. This 'overprediction' rises from around 0.03 percent at the one-month horizon, to 0.50 percent at the one-year horizon. To explain this, first note that the market will only ever be choosing between two possible outcomes for the upcoming announcement – either no change and a hike, or no change and a cut. During an easing cycle,¹⁰ the

market-implied expectation will lie somewhere between a decision to hold the OCR and a decision to cut. Given that the overall sample is dominated by the easing cycle through the GFC, it makes sense that the average market-implied forecast is higher than the realised OCR. Excluding the GFC, the model persistently picked a lower OCR than actually realised. This is due to the sample now being dominated by the tightening cycle from 29 January 2004 to 05 June 2008, where the market was picking between no change and a hike.

Using some simple regression analysis, we can test the idea that the model accurately predicted the actual OCR at various forecast horizons.¹¹ To do this, we test whether the model's forecast, made at time t for horizon h , will be exactly equal to the OCR realised at time $t+h$.

$$OCR(t+h) = \alpha + \beta \cdot OCR(t,h) + \varepsilon(t+h)$$

We impose the constraint that $\beta=1$ for all the horizons we test. This forces any systematic forecast errors (i.e. biases) over the sample for each horizon to be accounted for as a constant term premium α .¹²

The results are shown in table 1. The first column gives the forecast horizon we are testing, and the second column gives the estimate of the term premium α . The right-hand column is the most important, and shows how confident we can be that α is non-zero at that particular forecast horizon.¹³

The results suggest that the model is an unbiased predictor of the OCR for all horizons out to six months. That is, the probability of α being non-zero is less than 95 percent (a typical statistical benchmark) in all those cases. For six months and beyond, there is greater than 95 percent probability of α being non-zero. This suggests that

⁹ Specifically, period beginning at the first rate cut on 24 July 2008 and ending on 29 April 2010, which was the last meeting before the first rate hike.

¹⁰ Here, an easing cycle is defined from the first OCR cut until the next OCR hike.

¹¹ For this analysis, we use 67 Reserve Bank announcements from 9 September 2004 to 6 December 2012. While we have OIS prices implying OCR expectations for the 23 October 2003 meeting, one-year-ahead expectations are available only for the 9 September 2004 meeting onward.

¹² The error term $\varepsilon(t+h)$ always has mean zero and minimised variance.

¹³ For those familiar with regression analysis, the probabilities are obtained from t-statistics for the regression parameters (heteroskedastic- and autocorrelated-adjusted via the Newey-West method for our particular application). Also, regression analysis jargon would typically phrase the results as giving probabilities of not rejecting the hypothesis that $\alpha=0$. But, for easier interpretation by the reader, we have expressed our results as the probability of α being non-zero.

Table 1
Regression results

	Days	Estimate of α (basis points)	Probability α is non-zero (%)
One day	1	1	53.7
	2	1	51.0
	3	1	61.6
One week	7	1	69.8
	14	1	42.0
	28	3	88.3
Six weeks	42	3	79.5
	46	4	88.2
Three months	90	9	89.9
	108	11	90.6
	127	14	94.1
	145	15	92.0
	164	19	94.6
Six months	182	22	96.0
	218	28	96.7
	255	34	97.7
	291	38	97.6
	328	44	98.2
One year	364	50	98.9

the OIS data and/or the Bank's model may systematically overpredict the OCR (by 22 to 50 basis points) for those horizons.

Conclusions

The New Zealand-dollar Overnight Indexed Swaps market provides participants with an efficient way of expressing a view on New Zealand's monetary policy. Consequently, the market plays an important role in helping the Reserve Bank of New Zealand to gauge policy expectations. While there are periods in which market-implied expectations can misstate 'true' expectations, the increasing use of the market will improve the information content.

Our analysis suggests that OIS prices are an unbiased predictor of the realised OCR out to six months, with the estimated term premium being statistically immaterial. However, there may be small biases in the data or the Bank's model for horizons from six months outward. We will bear these results in mind when using the model as an indicator for OCR expectations.

References

- Australian Financial Markets Authority (2012), '2012 Australian Financial Markets Report', <http://www.afma.com.au/data/afmr.html>
- Choy, W K (2003) 'Introducing overnight indexed swaps,' Reserve Bank of New Zealand *Bulletin*, Volume 66 (1).
- Fleming, M, J Jackson, A Li, A Sarkar and P Zobel (2012) 'An analysis of OTC interest rate derivatives transactions: implications for public reporting,' *Federal Reserve Bank of New York Staff Report*, No. 557.
- Krippner, L (2012), 'Market-based expectations for New Zealand's Official Cash Rate', unpublished internal document.