

# **Derivatives and your company**

**How options and warrants can increase  
liquidity and lower volatility of your shares**

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**ASX**  
AUSTRALIAN STOCK EXCHANGE



## Executive Summary

Derivatives play an increasingly important part in equities markets both in Australia and overseas. ASX options market volumes have increased over 20% per annum for the past four years, while turnover in the warrants market has increased over 50% in each of the past two years.

The significant growth of derivatives in the Australian market has prompted a number of ASX listed companies<sup>1</sup> and trusts to ask ASX about the impact of derivatives on the securities over which they are listed. The concerns are centred on whether or not listed derivatives are a positive influence on trading in the underlying securities.

The purpose of this paper is to address these concerns by demonstrating how listed derivatives can in fact increase liquidity and lower volatility in underlying securities.

This report analyses Australian and US studies that looked at the impact of derivatives on trading in the underlying securities. The conclusions reached by the academic studies support the generally held market view that listed companies on the whole benefit from trading in derivatives offered over their securities. ASX's own figures indicate that 15% to 25% of equity market volume is the result of option and warrant market activity. On expiry days, up to 30% of equity market volume results from the exercise of derivatives into the underlying security.

In addition to the direct benefits to the company, a company's shareholders can also benefit from using a variety of derivative strategies to enhance the performance of their existing investment in the company.

The suite of derivatives listed on ASX includes exchange-traded options, warrants and futures. The options and warrants markets cover the most liquid securities on ASX. Futures cover indices and other specialist underlying assets.

Understanding the impact derivatives have on ASX securities is important for the directors and senior management of all listed companies.

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<sup>1</sup> The term company is used generally throughout this document to refer to listed entities, companies, or trusts.



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## **Derivatives in the Australian Equities Market**

In addition to operating an equities market, ASX also operates an exchange-traded options market, a warrants market and a futures market. Listed companies may also be familiar with company issued options, another derivative product traded on ASX.

While there are significant differences between these products, there are also common elements.

All derivative products are so named because they derive their value from another instrument, the underlying. On ASX's equities market, the underlying may be the listed securities of a company, or a market index, for example. The value of the derivative fluctuates with the value of the underlying, and also with movements in variables such as the volatility of the underlying, interest rates, dividends paid on the underlying, and the remaining life of the derivative.

All derivatives have a finite life, so provide exposure for a limited period of time. Because of the wide range of derivatives available, they can be used to achieve exposure to reflect virtually any market view, and to structure an almost limitless number of trading and investing strategies. Derivatives can be used to construct anything from a low-risk, low volatility exposure to the underlying, to a more speculative, leveraged position.

Following is a brief description of the derivative products available on ASX.

### **Exchange-traded options (ETOs)**

An ETO is either the right to buy an asset (call option) or the right to sell an asset (put option) for an agreed price on or before a specified future date. Options are legal contracts that arise as a result of demand between market participants, such demand being facilitated by the exchange. ETOs are derivatives of the underlying securities already on issue, so no new issue of shares takes place when they are exercised. The market capitalisation of the company does not change when ETOs are exercised.

### **Warrants**

Warrants are structured financial products generally issued by investment banks. As they are individually structured to meet varying investor needs, the range of warrants listed on ASX covers most of the investment spectrum. Traditional trading warrants have much in common with ETOs. However investment style warrants such as instalments have more of a long-term equity feel. Warrants derive their value from underlying securities that are already on issue, so no new issue of shares takes place when they are exercised. Hence the market capitalisation of the company does not change when warrants are exercised.

### **Company options**

Company options are issued by many ASX-listed companies. They are normally new issues of shares or other types of securities issued by way of a contract at a set price to employees of that company. (A contract by which the entity is bound to issue new securities, usually at a set exercise price, if the option holder wishes to take the new shares.)

A company may issue options for a number of reasons, including to raise capital, as consideration for an asset, or as part of a director or executive's incentive arrangements. When exercised, company options increase the company's issued capital as new shares (or other types of securities) are issued.

A table outlining the differences between ETOs, warrants and company options can be found in Appendix 2.

## **Impact of derivatives on underlying securities**

ASX Options market volumes have increased over 20% per annum for the past four years. An average of 90,000 ETO contracts are traded on ASX each day. There are currently over 18,500 option series listed over the securities of some 120 ASX listed companies.

