
A primer on derivatives markets

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Derivatives are now central to day-to-day activity in financial markets, but remain poorly understood outside the circle of active market participants. This article is intended as a primer, explaining derivatives in simple terms to those not familiar with the market or in need of a refresher. The thrust of the article is that derivatives help manage risk.

The article concentrates on interest rate and exchange rate derivative markets, but could be applied to other derivatives; the principles are identical.

The article:

- sets out the main derivative types: forwards, futures, swaps and options;
- describes the common features of these different derivatives which make them attractive to those using financial markets;
- addresses the risk question: if derivatives are so useful for handling risk, why have a number of firms lost substantial amounts trading them and
- discusses what information can be derived from derivatives prices.

1 What is a derivative?

It is a cliché that the world is a risky place. While we aim to minimise many of the risks we face, some are unavoidable. Secure locks reduce the risk of our houses being burgled, but they do not remove it. So we protect ourselves against the unavoidable risk by taking out house insurance. The insurance transfers some or all of the financial costs of being burgled to the insurer. And the price to us is the insurance premium. The insurance company may have to pay out, and so wants payment in exchange for providing insurance. We value the insurance, so are willing to pay for it. And even if our houses remain untouched – which we would prefer – the insurance is probably worth it for the peace of mind.

Derivatives work in much the same way. Like insurance, they are a means by which financial risks can be transferred.

The name 'derivative' is significant: they are indeed **derived**. A derivative is a contract whose value depends on the value of some 'underlying' asset. In financial markets, there are derivative contracts for a number of different underlying

assets, including sharemarket stocks, sharemarket indices, commodities, bank bills, governments bond and foreign exchange.² Derivative markets are not new. In ancient Greece there were the equivalent of derivatives on olive harvests. By the seventeenth century there were derivative contracts on the value of the sharemarket in Amsterdam and on rice in Japan. The first formal exchange in the United States was the Chicago Board of Trade, which opened in 1842 with contracts on corn. In New Zealand the first derivatives were contracts on wool traded via the London exchange back in 1953. However, it was not until the mid-1980s that derivatives on financial asset markets began to grow rapidly. The New Zealand Futures and Options Exchange (NZFOE) began trading in 1985.

A common perception is that derivatives are complex, mysterious and highly risky. This article aims to show that this need not be so. Derivatives are, first and foremost, a valuable risk management tool to help insure against future events cheaply and/or efficiently. As with any financial market, there are risks to using derivatives markets. A good understanding of these markets is essential in managing those risks.

¹ The author would like to thank Michael Reddell and Andy Brookes for their significant contributions to the article, and members of a number of domestic financial institutions for their input.

² See Lucas and Rosborough (1999) for information on the size of interest rate and exchange rate derivatives markets in New Zealand, and how their size has changed over time.

2 Who uses derivatives, and why?

Users of financial markets can loosely be divided into distinct types: hedgers, speculators and intermediaries.

A **hedger** is someone who uses financial markets to reduce the risks they face. A **speculator**, on the other hand, takes an outright bet on prices, deliberately increasing their risk.

Intermediaries make the market; they bring buyers and sellers together, finding prices that match willing buyers with willing sellers. They aim to have lots of offsetting contracts and normally do not take on significant risk themselves. (These three categories are, of course, somewhat stylised, but they are useful for understanding the market.)

As we show below, financial markets usually offer several routes by which the hedger and the speculator can achieve their respective aims of reducing and increasing risk. Derivatives offer one relatively simple and cheap way of changing the risks they face.

In other words, derivative markets enable firms to alter the financial consequences for them of a particular event occurring. In this sense, many firms use derivatives as a form of insurance. The monetary gains and losses on derivative contracts themselves are relatively symmetric; for every gain there is a loss. However, the role of derivatives is to help efficiently transfer particular risks to those who are more willing or better able to face them. The attitude to risk ('risk appetite') and the risks naturally faced in the course of their businesses determine how different firms use derivatives.

Take the example of wheat farmers and millers. In the spring, neither group knows the price of wheat come harvest time, and neither likes that uncertainty. Farmers would like to know what income they will receive, so they can plan and spend accordingly. Millers would like to tie down the price of their supplies, since they, in turn, have customers and planning to do. So they agree on a price now for the farmer's wheat.³ At harvest time, the wheat price may be above or below the price they agreed, but that is irrelevant; **both** were made better off by reducing - hedging - their risk.

³ For simplicity this example concentrates solely on the wheat price. Questions of volume – how good will the harvest be? – are ignored.

3 What are the common derivatives?⁴

Forwards

A New Zealand exporter typically sells their product on world markets, and is paid in US dollars. Conversely, the exporter's costs – their wages, power bill etc – have to be paid in NZ dollars. But the NZD exchange rate fluctuates, and at times very substantially. How should they cope with the uncertainty over the future NZD value of their sales? One way would be via a **forward contract**, the simplest type of derivative.

A forward contract involves agreeing today on the price at which an asset will be bought or sold at some future date. So the exporter would agree on a forward contract to sell their USDs at a rate of, say, US 55 cents for one NZD in one year's time⁵. In this case the **underlying asset** is the USD, the **forward price** is US 55 cents and the **exercise date** is one year from when the contract is agreed.⁶

By signing a forward contract, the exporter locks in the NZD value of future USD receipts and increases their certainty about future profitability. Table 1 overleaf highlights this point. Assume the exporter has NZD 10 million of known costs in New Zealand – wages, interest payments etc – and has already contracted to sell their goods in exchange for USD 6 million. When the exporter does **not** use a forward contract, their NZD revenue and hence NZD profitability varies with the exchange rate (That is, they are 'unhedged'). Once the exporter hedges their exchange rate exposure with a forward contract at US 55 cents, profits become more certain.

⁴ In addition to the common derivatives covered in this section, there are a number of other less common derivatives, including combinations of the derivatives that will be described. These include swaptions (options on swaps), forward starting swaps, options on futures and on forwards. These derivatives are still relatively simple in essence, as their characteristics merely combine those of the more common derivatives. A relatively new type of derivative is the credit derivative. These are designed to protect lenders against the chance of borrowers defaulting on their debt obligations.

⁵ The participant buying NZD forward is said to have a 'long' forward position, while the participant selling the NZD forward is said to have a 'short' forward position.

⁶ No money changes hands at the start of the contract. First, there is no initial margin or deposit, in contrast to futures. Second, there is no premium, in contrast to options. See Appendix 1 for how to price forward contracts.

Table 1
The profit of an exporter – hedged versus unhedged

a	NZD exchange rate	0.50 USD	0.55 USD	0.60 USD
b	NZD costs	10,000,000	10,000,000	10,000,000
c	USD revenue	6,000,000	6,000,000	6,000,000
d	NZD revenue unhedged (c / a)	12,000,000	10,909,091	10,000,000
e	NZD revenue hedged (c / 0.55)	10,909,091	10,909,091	10,909,091
f	NZD profit unhedged (b - d)	2,000,000	909,091	0
g	NZD profit hedged (b - e)	909,091	909,091	909,091

The exporter could reduce the risk of exchange rate movements without using derivatives. They would do this by borrowing USD 6 million and selling the proceeds in the spot market for NZD today. When the exporter receives the USD export payments, these would be used to repay the USD borrowings, leaving the exporter with just the NZD they had already received in the spot market. Although this strategy removes the risk of the exchange rate rising, it involves borrowing USD 6 million, which may not be a simple matter for the exporter. By contrast, taking out a forward contract with a local intermediary is fairly simple, and hence this is typically the preferred alternative for exporters.

In the example in table 1, buying forward has successfully removed the risk to the exporter of the NZD exchange rate rising above US 55 cents. There is, however, a cost – or rather a benefit missed – if the NZD falls significantly. In this case, by buying forward at US 55 cents, the exporter has given away the chance of being able to get more NZDs for their USD receipts. This too is evident in table 1; when the exchange rate falls to US 50 cents the profits of the hedged exporter fall below those of the unhedged exporter.⁷

This potential missed benefit was felt rather sharply by a number of New Zealand exporters who took out forward contracts in 1997 and 1998. In November 1997 the NZD rate was around US 62.5 cents and forward contracts were available to buy the NZD in eight months time for US 61.5 cents. However, eight months later, in June 1998, the NZD

was at around US 49 cents – 20 percent lower than the contracted forward rate.