The warrants market was established in 1991 and has also grown significantly in recent years. Turnover value has increased over 50% for each of the past two years (average turnover is now over \$500 million a month). Over 2,700 warrant series are available for trading on ASX, covering more than 200 different underlying instruments. The market has expanded beyond vanilla call and put warrants and into investment style products like instalment warrants that could be described as a listed form of margin lending.

The significant growth in the role played by derivatives in the Australian equities market has prompted discussion of the effect of derivatives on the underlying securities. Specifically, is it beneficial for a stock to have ETOs or warrants listed over its securities?

Studies in both Australia and the US have looked at the impact of derivatives on trading in the underlying securities. The conclusions reached by the academic studies support the generally held market view that listed companies on the whole benefit from trading in derivatives offered over their securities.

Specifically, listed derivatives can:

- Increase liquidity in the underlying securities
- Lower volatility in underlying securities

In addition to these direct benefits, a company's shareholders can also benefit from using a variety of derivative strategies that may enable them to enhance the performance of their existing investment in the company.

This paper details evidence for the liquidity and volatility effects, and explains how derivatives can have a positive impact on trading in the underlying securities of a company.

## Increased liquidity

ASX estimates that currently around 15% to 25% of equity market volume is the result of option and warrant market activity.

On expiry days, up to 30% of equity market volume results from the exercise of derivatives into the underlying security.

### Empirical evidence

The study "Options listings and the behaviour of underlying securities: Australian evidence", by Aitken, Frino, Jarneic<sup>2</sup> provides the following results.

The analysis performed was based upon 26 ASX listed firms. It examined the changes in security volume for 50 and 100 days before and after options were listed over the security. It also looked at the results of a subset of 20 firms for an extended period of 250 days before and after options listing. Thus both short term and longer term liquidity results were examined.

In the table below, 'Volume ratio' is the daily volume in securities post derivatives listing divided by the daily volume in securities pre derivatives listing.

Estimation Interval	+ / - 50 days	+ / - 100 days	+ / - 250 days
<b>Volume Ratio</b>			
Mean	1.19	1.09	1.32
Median	1.02	1.07	1.10
Sample firms that experienced an increase	54%	64%	65%

The data showed that almost two-thirds of the firms experienced increased trading volume after the options listing, and the mean increase ranged from 9% to 32%<sup>3</sup> over the different time periods measured.

The results also highlight that volume changes are not only a short term effect, with sample firms experiencing increased trading volumes over the longer periods. These results are consistent with evidence from US studies<sup>4</sup>.

The increase in liquidity in underlying securities can be attributed primarily to the hedging activities of market makers, and to the broader range of trading possibilities available through the use of derivatives.

### Market makers and hedging

Increased liquidity in equities is largely the result of hedging that flows from the options and warrants markets, in particular the hedging activities of market makers, who play an essential role in these markets.

#### *Who are market makers?*

Market makers can be either individuals or firms that aim to make a profit from the spread between the bid price and the ask price in a financial instrument.

They generally trade non-directional strategies, that is they do not have a view as to whether the market price will rise or fall. They therefore normally aim to minimise their market risk by being fully hedged: after executing a transaction in one instrument, they immediately effect a second transaction in another instrument to offset the risk created by the first transaction.

Market makers can also form part of the risk management teams of large investment banks, where their job is to "lay-off" stock market risk created by other divisions of the bank, for example as a result of underwriting a

<sup>2</sup> Full reference included in bibliography

<sup>3</sup> 1.09 mean for the 100 day sample, 1.32 mean for the 250 day sample

<sup>4</sup> see Skinner 1989 and Damadaran and Lim 1991.

placement of shares or a new float. Market makers also provide liquidity and pricing functionality to internal and external clients of banks and broking houses.

The increasing activity in derivatives markets in recent years has increased the competition among market makers for trades, given profits are sought from the bid-ask spread. Hence the bid-ask spread for both options and securities over which options are traded has generally tightened over recent years.

### ***Why are market makers a necessary part of derivatives markets?***

Unlike the equities market, where a stock usually has many bids and offers at any given time, derivatives markets may have hundreds of series per stock; for example RIO Tinto Limited currently has over 800 series listed.