So far we have assumed that the exporter knew with certainty the USD value of the export receipts. But what if their US sales turn out to be much lower than expected? In this case, the exporter is committed to sell USD forward for NZD, but are without the USD they expected. The attempt to hedge the NZD value of their expected US exports has unintentionally become an unhedged (speculative) position in the forwards market. This type of risk would have been realised in late 1997 and early 1998 during the ‘Asian crisis’ when a number of exporters saw their sales fall significantly below those that had been expected.

These potential downsides to taking out the forward contract demonstrate that the exporter must use forward contracts in a way that is consistent with the other risks they face. The decision on how much to hedge becomes a trade-off; the exporter weighs up which types of risks they wish to take on, and which risks offset each other. As a result, exporters usually hedge only a proportion of their expected future export receipts.

The basic characteristics of a forward contract outlined above can easily be applied to other financial assets. Take interest rates for example. A company planning its cash flow today may foresee the need to borrow in six month’s time to fund an expansion in its business. But interest rates fluctuate, and a sharp rise may render their plans unprofitable. By entering into a **Forward Rate Agreement (FRA)** – simply a forward contract on short-term interest rates – a borrower

⁷ Furthermore, what table 1 does not highlight is that given the ‘more favourable’ (lower) exchange rate the exporter who is unhedged may well be able to cut their USD prices, and this would act to further worsen the profits of those exporters who had hedged at US 55 cents.

can lock in interest payments in the future, protecting itself against a rise in interest rates.^{8, 9}

Forward contracts are one example of over-the-counter (OTC) products.¹⁰ These are **customised** for end users, like an exporter or a borrower, and taken out with intermediaries, such as a bank. Since forward contracts are customised, there is not usually a secondary market for them.

Futures

FRAs are a very attractive way for firms to manage the interest cost of their future borrowing or interest returns on future deposits, since they can be customised to the specific needs of the firm, such as the exact day that funding is needed for a future project.

By contrast, consider a bank that acts as an intermediary. It may have entered into 10 different FRA contracts with its clients. If these contracts do not offset each other exactly, the bank may be left with a net obligation to lend, say, \$10 million at, say, 4.5 percent, in six month's time. The bank faces the uncertainty over the level of interest rates at the exercise date. If rates are at 5 percent the bank will lose, as they will be lending money out below the market rate at which they will have to borrow. The bank could try to find a client who will take out a FRA to deposit funds in six month's time at 4.5 percent, offsetting its net position. However, finding such a customer may be too difficult and time consuming. The bank wants a market that it can enter quickly to offset its FRA position at the lowest cost possible. The **futures market** provides this avenue.

Like forwards, futures are contracts under which two participants agree on the price at which they will trade sometime in the future. However, unlike forwards, futures are typically traded on centralised financial exchanges, which offer an

active secondary market that the bank, in this case, values. To enable a large secondary market to develop, however, the contracts must be **standardised** – rather than customised contracts like forwards – and this restricts the bank to particular dates to borrow or lend forward. For example, the NZFOE has eight 90 day bank bill futures contracts available at any one time – maturing on a set day in each of March, June, September and December for the next two years. And of these, just the first four contracts are used extensively.¹¹

However, the bank's priority is to find a futures contract that **approximately** matches the date it has agreed to lend \$10 million forward, in order to offset the bulk of any exposure as quickly and cheaply as possible. Borrowing forward in the futures market allows this to be done. Another advantage of the futures market is that if the bank no longer needs to hold the futures contract to hedge its FRA position, the liquid secondary market allows the futures contract easily to be sold.

Futures exchanges require participants to deposit money as an **initial margin** (say 1 percent of the value of the contract) to protect against counterparty default. Such margins are designed to cover potential losses on the contract. Measures to reduce credit risk, similar to these, may be arranged in OTC contracts. However, these measures are standard and centralised in futures exchanges.

Secondly, these margins are adjusted daily. Futures exchanges require participants to **mark-to-market**. That is, the outstanding contract is revalued each day. If the contract price falls, the bank is obliged to transfer money (a **variation margin**) equal to the price change to the futures exchange. By doing this each day, any loss or gain on the contract is automatically spread over the life of the contract, rather than being left as one lump sum on the exercise date. Variation margins reduce credit risk on the contract, as the worst that can happen is that the party to the contract defaults on one day's loss, rather than the loss incurred over the entire life of the contract.

Although forwards and futures contracts are explained in terms of a commitment to buy or sell an asset in the future,

⁸ In a sense, there is a parallel between a FRA and the fixed rate mortgages, which have become very popular with individual borrowers. A fixed rate mortgage could be thought of as a number of FRAs, with the exercise dates corresponding to interest rate payment dates for the mortgage, and one prearranged interest rate (the fixed rate) for all of these FRAs.

⁹ In April 1998 the average daily turnover in FRAs was NZ \$328 million, and in outright forward NZD contracts US \$226 million.

¹⁰ See below for exchange traded products, typically futures, in contrast to OTCs.

¹¹ In April 1998 the average daily turnover in New Zealand interest rate futures was NZ \$2,067 million.

this may not always be the case – they can be **deliverable** or **non-deliverable**. Suppose that on the exercise date the price of the underlying asset is above the futures price. If the contract is deliverable, the party who sold the asset forward must buy the asset at the higher spot price and sell it to their counterparty at the lower future price, making a loss. The party who bought the asset forward gets to pay the lower futures price and – assuming they do not wish to hold the asset – immediately sell in the spot market, making a profit of a corresponding size to their counterparty's loss. With a non-deliverable future, the asset is not delivered; instead whoever loses on the contract makes a cash payment to the futures exchange, who in turn pays the holder of the contract.

Deliverability varies across different futures markets. For example, contracts on New Zealand and Australian exchanges are settled in cash, while by contrast the US, Japanese, UK and major continental Europe government bond futures contracts are all deliverable in the underlying asset.¹² In fact only a very small percentage of deliverable contracts are actually held till the exercise date, as most contracts are 'closed out' before this time with an equal and offsetting contract.

One of the advantages of having a non-deliverable contract is that it enables speculators to take positions in diverse assets or commodities that have futures markets, without requiring direct dealings with the physical asset or commodity itself.¹³ The disadvantage of a non-deliverable contract is that if the physical commodity is required on the exercise date, it is not actually delivered. This could be a problem for the forward buyer of the commodity if the physical market for the underlying commodity is not liquid. In this case, the price used for the purpose of the cash settlement may not be representative of the price at which the commodity can be secured in the market. With a deliverable contract this risk is carried by the party selling forward, as they may be required to enter the illiquid market to secure the asset for delivery.

¹² Some deliverable futures contracts allow a choice among a number of underlying assets that can be delivered to fulfil the contract. When this is so – as with many overseas bond markets – the party committed to deliver the asset will work out which of their alternatives is cheapest to deliver (CTD).

¹³ There is also the advantage of 'leverage', which will be discussed later in the article.

Swaps

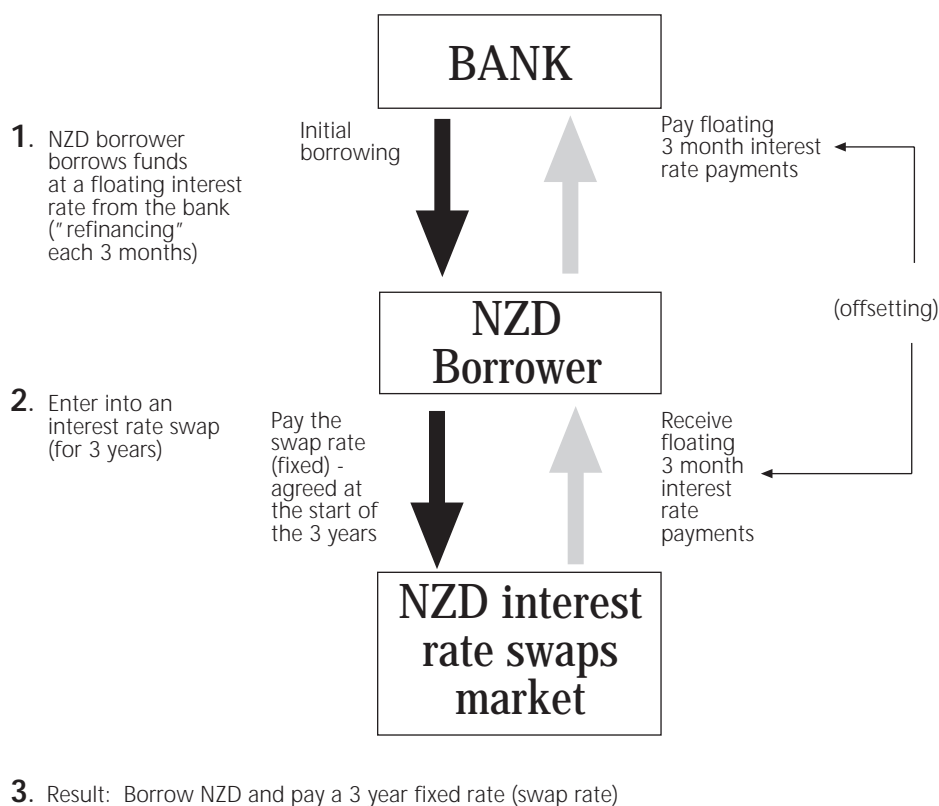
Interest rate swaps: Take the example of a bank offering longer-term fixed rate mortgages. The mortgages are an asset for the bank, yielding a known income – say 7 percent per annum of the amount lent. The bank gets the money to lend to the mortgage holders from its depositors, most of whom do not want to lock up their money for longer than, say, 90 days. The depositors are paid a 'floating' interest rate, which rises and falls over time with short-term market rates. If market interest rates rise, say from 5 percent to 8 percent, depositors expect a higher interest rate from their bank, and will withdraw their money if they don't get it. The bank has a problem. Either it leaves its interest rate at 5 percent and watches the depositors withdraw their money, or it increases its deposit rate to 8 percent, and loses money, since it is continuing to lend at the fixed rate of 7 percent.

In fact banks aim to insulate themselves against a rise in short-term market (and hence deposit) interest rates. An **interest rate swap** is a derivative designed to do this. It is an agreement to swap, over a period in the future, a series of fixed interest rate payments for a series of variable interest rate payments (or vice versa). By entering into the (fixed for floating) swap, the bank agrees to make the fixed interest payments – at, say, 6 percent per annum – over the life of the swap. In return it agrees to receive floating interest rate payments. The bank is now receiving 7 percent from the mortgage holder, and paying 6 percent in the swaps market. The floating rate payments received by the bank through the swaps market, and the interest paid to its depositors, rise and fall together – the bank has successfully insulated itself against movements in short-term market rates.

The interest rate on the fixed rate side of the swaps contract is called the **swap rate**. The variable rate is usually something like the 90 day bank bill rate. In practice, interest rate swaps are described in terms of the **swap spread**, where the swap spread is the difference between the swap rate and a government bond rate of a similar maturity.

The floating interest rate is reset at the start of each interest payment period. The difference between the fixed and floating rate is settled in cash. So, for example, if the 90 day rate is lower than the swap rate this quarter, the party paying the fixed rate – the bank in the example above – will simply pay

Figure 1
Transferring floating rate borrowing
into fixed rate borrowing



the difference to their counterparty. Also note that the maximum credit exposure is the **net** of the fixed/floating payments, because typically no principal changes hands (remember the actual cash for the mortgage lending was raised from the depositors) so there is no credit risk on the **notional principal** amount of the swap.

The interest rate swaps market in New Zealand has developed to become extensively used by banks, firms and the government.^{14 15}

Consistent with the example above, in 1998 banks used the interest rate swaps market actively to swap their predominantly floating rate liabilities (deposits) into fixed rate liabilities

to match the increasing proportion of fixed rate mortgages within their assets.¹⁶

The essence of the interest rate swaps market is that it allows firms (and banks as above) to secure a long-term fixed rate without having to issue a long-term bond. A company can do this by issuing short-term commercial paper with a maturity of 90 days, thus raising funds, and refinancing that borrowing by reissuing each 90 days. At the same time it can swap these floating interest payments for fixed payments in the swaps market. As a result, the floating payments received in the swaps contract cancel out the floating payments paid on the commercial paper; and the company is left with an obligation to pay the fixed rate. A firm would undertake such a strategy if they had a preference to have fixed rate funds, but were unable to raise fixed rate funding

¹⁴ In April 1998, average daily turnover in the NZ interest rate swaps market was NZ \$110 million, up from NZ \$40 million in April 1995.

¹⁵ The New Zealand Treasury's Debt Management Office announced on 20 May 1999 that it was planning to participate in the New Zealand interest rate swaps market in the 1999/2000 fiscal year in order to achieve cost savings on its borrowings.

¹⁶ See Eckhold (1998) for the linkages between the Eurokiwi market, fixed rate mortgages and the swaps market.

directly or as cheaply by issuing bonds in the physical market.¹⁷

The seminal interest rate swap was executed by the Student Loan Marketing Association (Sallie Mae) in 1982. As a United States quasi-governmental agency with a high credit rating, Sallie Mae could borrow relatively cheaply in the fixed rate market, but its assets – student loans – were all floating rate. To benefit from the advantage it had in borrowing at a fixed rate, while matching the maturity of its assets and liabilities, it swapped its fixed rate interest rate payments for floating rate payments.

The flip side of borrowing at a fixed rate through the swaps market is investing at a fixed rate through the swaps market. The swap rate is, from an investor's point of view, **diversified** bank risk – the spread between the swap rate and the interest rate on government debt moves up and down with the perception of the aggregate credit standing of the banking sector. The interest rate swaps market thus provides an avenue to earn a return on a diversified bank risk exposure at much lower transaction costs than if the investor actually purchased a diversified portfolio of bonds issued by banks. At the same time the interest rate swap does not have the credit exposure that the portfolio of bonds would. As such, investing through the swaps market allows an investor – say a life insurance company – to lock in a long-term fixed rate, while substantially reducing credit risk on the bank with whom it does the swap.¹⁸

¹⁷ If a firm is considered relatively risky by the market, investors may be unwilling to lend to it on a long-term basis, as they open themselves up to default risk over the life of the borrowings. Instead they may only be willing to lend to the firm on a short-term basis, as this allows them to reassess each time the short-term debt matures whether they wish to re-invest. (Note that bank deposits are generally short term not because of credit risk, but the need by depositors to have funds available for transactions). Counterparties will enter into the swap to transfer the floating rate payments into fixed rate payments as their only credit exposure is to the net of the fixed/floating payment, not any principal. If the firm's credit standing did fall, a 'risk premium' would be added to the short-term interest rate they paid from then on in the short-term debt market. This margin would then essentially become an extra cost to the firm over and above the fixed rate payments in the swap contract.

¹⁸ Suppose that after the signing of the swap contract, market swap rate rates fall below those being received by the insurance company from the bank. In these circumstances, if the bank defaults on the contract the insurance company will have to re-enter the swaps market and agree on a new contract at a lower swap rate. It is thus exposed to this market risk. Note, though, there is no risk on the notional principal.

Foreign exchange swaps: Suppose a New Zealand investor is looking to invest an amount of money for three months. To get a New Zealand interest rate they have two options: either deposit their NZDs in a domestic bank, or sell their NZ dollars for US dollars, invest in a USD deposit, and enter into a forward contract, agreeing to sell the initial amount of USDs (plus the USD interest) back for NZDs in 3 month's time, at a pre-arranged exchange rate. The second strategy provides the investor with an assured NZD return, even though the interest payments they receive are in USD. Selling a currency today, while simultaneously agreeing on an exchange rate to buy the currency back in the future, is called a foreign exchange swap, or FX swap for short. It is equivalent to a spot FX transaction and an offsetting forward FX transaction.