The likelihood of a buyer wanting to purchase a specific derivative series for a particular price at the same time as an opposing seller wishes to sell the same series at that price is less than for a stock. For derivatives markets to operate efficiently, traders must be able to open and close positions with ease. It is the role of professional market makers to provide the bids and offers that make this possible.

There are currently 15 market makers (see Appendix 3) who provide liquidity to the ASX options market.

Similarly, the warrants market operates with market makers providing liquidity on behalf of the warrant issuers, who are normally financial institutions. A current list of warrant market makers can be found at [www.asx.com.au/investor/warrants/tools/issuers.htm](http://www.asx.com.au/investor/warrants/tools/issuers.htm)

### ***How does hedging generate liquidity?***

As well as adding significant liquidity to the options and warrants markets, market makers provide substantial liquidity to the underlying stocks that they trade to hedge their market making activities in the derivative markets.

Market makers hedge their trading activities via the underlying securities or through other options or warrants. When other options or warrants are used as a hedge, these transactions themselves may in turn generate further hedging activity in the underlying securities by other market makers.

For example, assume a trader buys call options over BHP Billiton shares, with a market maker taking the other side of the trade. The market maker is now short BHP calls, and is exposed to a rise in the price of BHP shares. To offset this risk, the market maker needs to take a long position in BHP shares. To achieve a neutral position, the market maker uses the delta of the option position to calculate the number of shares he must buy. Delta is a measure of an option's sensitivity to changes in the price of the underlying asset, and is calculated from option pricing models.

The trader could alternatively offset the position by taking another, long position in the options market. While this would not directly increase liquidity in BHP shares, the need to hedge in the underlying market is simply passed on to the trader taking the other side of the second transaction.

The trade in the underlying does not necessarily end with the initial purchase of BHP shares. Because an option's delta changes over time with movements in the price of the underlying, and the passage of time, for the position to remain delta-neutral the trader must regularly adjust his exposure to the underlying by buying and selling shares.

The process is similar for market makers in the warrants market, who hedge their positions by trading in the physical market and/or the options market. Note also that for every instalment warrant sold by the warrant issuer, the issuer buys a share in the underlying company for the investor.

Please refer to Appendix 4 for a detailed example of the hedging process.

### ***Arbitrage***

Arbitrage by market makers also generates liquidity. Market makers specialise in the accurate pricing of options and warrants according to mathematical models. On occasion an option or warrant may be overvalued or undervalued according to what the market maker considers "fair value". In this situation, trades in both derivatives and shares may occur as the market maker attempts to profit from the perceived mis-pricing of the market by buying the undervalued and selling the overvalued instrument; this is a form of arbitrage.

### **Additional trading tool**

The introduction of a derivative to the market gives investors a choice of which tool to use in order to effect the market exposure they require. For example, a trader is able to take positions in the underlying security via options or by using options in conjunction with stock.

The range of strategies available to the investor also increases. By increasing the number of trading possibilities, a trader has greater flexibility in tailoring their investment strategy to their risk profile.

If no derivatives are available, then the number of strategies to reflect a particular market view is reduced, and thus the likelihood the trader will effect exposure to the security may be reduced.

### ***Example***

An example of how derivatives can increase volume in the underlying security is the "buy and write" or "covered write" option strategy. This strategy is used when the trader's view of the stock is neutral to slightly bullish, and can be used by long-term stock holders to increase the yield on the stock.

The trader buys the underlying shares and simultaneously writes a call option. The trader receives a cash payment (option premium) for agreeing to sell those shares at a set price in the future if the option is exercised.

This strategy can be used to effectively lower the entry price of buying the stock. For example, an investor might buy 1000 shares in NAB for \$34.00 and write a one month call option for \$0.50, effectively reducing the purchase price of NAB to \$33.50.

The long-term stock holder can use this strategy to increase the yield on the underlying stock by writing calls over the stock on a regular basis.

The buy and write/covered call strategy is just one of many strategies involving both stock and option legs, that are possible only if options are available over the underlying security. Therefore having options listed may make a stock more attractive to traders than an alternative security that does not have options listed over it.

The "buy and write" strategy can also be implemented by using instalments instead of shares. In this case liquidity in the underlying securities is also increased, as shares are purchased as a consequence of the instalment acquisition. When an investor buys the instalment from the issuer, the issuer purchases the underlying shares and holds them in trust for the benefit of the instalment holder.