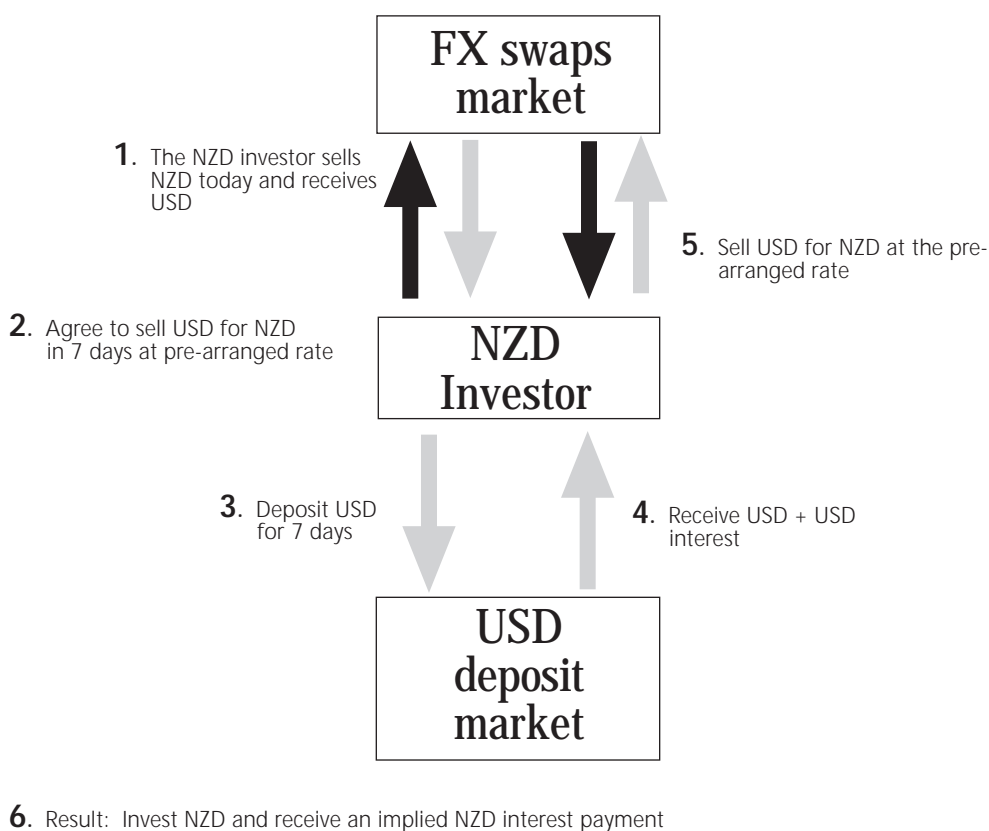
In an efficient market the return to investing in either the domestic market, or in the foreign market combined with an FX swap, should be the same. Otherwise there would be an opportunity to profit from borrowing money through the cheaper market and investing in the other¹⁹. But note how the FX swap market allows investors to tap the liquidity available in the very large USD deposit market, while still securing a known implied NZD interest. Many FX swaps are for terms of less than a week. However, by continually repeating the swap each time the USD deposit matures, the obligation to buy or sell the currency can easily be 'rolled forward.'²⁰

The main users of the FX swaps market are intermediaries, usually banks, who use swaps to manage their position in the forward foreign exchange market. Frequently exporters enter into forward contracts with banks – as we explained above. Suppose the exporter agrees to sell the USD for NZDs to the bank in one year's time, to cover their future USD

¹⁹ However, there may be factors, such as credit limits, preventing any difference being exploited. When this occurs – typically on interest rates for very short terms (1-14 days) – there is some uncertainty over which is the 'true' NZD interest rate. Given the deep and liquid nature of both the FX swaps market and the USD deposit market, the implied interest rate through the swaps market may sometimes give the better indication.

²⁰ In fact, due to the way the market allows participants to pay or receive an implied NZD interest rate and the fact these transactions can be rolled forward through time, a large market in New Zealand has developed in FX swaps. In New Zealand in April 1998 average daily spot FX turnover was US \$1,307 million, and turnover in outright forward NZD contracts was US \$226 million. By contrast, turnover in the FX swaps market was US \$3,691 million.

Figure 2
Investing through the FX swaps market



export receipts. This leaves the bank with a commitment to buy the USD forward. To hedge its position the bank needs to sell the USD forward. One way to achieve this would be to find an importer who wants to buy USD forward (for delivery on the same date the exporter has contracted to sell the USDs). But such exact matching is unlikely. However, the bank has another alternative to hedge its position, which involves two steps. First, it enters into an FX swap contract agreeing to buy the USD today and to sell the USD in 1 year's time. This step essentially swaps the previous commitment to buy the USD forward into a purchase of the USD today. The bank can then sell those USDs in the spot market, leaving them with no open foreign exchange position, either today or in one year's time. Intermediaries managing forward positions account for a major part of the turnover in the FX swaps market.

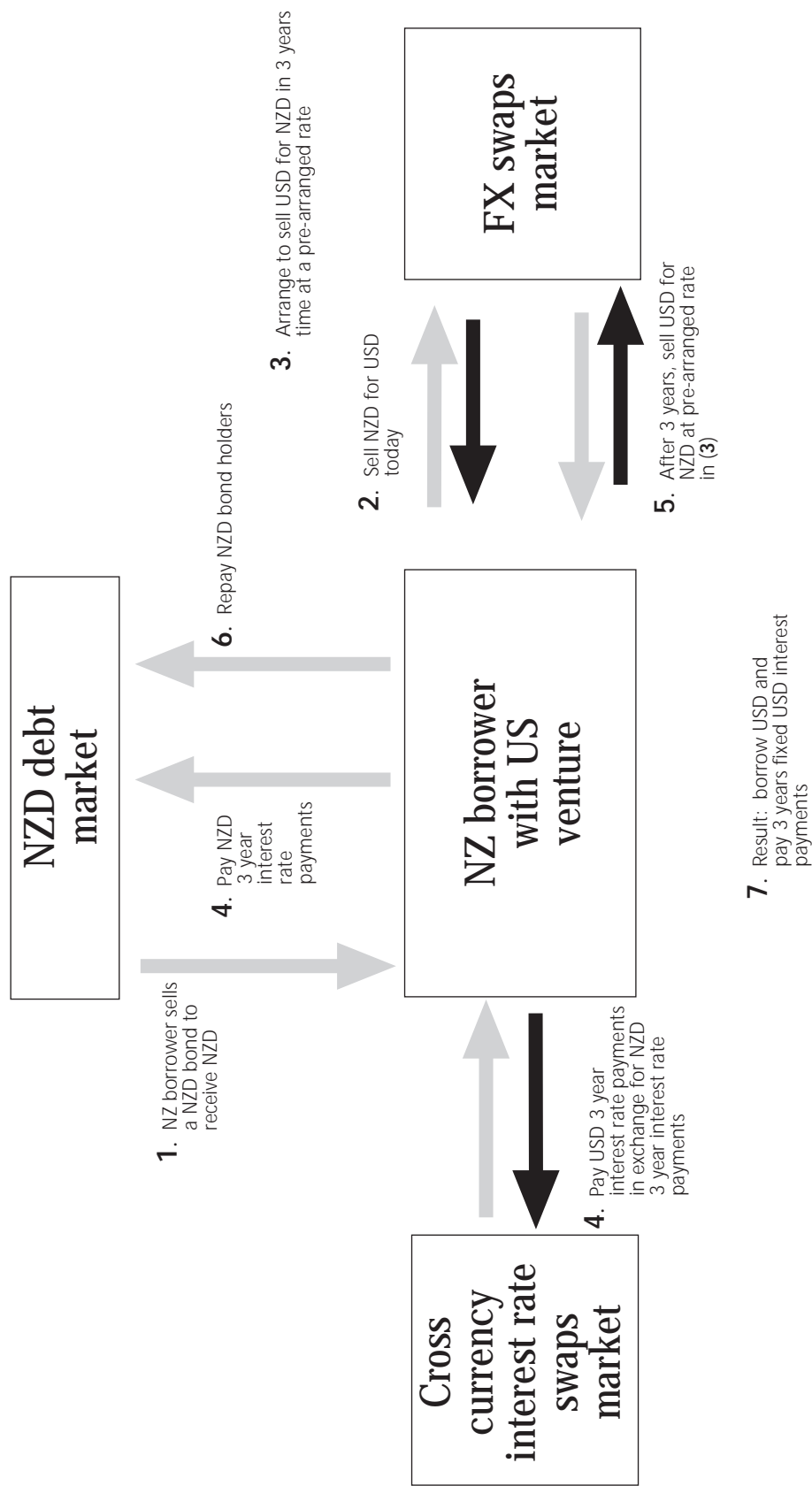
The Reserve Bank has a direct interest in the FX swaps market as part of its liquidity management operations. For example, if the financial system is short of NZD liquidity (be-

cause of tax payments to the government, for example) the Bank may wish to inject liquidity by investing in the FX swaps market. The initial leg of the FX swaps contract, of selling NZD for USD today, injects New Zealand dollars into the system, while the forward leg, which involves buying the NZD back, withdraws cash at that later date.²¹

A **cross currency swap** combines an interest rate swap and a FX swap. Suppose a company based in New Zealand has a venture in the United States that requires USDs to fund it. The company may be unknown in the United States, and hence have difficulty borrowing there, but well known in New Zealand, where it can easily raise the required funds. It may then decide to borrow NZDs and enter into a so-called cross currency swap. The first step would be to transfer the NZDs into USDs, while simultaneously agreeing, as part of a

²¹ The Reserve Bank's decision whether to use FX swaps or other means of liquidity management, such as entering into a reverse repurchase agreement, is a commercial one and is subject to risk management criteria.

Figure 3
A cross-currency swap



FX swap contract, to reverse the transaction (selling USD for NZD) at an agreed date in the future. This date would be chosen to coincide with the maturity of the initial NZD borrowings. This eliminates any foreign exchange risk associated with taking the principal amount of the NZD loan into the US. But what of the interest payments – the company is paying NZD interest, and receiving USD income? The company also enters into a contract to swap the future stream of NZD interest payments for a stream of USD interest payments.

By taking out an FX swap on the principal and by swapping its interest payment obligations into USDs, the company has achieved two things:

- acquired the USDs needed to fund its United States venture more cheaply than borrowing directly in the US; and
- covered itself against the risk of the NZD appreciating over the life of the loan. Without this cover, the NZD interest rate payments and final NZD principal repayment might be too expensive to pay with the USD operating profits from the US venture, should the NZD appreciate substantially.

These types of transaction are driven by the ability of the company to borrow relatively cheaply in a different currency from the one it needs for its operations. The seminal cross currency swap was between the World Bank and IBM in 1981.

Options

When we discussed forwards, we noted that New Zealand exporters are natural customers for derivatives. They expect to be paid US dollars in the future, but want more certainty about the NZ dollar value of those receipts, since their costs are mainly incurred in NZDs, and their profits are measured in NZD terms. One way to do this is to enter into a forward contract, as explained above. However, there is another alternative: the purchase of an option contract.

Options are similar to forwards in that they relate to buying or selling the underlying asset in the future. However, the difference is that the holder of an option is not obliged to buy or sell. That is, they have the 'option'. In this sense, the exporter gains peace of mind, while avoiding some of the

potential drawbacks of a forward contract. For example, if the US dollar receipts do not arrive, under an option contract the exporter is not obliged to sell the USD. And, if the export receipts arrive and the market exchange rate at the time is more favourable than the rate arranged in the options contract, they simply do not exercise the option and instead sell the US dollars directly in the physical market. Given the one-sided nature of the insurance provided, there is a price that has to be paid for the option – the option 'premium'.

Options are, in the main, designed specifically for the needs of the end user, and are therefore usually OTC products. Despite the options market being a growing industry internationally, volumes are not particularly large in New Zealand.²²

There are two basic types of options. A **put** option gives the holder of the option the right, but not the obligation, to **sell** the underlying asset at a pre-arranged price.²³ So, for example, an exporter who expects to sell USDs for NZDs in the future may take out a put option on the USD with an **exercise price**²⁴ of US 55 cents for one NZD and an exercise date in one year's time. The exporter will only exercise the option if, at the exercise date, the exchange rate in the market is above US 55 cents, say US 60 cents. By exercising the option the exporter is able to acquire one NZD for every US 55 cents of export receipts, when in the spot market they would only get one NZD for every US 60 cents. If the exchange rate is US 50 cents at the maturity date, the option would not be exercised, as the exporter can get more NZDs for their export receipts by entering the spot market.

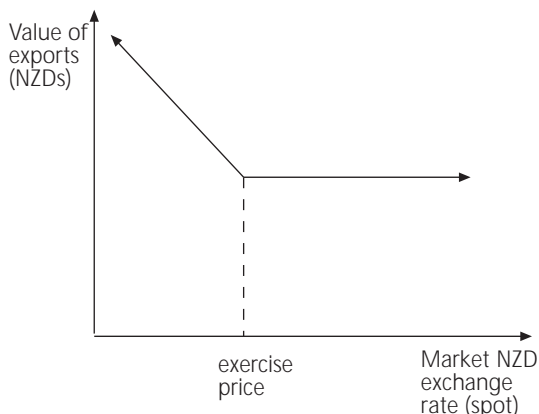
We noted previously the New Zealand exporters at the end of 1997 who would have taken out forward contracts to sell USDs in eight month's time for a rate of one NZD for every US 61.5 cents. If they had not taken out those contracts, once the eight months had passed, they could have received

²² In April 1998, average daily turnover in interest rate options was NZD 54 million, while average turnover in exchange traded options was NZD 1 million.

²³ An American option allows the option to be exercised any time from its purchase until the exercise date, whereas a European option only allows the option to be exercised on the exercise date. Options on the NZFOE are European.

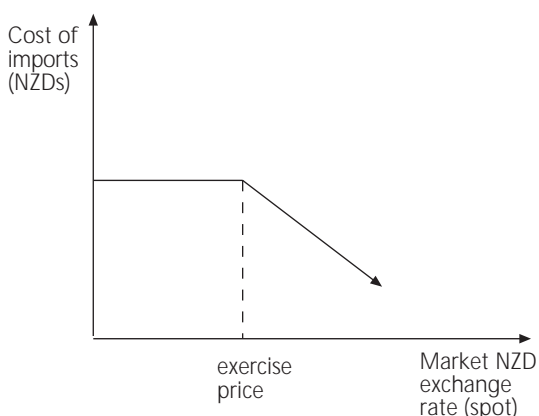
²⁴ Often also referred to as the 'strike price'.

Figure 4
The NZD value of exports for a holder of a put option on the USD (fixed quantity)



one NZD for each US 49 cents they sold in the spot market. If instead of entering into the forward contract, they had purchased a put option on the USD with an exercise price of US 61.5 cents, they would have been insured against the exchange rate rising, but would not have foregone the higher NZD receipts that the large fall in the exchange rate made possible.²⁵

Figure 5
The NZD cost of imports for a holder of a call option on the USD (fixed quantity)



²⁵ To gain an appreciation of magnitudes, in this specific example, if the exporter wanted to sell USD 10 million the option would have cost approximately USD 240,000. Having to sell USD 10 million at a rate of 61.50 US cents as opposed to 49 US cents in the market would incur a cost (foregone profit) for the exporter of over NZD 4 million.

A **call** option gives the holder of the option the right, but not the obligation, to **buy** the underlying asset at a pre-arranged price. So, for example, an importer who needs to buy USDs in the future to pay for imports may take out a call option with an exercise price of US 55 cents for one NZD and an exercise date in one year's time. At the exercise date the importer will only exercise the option if the spot exchange rate is below US 55 cents, say US 50 cents. By exercising the option, the importer is able to get US 55 cents for each NZD, when in the spot market they would only get US 50 cents. If the exchange rate is US 60 cents at the exercise date, the option is not exercised, as the USD needed can be acquired for fewer NZD by entering the spot market.

In the discussion so far the **writer** of the option – the person who sells the option – has been largely overlooked. The writer of the option provides insurance to the holder by taking on the risk against which the buyer wants to protect themselves, and hence the writer requires compensation in the form of an insurance 'premium'.

How big should the premium be? The seminal, and still widely used, option pricing technique is the Black-Scholes option pricing model.²⁶ In general terms, the price of an option can be expressed as a function of a few key factors: the price of the underlying asset, the exercise price, the anticipated volatility in the underlying asset price, the riskless interest rate, and the time until the exercise date. The first three of these factors are covered below.²⁷

- With a call option, the higher the price of the underlying asset, the higher the chance that the prospective buyer of the asset will exercise the option, and the greater the value of the option to the holder. Conversely, the higher the price of the underlying asset the lower the chance that the prospective seller of the asset will exercise the put option, and hence the lower the value of the option.

²⁶ Black and Scholes (1973).

²⁷ The other two factors are the riskless interest rate and the time to the exercise date. An increase in the riskless interest rate increases the price of call options and reduces the cost of put options. A longer time until the exercise date increases the price of a call option and has an ambiguous effect on the price of a put option. For an easily accessible reference on option pricing see Hull (1998). For a more detailed reference see Hull (1997).