## Reduced volatility

Research indicates that there is a significant reduction in the volatility of the underlying security after the introduction of options over the security.

Volatility is measured as the standard deviation of daily stock price returns. All else being equal, the lower the volatility of an investment, the more attractive it generally is to a fund manager.

### Empirical Evidence

A comprehensive survey of research on the effects of options on underlying security volatility was conducted by Mayhew in 2000<sup>5</sup>.

This research concludes that there is a significant reduction in volatility of the underlying security, and that there is no significant change in beta after the introduction of options over the security.

This finding is supported by the Australian study by Aitken, Frino, and Jarnecic as shown in the table below.

Estimation Interval	+ / - 50 days	+ / - 100 days	+ / - 250 days
<b>Variance Ratio</b>			
Mean	1.086	0.989	0.864
Median	0.808	0.913	0.819
Std Dev	0.811	0.518	0.449
Sample firms that experienced a decrease	62%	64%	79%

The percentage of firms that experienced a decrease in volatility ranged from 62% over the 50-day period to 79% over the 250-day sample. A variance ratio greater than 1 shows an increase in volatility, which was evident in the 50-day mean. However both the 100 and 250-day sample periods showed ratios lower than 1 and hence decreases in security volatility.

The decrease in volatility may be at least partly attributed to the use of derivatives by investors to effect market exposure, in the process removing some of the pressure of buying and selling activity from the equities market.

### Use of derivatives to effect market exposure

The previous section explained how derivatives give investors a choice of how to achieve their desired market exposure. Where investors use derivatives to effect their required exposure, rather than undertaking transactions solely in the underlying stock, lower volatility can result.

This is especially the case when it comes to high volume strategies undertaken by fund managers and institutional investors. When buying or selling a large quantity of shares, the trading activity itself can cause the price of the stock to rise/fall during the process of buying/selling.

The options and warrants markets provide an additional means of entering or exiting stock positions. Because trades are taking place in the derivatives market, there is no direct market impact pressure in the underlying share market, and consequently lower volatility than if the trades were taking place in the underlying securities.

#### *Example 1 – reducing an existing holding*

Assume a fund manager has a significant holding in ABC Limited, but has now decided to sell or reduce the position. If no derivatives are listed over ABC Ltd, the fund manager's only course of action is to sell the physical securities. Depending on the size of the holding, and the time frame over which the selling takes place, the share price may fall as a consequence of the fund's trades, depressing the overall sale price received by the fund.

<sup>5</sup> Full reference included in Bibliography

If options are listed over ABC Limited, the fund could buy put options to lock in the sale price of the physical shareholding. Subsequently, the fund can exercise the options to achieve a guaranteed sale price for the underlying shares. Alternatively, the fund manager can start to sell the shares on market. Any fall in the share price over the selling period will be compensated for by an increase in the value of the put options the fund holds.

The net result for the market is that the derivatives market is able to absorb at least some of the price impact of the fund's activities, reducing volatility in the physical market.

***Example 2 – building a physical position***

A similar course of action can be followed when an investor wants to build a position in a stock. Accumulating exposure via options can reduce the impact on the physical market.

The investor can buy call options to obtain the required exposure. Different call option series on the stock can be bought (different months and/or different strikes), thereby spreading the market impact within the options market. Once the desired level of exposure to the stock has been gained through the purchase of options, the investor switches into shares. That is, sells the options on the options market while simultaneously buying shares on the equities market. Alternatively, the investor may wait until expiry of the options and then exercise the calls to purchase the underlying securities.

The benefit to the listed company in both these examples is that selling/buying pressure on the stock price may be alleviated by participants using derivatives to establish their positions, and over time converting them to stock positions, rather than effecting a major trade directly into the physical market over a short period of time. The result may be a reduction in volatility of the underlying shares.

## Derivatives, Corporate Actions and Dividends: Implications for Shareholders

### Dividends

The price at which a derivative trades incorporates the market's expectation of dividends payable on the underlying security. This expectation includes the size of the dividend and the expected ex-dividend date. If a listed company changes the ex-dividend date for a dividend, the value of derivative contracts will change when the company makes the relevant announcement.

For example, the market may estimate that company ABC Limited will trade ex a \$0.50 ordinary dividend around mid-April and again around mid-October. The market value of call/put options and trading warrants will take this into account.