Box 1

Caps, floors and collars

By entering into a Forward Rate Agreement (FRA) a firm can lock in their future interest rate. Similarly, by using options firms are able to gain more certainty over the interest rates they face in the future. A few of the common strategies for interest rate options are set out below. As has been shown with options on the exchange rate, the option provides protection, but avoids the obligation inherent in a forward contract.

Caps: A firm planning to borrow in the future may purchase an option giving it the right, but not the obligation, to sell short-term commercial paper in the future at a pre-arranged interest rate – the **cap rate**. Acquiring the put option puts an upper bound on their borrowing costs, because the option will be exercised if market interest rates rise above the cap rate. Conversely, if market interest rates are below the cap rate at exercise date, the option will not be exercised, and instead the required funds will be borrowed directly at the prevailing market rate. In a similar way, a number of banks in New Zealand have offered capped rate mortgages to individual borrowers. That is, borrowers can acquire a mortgage where the payments are floating, but are guaranteed not to rise above a certain cap rate. This is equivalent to the bank selling the individual a put option.

Floors: A firm planning to invest in the future may buy an option giving it the right, but not the obligation, to buy short-term commercial paper in the future at a pre-

Figure 6
Interest rate for the holder of a cap
(borrowing)

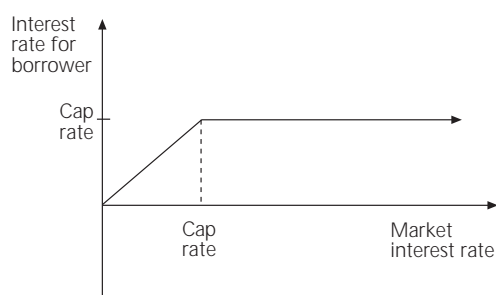
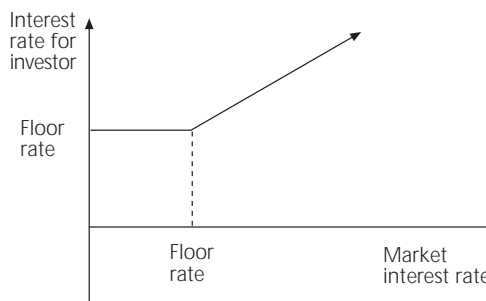


Figure 7
Interest rate for the holder of a floor
(investing)



arranged interest rate – the **floor rate**. Acquiring the call option has put a lower bound on future investment income; if market interest rates fall below the floor rate the option will be exercised. Conversely, if market interest rates are above the floor rate on the exercise date, the option will not be exercised and instead the holder of the option will invest the funds at the higher market rate.

Collars: By putting together these two types of strategies (into a 'collar') borrowers and investors are able to restrict the future interest rate they face to a **range**. For example, by buying a floor and selling a cap an investor can essentially limit the future interest rate that they will receive to a range, with the cap rate at the top and the floor rate at the bottom.

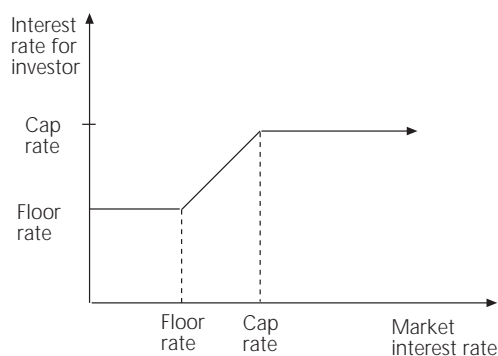
As before, if market interest rates fall below the floor rate, the investor will exercise the call option, as it means they are able to invest at a rate higher than in the market. While, if at the exercise date market interest rates are above the cap rate, the investor will be forced to invest at the cap rate. This occurs as the borrower, who purchased the 'cap' from the investor, will have the incentive to exercise that option, since it allows them to borrow at an interest rate below the market.²⁸ The

²⁸ The cap and floor rates in the collar can be set such that the prices of the two options offset each other, and hence no money changes hands between the two parties on the initiation of the contract. Such a contract is described as a 'zero cost collar'.

investor has essentially financed the insurance of putting a floor on their future investment rate by selling the opportunity of investing above the cap rate in the future.

Given that caps, floors, and collars provide protection against adverse movements in market interest rates, their use is related to volatility in short-term interest rates. The reduction in interest rate volatility in New Zealand following the introduction of the Official Cash Rate regime in early 1999 is likely to reduce the number of caps and floors that are purchased, compared with 1997 and 1998.

Figure 8
Interest rate for the holder of a collar (investing)



- A call option with a higher exercise price provides less insurance for a prospective buyer of the asset against rises in the underlying asset price – it is less likely the option will be exercised – and hence it is less valuable. Conversely, a put option with a higher exercise price provides more insurance for a prospective seller of the asset against falls in the underlying asset price, and hence is more valuable.
- The more volatile the underlying asset price, the higher the probability that the asset price will reach the exercise price and the option will be exercised. Another way to think of this is that more volatility means that the environment is more uncertain, and hence the option – designed to protect against uncertainty – is more valuable to own.

The effects of these factors on the price of an option, all other things equal, are summarised in the table 2 below.

All of the factors that determine the option price are known with certainty when the contract is entered into, except the volatility of the underlying asset price. As a result, option prices are usually quoted in terms of the **implied volatility** of the underlying asset. Once the writer and the purchaser of the option agree on the implied volatility – the (implicit) degree of risk that is being protected against – the settlement price is calculated mechanically using the Black-Scholes model (the market-agreed option pricing model).

Table 2:
The impact of a change in different factors on the option premium

The effect of an increase in	call option premium	put option premium
The price of the underlying asset	↑	↓
The exercise price	↓	↑
The anticipated volatility of the underlying assets price	↑	↑

Box 2

The Greek letters

As evident from table 2, the value of an option is dependent on a number of factors. Take an intermediary, who has written an option for a client but does not want to leave themselves open to the adverse effects that changes in these factors may have on the value of the option. They have two alternatives. First, they can simply buy an option with all the same characteristics, essentially cancelling out their position. However, this may not be possible. Secondly, they can hold some other asset, or portfolio of assets, whose value will move to offset movements in the value of the option – that is, act as a hedge. In this context, the so-called ‘Greek letters’,²⁹ explained below, are an integral part of managing interest rate and exchange rate option positions.

Delta: Delta measures how the price of the option changes for a given movement in the price of the underlying asset. So, for example, a delta of positive 0.5 means that if the underlying asset price moves, the price of the option will move in the same direction but by half as much.

²⁹ Derived from the mathematical representation of these terms in the pricing equations

Take an intermediary who has written a put option on the USD giving an exporter the right, but not the obligation, to sell USD 10 million to the intermediary in one year’s time at a rate of US 55 cents for one NZD. Assume the option has a delta of 0.5. To hedge the option position with respect to small changes in the spot exchange rate, the intermediary needs to sell USD 5 million. This way, if the NZD rises (the value of the USD falls), the intermediary loses money on the value of the option contract but gains an equal and offsetting amount on the spot USD holding. Note that delta may change through the life of the option, as the spot price moves closer to or further away from the exercise price causing the probability of the option being exercised to change. To remain correctly hedged the intermediary will need to adjust the size of their position in the spot foreign exchange market – the so-called ‘delta hedging’.

Gamma: Delta is only constant for small changes in the underlying asset price. Gamma measures how rapidly the delta of an option changes for a given change in the price of the underlying asset. Delta becomes a more realistic measure of risk arising from movements in the underlying asset price when gamma is small.

Vega: Vega measures the sensitivity of the option price to small changes in the implied volatility of the underlying asset price.

4 Characteristics of derivative markets

The section above describes the main types of derivatives. This section reviews the common features that attract firms to these different products. Successful derivative markets enjoy some combination of the following characteristics:

- a high level of liquidity;
- low transactions cost;
- the ability to achieve leverage;
- the possibility to arbitrage; and
- transparency.

In the best derivative markets, these favourable characteris-

tics attract more business, which in turn improves liquidity, reduces transactions costs and so on.

Liquidity

Liquidity in a financial market is the ability to buy or sell without moving the price too far – transactions can be done easily at the quoted market price. For example, the New Zealand foreign exchange market is sufficiently liquid that trading NZD 50 million for USD scarcely moves the exchange rate. The benefit of a liquid market is that a user of the market can quickly enter or exit at the lowest possible cost.

As activity has increased, the liquidity of some derivative markets has overtaken that of the physical markets themselves. This is especially evident in exchange-traded futures

markets where contracts are standardised and the rules are clear. For example, the New Zealand bank bill futures market is more liquid than the physical bank bill market. Similarly, the Australian bond futures market is more active than the physical Australian government bond market. Even though interest rate swaps are not exchange-traded, in the New Zealand market turnover is greater than in the corporate bond market.

However, derivatives markets are not always more liquid than the physical market – both the currency and bond futures markets in New Zealand are very illiquid. This is ‘chicken and egg’: investors prefer to trade in a liquid market, but a market can only become liquid if investors use it.³⁰ In New Zealand, the bank bill futures market has achieved sufficient liquidity, while the government bond futures and currency futures markets have not.

Transaction costs

A **bid-offer spread** is the difference between the price at which a buyer can be found (the bid) and the price at which a seller can be found (the offer). The bid-offer spread can be thought of as a type of **transaction cost**; with no change in the asset price, to buy and sell an investor must ‘cross the spread,’ directly incurring the cost of the spread.

With greater liquidity in some futures markets, transaction costs have fallen below those in the physical market. For example, the bid-offer spread in the most liquid bank bill futures contract in New Zealand is usually around 1 basis point (one hundredth of one percent), while the bid-offer spread in the physical bank bill market is usually around 3 to 5 basis points.

³⁰ At a more fundamental level, the success of a derivative market depends on whether it can fulfil its role better than available alternatives. In New Zealand, the prior development of the interest rate swaps market and the bond repurchase agreement market may have meant that these off-exchange markets were already fulfilling the role that the bond futures contract was offering to provide (hedging and speculating). Similarly, liquidity was (and is) so large in the spot FX market, that participants could not be induced to trade in the less liquid currency futures market. Illiquidity in currency futures is not confined to New Zealand.

Leverage

Higher **leverage** enables a greater gain (or loss) to be made for a given amount of initial capital employed – higher risk for higher returns. In this sense, derivatives can be used as an efficient avenue to obtain leverage in financial markets.³¹ For example, if a speculator thinks the NZD will rise, they can buy the NZD forward or purchase a call option on the NZD. Both of these use less capital than buying the NZD outright, since less money is required on the initiation of the contract. In the case of the forward contract no money changes hands, while with the option only the premium is paid. The leverage that can be acquired in derivatives markets is also a highly attractive feature to those looking to hedge, as it allows a smaller amount of money to be put up front in order to gain protection against changes in the asset price.

Arbitrage

An **arbitrage** opportunity offers riskless profit.³² The most basic example would be to buy one NZD for US 53 cents, while at the same time selling the NZD for US 55 cents, making US 2 cents risk free. Such a transaction presumes a degree of market inefficiency – buyers and sellers willing to transact away from the ‘true’ price (probably around US 54 cents in this case).

Derivative markets create links between different underlying asset markets, and hence provide an avenue by which arbitrage opportunities can be exploited if prices in different markets move out of line from each other. For example, the return from investing in a 180 day bank bill should be the same as an investment in a 90 day bank bill combined with a forward contract to invest in a 90 day bank bill in 3 months time. If the return was not the same, the arbitrageur could borrow through the one with the lower return and invest in

³¹ Note that derivatives markets do not strictly speaking provide more leverage than can be attained using some combination of available spot markets; however, derivatives markets make attaining leverage considerably cheaper and easier.

³² More formally, an arbitrage opportunity exists where two or more transactions can be undertaken to yield a riskless profit. This is a strict definition of arbitrage. Some US definitions state that an arbitrage opportunity involves being able to make two or more transactions in financial markets that together provide an ‘expected’ profit.

the one with the higher return, making a riskless profit in the process. Since many market participants are monitoring possible arbitrage opportunities, they rarely last for long, as traders' actions bring prices back into line.

Transparency

Investors value having access to accurate market prices. But what is the 'true' market price? In many physical markets 'prices' are actually quotes, indicating only the general level at which transactions are expected to take place. By contrast, futures markets typically have a high degree of 'post-trade transparency': the price and quantity of trades executed can be seen immediately. In addition, firm prices can usually be seen by those using the market. This tends to increase the willingness of investors to use exchange-traded derivatives.³³

5 The risk in using derivatives

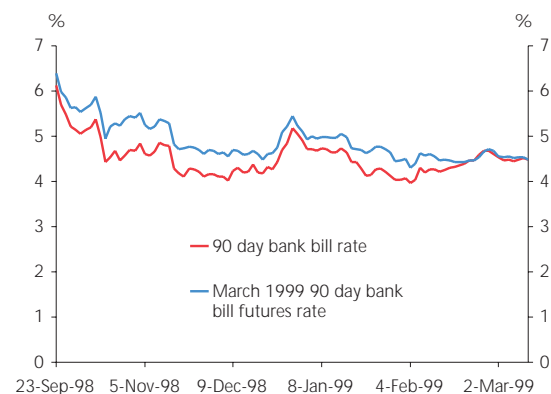
Used properly, derivatives offer the opportunity to move risk to those most willing and able to bear it. How does this square with highly publicised losses associated with the use of derivatives in the past?³⁴

Some of the risks involved in trading derivatives are common to many financial assets: credit risk, liquidity risk,³⁵ operational risks and legal risks. However, failing to under-

stand the derivatives contract properly is perhaps more likely, and potentially more costly, than for other financial products (more likely, since derivative market activity is relatively new, more costly on account of the potential for higher leverage and the risks associated with that). A good understanding is therefore important, not only for the direct users, but also for those in charge of risk management and auditing.

As has been shown so far, futures markets can have a number of advantages over physical markets, such as lower transaction costs, higher liquidity and greater transparency. Because the prices of liquid futures contracts are highly correlated with the price in the physical market (see graph below),³⁶ futures markets can become attractive for the rapid and cheap execution of trades, as a substitute for the physical market itself. For example, if a speculator thinks the price of a 90 day bill will rise, it may be quicker and easier to buy the futures contract than an actual bank bill. Similarly, if an investor held a bank bill and wanted to hedge the position quickly, in the short term it may be easiest to sell a bank bill futures contract. The success of both strategies depends on the correlation between the price of the futures contract and the physical bank bill.

Figure 9:
The 90 day rate against the 90 day bank bill futures rate



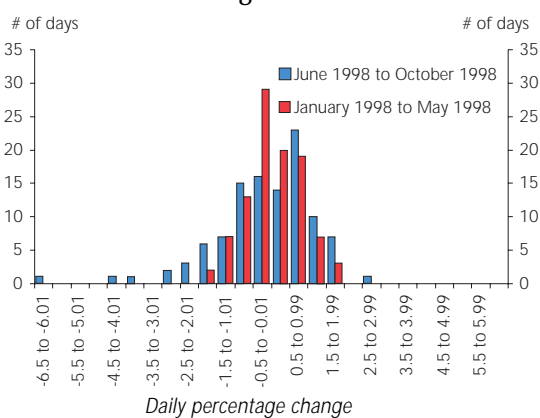
³³ The optimum degree of pre-and post-trade transparency in a given market is not easily determined. There is a tension between the willingness of price makers to commit risk capital to highly transparent markets – post-trade publication may reduce their ability to manage a position which results from quoting two way prices; and the willingness of investors to deal in markets where they are unaware of the price at which trades are going through the market. Highly liquid markets can typically cope with a higher degree of transparency, which in turn may contribute to higher liquidity. The potential for “private” information on the value of the asset increases investors’ desire for transparency. For example, there is probably a higher potential for an investor to have “private” information on an equity compared with a currency, where all important information is likely to be public.

³⁴ Proctor and Gamble (US \$137 million), Metallgesellschaft (US \$1 billion), Barings PLC (US \$1.3 billion), and Orange County, California (US \$1.7 billion), are the most frequently quoted cases.

³⁵ Liquidity in the derivatives market may disappear more quickly than liquidity in the physical market in a period of financial market turmoil.