Assume a shareholder is concerned about short-term price weakness over the ex-dividend period. In late March, the shareholder buys put options/warrants due to expire at the end of April with a view to protecting their shareholding from any price fall.

If the company were to announce in early April that instead of mid-April, the ex-dividend date would be mid-May, then the holder of the April put option/warrant will be disadvantaged in two ways. Firstly, because the April derivative will expire prior to the ex-dividend date, the shareholder's insurance for a price fall is disrupted as the put no longer offers protection over the ex-dividend period. Secondly, the value of the put itself falls (because the dividend is an input to the put price) so the shareholder loses money on the put.

The following table shows the quantum of the shareholder's losses:

Derivative strike price	Put option value*	
	Ex-div date 14 days pre-expiry	Ex-div date 14 days post-expiry
\$ 18.50	\$ 0.04	\$ 0.01
\$ 19.00	\$ 0.14	\$ 0.04
\$ 19.50	\$ 0.32	\$ 0.14
<b>\$ 20.00</b>	<b>\$ 0.63</b>	<b>\$ 0.32</b>
\$ 20.50	\$ 1.03	\$ 0.63
\$ 21.00	\$ 1.49	\$ 1.03

\*The above example is based on a stock price of \$20.00, interest rate of 5%, a \$0.50 dividend and the volatility of the underlying stock at 20%.

The writer of a call option will be similarly disadvantaged, as the call option will increase in value due to the ex-dividend date now falling outside the term of the option.

When derivative holders are disadvantaged unexpectedly as a result of a listed company changing an ex-dividend date, they may consider ceasing to hold option positions. They may judge the risk of unexpected company announcements to be too high, relative to the benefits of holding exposure to the security via derivatives. This in turn can affect liquidity in the underlying because the associated hedging behaviour of the market makers will drop.

In the period leading up to an ex-dividend date, there is sometimes a marked drop in derivative trading in certain stocks with historically large dividends that fluctuate in timing of payment. This takes away from liquidity in the underlying stock.

It is important that listed companies are aware that unexpected changes to dividend record dates will affect the value of calls and puts. Major shareholders such as equity fund managers often hold portfolios of options for insurance, or with the expectation of exercising at a later date. Ensuring the market is not surprised by unexpected changes to ex-dividend dates is therefore an important consideration for listed entities whose shares are covered by derivatives.

Companies should also be aware that ASX Listing Rule 3.20 requires companies to announce the ex-dividend (or record) date as soon as it is determined, though it is not a requirement that the dividend amount is announced at the

same time. Companies frequently set record dates well ahead of finalising the amount of a dividend. This practice can continue, however a company must have announced to the market the record date before it can be provided in response to a general enquiry.

Note that it is the ex-dividend date that affects derivative holders, not the dividend payment date. Listed companies can still maintain flexibility in setting the payment date for dividends in order to manage cash flows, while standardising the ex-dividend date to assist market certainty for both shareholders and derivative holders.

### **Corporate Actions**

Corporate actions can also affect the value of listed derivatives over the security subject of the corporate action. It is the philosophy of ASX (and all other exchanges globally) that as long as the corporate action affects all shareholders pro-rata, then option holders are compensated pro-rata by an adjustment to the value of the derivative. Guidelines for ETO adjustments are set out in the ASX Market Rules on our website, see <http://www.asx.com.au/investor/options/notices/adjustments/2006.htm> Warrant adjustments are generally similar to ETO adjustments, however they are detailed in the terms of issue for each warrant.

Derivative adjustments can only be made for corporate actions that are pro-rata to all holders of the underlying security. As derivative holders may also be shareholders of the same company, listed companies are encouraged to consider the potential impact on derivatives of a proposed corporate action.

Companies should also give consideration to how dividends to shareholders are labelled, as this may have significant implications for holders of derivatives. For example, where a 'special dividend' is paid pro rata to shareholders, an adjustment will be made to the terms of options over the stock. If the same amount was paid as part of the 'ordinary dividend', no adjustment would result. While the amount received by shareholders might be the same regardless of the form the dividend takes, the consequences for derivatives traders could be substantially different.

## **Appendix 1**

### **Eligibility rules for the listing of exchange traded options over securities on ASX.**

1. Underlying security must have issued market capitalisation of at least \$200 million.
2. Underlying security share price must be greater than \$1.00 at the time of listing.
3. Liquidity in the underlying security must be greater than 20% over the six months prior to the listing. Liquidity is calculated by the total value of turnover divided by the average market capitalisation.
4. Top 20 shareholders cannot hold greater than 80% of the underlying shares on issue.
5. ASX will also take potential demand in the market place for the options into consideration.

### **Eligibility rules for the listing of warrants over securities on ASX**

Given warrants are a structured financial product issued by a financial institution, there are no restrictions on the eligibility of warrants over ASX listed securities. Warrant issuers will generally not issue warrants over securities where they cannot effectively hedge their exposure. In practice the majority of warrants are issued over companies within the S&P/ASX 200 index.

## Appendix 2

### Differences between company options, ETOs and warrants

Company options have quite different characteristics to Exchange Traded Options and warrants. The table below outlines some of the basic differences between company options and derivative products.

Characteristic	Company Options	ETOs	Warrants
Length of life	Variable, usually a number of years	Standardised to 3, 6, and 9 months. Then some up to 5 years (or more)	Between 3 months and 15 years
Type of companies over which they can be listed	Any company listed on ASX – a decision of the company in compliance with the Listing Rules.	Approved ASX securities, see eligibility guidelines in Appendix 1 – a decision of ASX in accordance with market demand and the Business Rules.	Any company – although generally over those companies within the S&P/ASX 200 (see eligibility guidelines in Appendix 1).
Types of options/warrants	Calls only	Calls, Puts, LEPOs	Instalments, Trading Warrants (both Calls and Puts), Knock-out Warrants (both Calls and Puts), and Capital Protected.
Equivalent number of shares	1 for 1: or variable	1 for 1000: standardised	Depends on the conversion ratio
Short selling	No	Yes	No
Margin requirements	No	Yes (on short positions)	No
Have offsets on other Options	No	Yes	No
Exercise style	Generally European	European or American	European, American or combination of both
Entitlement to ordinary distributions	No	No	Yes (generally only for instalments)
Exercise dilution effect on issued capital	Yes	No	No
Liquidity	General Interest	Assigned market maker	Issuer generally appoints market maker
Accounting treatment required by company	Yes	No	No

<sup>6</sup> All securities will be traded on the same system in 2006.

## **Appendix 3**

Citigroup Global Markets Pty Limited – Broker code AU905

Macquarie Options Pty Limited – Broker code AU908

Sandy Bay Trading Pty Limited - Broker code AU913

Liquid Capital Australia Pty Limited - Broker code AU916

Optiver Australia Pty Limited - Broker code AU923

Principle Strategic Options Pty Limited - Broker code AU928

Torque Trading Pty Ltd - Broker code AU929

Blue Shark Trading Pty Limited - Broker code AU931

UBS Securities Australia Limited - Broker code AU933

JP Morgan Securities Australia Limited - Broker code AU937

Timberhill Australia Pty Limited - Broker code AU940

SAEN Options Pty Limited - Broker code AU942

Susquehanna Pacific Pty Limited - Broker code AU945

JB Were Registered Traders Pty Limited - Broker code AU950

IMC Pacific Australia Pty Limited - Broker code AU951

## Appendix 4

### Hedging Example

In order to fully hedge a position taken in the options market, a market maker must calculate the delta of the option position. Delta is derived from the Black-Scholes options pricing model, and is used to estimate the amount an option price will move given a change in the underlying stock price, all else being equal. The market maker then enters other transactions in the physical market and/or the options or warrants market to achieve a delta-neutral position.

The principal behind a delta-neutral hedge is that for a given move in the price of the underlying securities, regardless of the direction of that move, an equal and offsetting move will occur in the other 'legs' of the hedge. The aim is that the value of the overall position does not change.

As the price of a stock moves, and as time passes, the delta of an option itself changes. Consequently, delta-neutral, or dynamic hedging, requires constant monitoring and regular adjustments to the position.

#### Example

Assume a market maker enters into a trade to sell 10 NewsCorp (NWS) call options with a delta of 0.6. While call options have a positive delta (the price of the option rises as the stock price rises), the market maker has a negative delta position, as they have sold the options. To achieve a delta-neutral position, the market maker must buy NWS shares as follows:

$$\begin{aligned}\text{Number of shares} &= \text{no. option contracts} \times 1000 \times \text{delta} \\ &= 10 \times 1000 \times 0.6 \\ &= 6000\end{aligned}$$

Similarly, if the market maker had bought 10 of the same call options they would need to sell 6,000 NCP shares to achieve a fully hedged position.