³⁶ This correlation is best for futures contracts with a short time until their exercise date; these are usually the most liquid. For example, the 90 day bank bill futures contract with an exercise date in September 1999 should have a higher correlation with the actual 90 day bank bill rate now (June 1999) than a 90 day bank bill futures contract with an exercise date in September 2009, as more uncertainty surrounds interest rates in 2009.

Figure 10:
The distribution of daily percentage changes in the USD/JPY exchange rate



However, correlations are never precise and there is a risk that the correlation between price movements in the futures market and in the physical market breaks down. As a result, the trade made in the futures market may not fulfil its purpose – whether it is hedging or speculation. In technical terms, this is described as the **basis risk**. It is the risk that the basis (the difference between the spot price and the futures price) moves unexpectedly.³⁷

Past relationships can also break down in the option market. There are a number of assumptions made when pricing options, including expectations of the future volatility of the underlying asset price. These expectations are influenced by historical data on price volatility. When these past relationships break down, so does the accuracy of the option pricing. For example during the financial market turmoil in 1998 the pattern of daily movements in the USD/JPY was noticeably more variable, as shown below. An option priced using the distribution of movements in the first part of the year would look very cheap as volatility picked up later in the year. This would impose considerable costs on the writer of the options, as many more options would have been exercised than had been expected.

Finally, suppose a speculator is willing to carry a certain amount of total risk, made up of credit risk, liquidity risk, and the risk of the price of the underlying asset moving in the ‘wrong’ direction from that they are betting on (price risk). Futures and other derivative markets help reduce credit

and liquidity risks, for a given size of ‘bet’ on the underlying asset. The speculator can therefore increase the bet without increasing the total risks they face. Their exposure to price movements increases with the size of the bet; likewise the consequences of any credit or liquidity problems are that much greater (though the probability of these occurring is lower). Therein lies the irony: by making position-taking ‘safer’, derivatives may encourage investors to take greater price risk – in a similar way that safer cars lead to faster driving.

6 What can we learn from derivatives?

Derivatives markets can provide market participants, policy makers and regulators with valuable information. Much of the information could be gathered in other ways, for example by asking market participants. However, derivatives markets provide information on a real-time basis, implicitly aggregate views from the whole market rather than sampling a selected group, and (like other financial prices) reflect what those in the market do, not what they say.

Expectations

Forward and futures prices can provide a measure of expectations of where the market believes asset prices will be in the future.

For example, interest rate futures give information on expected future interest rates. If, in aggregate, the market thought the New Zealand 90 day rate would be at 4.50 percent in one year’s time, but the futures rate was at 4.75 percent, there would be a strong incentive to invest at the futures rate until it fell to 4.50 percent.³⁸ The Reserve Bank is interested in market expectations of future interest rates in order to gauge the extent of ‘surprise’ in any monetary policy announcement, and hence to anticipate any likely financial market reaction.

Forward rates typically embody the market’s best guess of where interest rates will be in the future. However, forward rates are not necessarily a good guide to where the market

³⁷ Some degree of basis risk will always be present when trading futures as a hedging instrument, as the only exact hedge is an equal and opposite position in the same asset.

³⁸ Factors, such as risk premia, may cause a divergence between futures rates and ‘pure’ expectations of future official interest rates, and hence the futures rate approximates expectations, subject to a ‘wedge’ to allow for these factors.

interest rate will actually be at the time the contract expires. This is consistent with derivatives existing largely because financial prices are difficult to forecast. Unexpected events, including alterations to the stance of monetary policy, may move interest rates before the forward contract expires.³⁹

Although forward rates are not great predictors of future interest rates, research has shown that for New Zealand, forwards do tend to get the direction of changes in interest rates right.⁴⁰ By contrast, the forward exchange rate has not been a good predictor of future changes in the New Zealand exchange rate.⁴¹

Implied volatilities

In a similar way, the **implied volatilities** used to price options indicate how volatile the market expects the underlying asset price to be in the future. This expectation can usefully be compared with measures of volatility calculated using past movements in the asset price. During the financial market turmoil in 1998, implied volatilities on options rose immediately as the market expected the increased volatility to continue into the near future. The rise in implied volatility also highlighted a reduced 'risk appetite' – participants required higher option premium income to induce them to write options for those looking to reduce risk. Conversely, in early 1999 when the Reserve Bank announced the introduction of an official cash rate (OCR) regime, implied volatilities on New Zealand short-term interest rates fell immediately, as market participants expected that the new regime would reduce short-term interest rate volatility.⁴²

³⁹ In a sense, taking out the forward contract allows participants to hedge against these unexpected shocks.

⁴⁰ See Ha and Reddell (1998).

⁴¹ *Ibid.*

⁴² As well as giving an insight into anticipated variation of the underlying asset and risk appetites, option prices can give some indication of the likely direction in which the market thinks the asset prices will move. For example, if the price of call options on the NZD rise relative to the price of put options on the NZD, one could conclude that market was putting more weight on the NZD rising than previously. Option prices can also be used to derive the anticipated future correlation of the value of two different currencies against a third. See Butler and Cooper (1997).

The reaction of financial markets to news events

Where futures markets are more liquid and leverage is easier to attain than spot markets, futures prices may react more quickly to events. For example, if an indicator of future inflation – and hence the required stance of monetary policy – is significantly different from expectations, the market's reaction may best be represented in the futures market. Research has shown this to be the case for the UK, French, German and Italian government bond futures markets⁴³. Even if the reactions of the spot and futures markets to news events are simultaneous, the futures market reaction may be more easily observed, since exchanges publish trades and prices as they take place.

Swap spreads

A swap spread is the difference between the swap rate and a government bond rate of equivalent maturity.⁴⁴ These swap spreads are driven by two factors. The first is the supply and demand for fixed rate funding in the swaps market. For example, if banks increase the number of fixed rate mortgages they enter into, they are likely to want to hedge these mortgages by paying fixed in the swaps market, which would put upward pressure on the swap rate and hence the swap spread. Second, since the swap spread represents the difference between interest rates available to borrowers of different credit quality (banks versus the government) they can be thought of as a type of **credit spread**. As a result changes in swap spreads can give an indication of changes in the perceived credit standing of banks.

With swaps markets tending to be more active than corporate bond markets, they often lead other types of credit spreads, and hence are a good indicator of changes in perceived credit quality. This was demonstrated in the period of financial market turmoil in 1998 when investors' perceptions of credit risk rose and their appetites for risk fell.

⁴³ See Holland (1999)

⁴⁴ The swap rate is the fixed rate leg of a plain vanilla fixed for floating interest rate swap.

7 Summary

This article is designed as a primer, explaining derivatives in simple terms to those less familiar with them or in need of a refresher. The more common derivatives, such as forwards, futures, swaps and options, are explained in detail. The concepts used to describe these products can easily be extended by the reader to less common derivatives.

The central thrust of the articles that derivatives help manage risk. In doing so, a number of common features of these different derivatives make them attractive to three distinct groups in financial markets – hedgers, speculators and intermediaries. Finally, the article discusses what information can be derived from derivatives prices.

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Appendix 1

Pricing forwards

Pricing of forward contracts is best illustrated with an example. If an investor holds an asset that is worth S today in the spot market and she is looking to sell the asset in T days time to receive cash she has two alternatives. First, she could take out a forward contract where no money changes hands initially but she will receive the pre-arranged price, F , in T days time on the expiry date. The second alternative is to sell the asset today in the spot market, receiving S , and depositing that cash in the bank for T days. Both ways the investor is able to sell the asset and have an amount of money available in T days time.

Under the first alternative she will receive F while under the second alternative she receives

$$S \times \left(1 + \frac{T \times r}{365} \right),$$

where r is the T day interest rate.

If F was less than

$$S \times \left(1 + \frac{T \times r}{365} \right)$$

she could make

$$S \times \left(1 + \frac{T \times r}{365} \right) - F$$

for every one of the assets she sells today, depositing the proceeds in the bank, while simultaneously agreeing to buy the asset forward at the forward price. Since market participants should quickly exploit such profit making opportunities, these prices received under these two alternatives should normally be almost identical, resulting in the condition:

$$F = S \times \left(1 + \frac{T \times r}{365} \right)$$

Such a condition is called an arbitrage condition, as it is based on the condition that no riskless profit opportunities (arbitrage opportunities) exist. So, for example, if the current asset price is \$100 and the 90 day interest rate is 4.5 per cent, the forward price of the asset in 90 days time has to be \$101.1.