Assume that a day later the price of NWS shares rises by \$0.50. The call options will increase in value, resulting in an (unrealised) loss to the market maker. However, the value of the NWS shares held by the market maker will also have increased. If the hedge is accurate, the overall position should be neutral.

As a result of the increase in the share price, however, the delta of the options will have increased, as the options move further into the money. Assume the delta of the options has increased to 0.65. To maintain a delta neutral hedge, the market maker needs to hold shares as follows:

$$\begin{aligned}\text{Number of shares} &= \text{no. option contracts} \times 1000 \times \text{delta} \\ &= 10 \times 1000 \times 0.65 \\ &= 6500\end{aligned}$$

The market maker should therefore buy 500 more NWS shares.

In this way, option and warrant transactions generate liquidity in the equity market. When an option or warrant trade is executed it often results in a number of trades in the underlying securities, both at the time of the initial trade, and during the remaining life of the derivative product as the market maker actively manages the risk of the position.

## **Bibliography**

Aitken, Frino, and Jarnecic (1994), 'Option listings and the behaviour of underlying securities: Australian evidence', *Securities Industry Research Centre of Asia-Pacific paper*.

Skinner, D (1989), 'Options markets and stock return volatility', *Journal of Financial Economics* 23, 61-78.

Damodaran, A. and J. Lim (1991), 'The effects of option listing on the underlying stocks' return processes', *Journal of Banking and Finance* 15, 647-664.

Mayhew, S. and V. Mihov (2000), 'Another look at option listing effects'. *Research paper, University of Georgia*.

## Glossary

American exercise – the option holder may exercise the option at any time up to and including the date of expiry

Beta – a measure of the price movements of a security compared to the price movements of the overall market or other broad index. For a given move in the broad market, a security with a beta greater than 1 will move proportionally more than the index, a security with a beta less than 1 will move proportionally less.

Call Option - An option contract which gives the holder the right, but not the obligation, to buy the underlying asset at the exercise price on or before a fixed expiry date.

Company Options - A contract by which an entity is bound to issue new securities, usually at a set exercise price, if the option holder wishes to take the new shares.

Delta - a measure of an option's sensitivity to changes in the price of the underlying asset. Delta is derived from an option pricing model and gives an indication of how the price of an option will move given a specified movement in the price of the underlying asset.

Delta neutral hedge – a hedge constructed so that any movement in the value of one instrument is wholly offset by an equal and opposite movement in the instrument(s) used to construct the hedge. The ratio of the number of option contracts to the underlying security is determined by the options' delta.

Derivative – an instrument which derives its value from the value of an underlying asset (such as shares or a share price index). Derivatives traded on ASX include options, warrants and futures.

European exercise – the option holder may exercise the option only at expiry

Exercise – to invoke the right attached to an option or warrant. For call holders, the right to buy the underlying asset at a specified price. For put holders, the right to sell the underlying asset at a specified price.

Exercise price – the price at which the buyer of an option or warrant may buy/sell the underlying securities. Also known as the strike price.

Fair value – the price at which an option should sell according to a mathematical option pricing model. Different pricing models may establish different fair values for an option.

Hedge – a transaction which reduces or offsets the risk of a current holding (for example a bought put to hedge against a fall in value of a current share holding) or a future transaction (for example a bought call to hedge against the risk of a rise in price of a potential share purchase).

LEPO – Low Exercise Price Option. A European exercise call option with an exercise price of \$0.01. Put Option - An option contract which gives the holder the right, but not the obligation, to sell the underlying asset at the exercise price on or before a fixed expiry date. Short selling - Where an investor or fund manager borrows a security and subsequently sells the security with an obligation to buy back the security and return it at a later date

Strike price – see exercise price.

Standard deviation – the mathematical/statistical measure of volatility used to calculate an option's fair value.

Taker – the buyer of an option contract.

Underlying security – the shares subject to purchase or sale upon exercise of an option or warrant.

Volatility – a measure of the size and frequency of fluctuations in share price. Statistically, volatility is the annualised standard deviation of daily percentage changes in a stock's price.

Writer – the seller of an option contract.