

**Keywords:** warrants, equity options, ASX, market structure, market efficiency, overpricing, short selling.

# AUSTRALIAN EQUITY WARRANTS: ARE RETAIL INVESTORS GETTING A FAIR GO?

*The ASX has two functionally similar markets for contingent equity contracts — a warrants market principally serving retail investors and an ETO market that may be used by retail and professional traders. Using pricing and volatility comparisons, this study finds that warrants are generally overpriced and are significantly dearer than their ETO equivalents. The paper recommends that short selling be allowed in the warrants market in order to reduce the pricing differentials and end the systematic exploitation of retail warrant investors by warrant issuers.*



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An earlier version of this paper was presented to the 16th Melbourne Money and Finance Conference — Retail and Household Finance: Current Issues. The conference was held in July 2011 by the Australian Centre for Financial Studies.

The Australian Securities Exchange (ASX) and its antecedents have traded call and put exchange-traded options (ETOs) over ASX-listed stock since 1976. This was the first market outside the United States to trade equity options.<sup>1</sup> In 1991, the ASX commenced trading third-party issued call and put warrants. Many of the traded warrants contracts have the same underlying security, exercise style,<sup>2</sup> exercise price and expiry date as a contemporaneously traded ASX option contract. The seeming duplication of contracts raises two important questions: Why did the ASX introduce warrants trading when its existing ETO market had the ability to satisfy the demand for price-contingent contracts to buy and sell Australian stocks? And, why have the two markets existed in parallel for more than 20 years?

Market segmentation appears to be the main reason. The ETO market, with its relatively complex trading arrangements to facilitate margin-based trading, can be more easily accessed by institutional and professional investors, whereas the warrants market, since its inception, has aimed to attract retail investors. According to Hunter (1999), warrants are more suited to retail investors because they are not called upon to write them; this being more risky than simply taking long positions. Moreover, when introduced, warrants traded on the existing electronic equity trading platform, which meant that retail investors could directly trade warrants via internet systems provided by brokers. At the time (and up to 1997), options were traded on a 'floor' where brokers executed orders placed by the traders.

The existence of dual markets offering functionally equivalent instruments is unusual in global financial markets and we could find no non-Australian studies that investigated relationships between related warrants and ETOs. There are, however, two previous Australian studies. Lee (2000) found evidence of warrant overpricing, although the results of the study are subject to the criticism that non-contemporaneous pricing data formed the basis of his findings. A more recent study by Bertin et al. (2010) investigated the lead/lag price dynamics between the two markets rather than the question of pricing parity in the two markets.

The central contention of this study is that functionally identical instruments should trade at the same price (according to the law of one price), unless there are differences in the institutional arrangements for trading these two instruments that justify the price difference.

## Institutional arrangements, ETOs and warrants

The main specifications of option contracts are the underlying security, the option type (call or put), the exercise style (European or American), the contract size, the expiry date and the exercise price.

Traders can take long or short positions in ETOs, and the clearinghouse (ASX Clear) operates a margin management system, ASX Derivatives Margining System (ADMS). ASX Clear calls margins from the brokers who, in turn, call margins from their clients. The ADMS offsets individual option positions to arrive at an overall 'portfolio' margin value for each option market trading entity. ASX Clear manages the aggregate positions of the participating options brokers who, in turn, are responsible for managing their clients' positions.

The market attracts traders through low transaction costs, such as small trading commissions and narrow bid-ask spreads. The ASX employs a system of market makers and those who fulfil their obligations to maintain market liquidity, either on a continuous basis or on a quote request basis, are rewarded by the ASX with lower trade registration fees.

## The warrant market

Historically, warrants were company-issued call options over their own stock. Initially ASX warrants were also equity options over Australian-listed equities. Currently,

however, the ASX warrants market trades a wide variety of derivative instruments. Moreover, the ASX warrants market has moved away from its option origins as a number of the most traded warrants, such as Minis and International LEPOs, have very little or no option component and are more like forward/CFD instruments.<sup>3</sup> Data on the dimensions of the warrants market are presented in Table 1.

This study focuses on ordinary call and put equity warrants which, while producing some 35 per cent of ASX warrant volume, have had a much smaller (4.7 per cent) share of the value of ASX warrant trading to date in 2011. While the share may be small, it is worth noting that the total value of the turnover in ordinary equity warrants exceeded \$500 million in 2010.

Applications to list a new warrants series must be accompanied by a product disclosure statement (PDS) that specifies the nature of the instrument and the conditions under which it will trade. Most of their specifications are the same as for equity ETOs but warrants have two further specifications: the warrant issue size and the warrant conversion ratio.

The issue size is not really a constraint as there is no initial public offering (IPO) for equity warrants but rather the warrant issuer normally stands ready to continue to issue fresh securities throughout the life of the warrant by maintaining an active offer price and volume presence during market trading hours.

TABLE 1: Warrant market activity for 2011\*

| Type                | Warrant        | Volume      |        | Value         |        |
|---------------------|----------------|-------------|--------|---------------|--------|
| Traditional Trading | Commodity      | 3,616,692   | 0.9%   | 7,713,835     | 0.8%   |
|                     | Currency       | 802,221     | 0.2%   | 294,939       | 0.0%   |
|                     | Equity         | 148,338,626 | 35.0%  | 47,678,955    | 4.7%   |
|                     | Equity Barrier | 67,626,430  | 15.9%  | 64,036,620    | 6.3%   |
|                     | Index          | 34,416,558  | 8.1%   | 25,535,872    | 2.5%   |
|                     | Index Barrier  | 10,996,812  | 2.6%   | 12,783,385    | 1.3%   |
| Investment          | Various        | 74,191,761  | 17.5%  | 302,865,623   | 29.9%  |
| International LEPOs |                | 3,884,269   | 0.9%   | 177,514,203   | 17.5%  |
| Minis               |                | 80,414,145  | 19.0%  | 374,805,205   | 37.0%  |
| Total               |                | 424,287,514 | 100.0% | 1,013,228,637 | 100.0% |

\*Market volume and value, May year to date.

Source: ASX.

The warrant conversion ratio specifies the number of warrants needed to be exercised to purchase one unit of the underlying security. Most ASX warrants have conversion ratios of between 4:1 and 6:1 whereas ETO conversion ratios are 1:1. The higher the conversion ratio the lower is the price per warrant, which may have a superficial appeal to retail traders, but it has no effect on any other important feature of a warrant.

Warrants trade on the ASX's equity trading system ASX Trade. Warrant transactions are registered and cleared through CHES. Retail investors are more familiar with CHES trading and settling arrangements than they are with the trading and settling arrangements of ASX options that are designed to support margin trading.

Issuers are required to provide a reasonable bid quote with sufficient volume on a continuous basis during market opening hours to enable investors to closeout an open long warrant position. On the expiry date, the issuer of the warrant is required to accommodate the exercise requirements of warrant holders; to purchase (sell) the contracted quantity of the underlying security from any in-the-money call (put) warrant holders. Most warrant issuers choose to hedge the resulting exposure to risk of loss<sup>4</sup> in one of two ways. First, the issuer can purchase an equivalent offsetting ETO contract. The advantage of this strategy is that it completely eliminates warrant risk as the long ETO position is the mirror image of the issuer's short warrant position. The disadvantage of the ETO hedge

strategy is that the ETO market is often thinly traded (see Table 3 below) and an attempt to hedge a large warrant position could have a significant impact on ETO prices, and thus erode a proportion of the warrant issuer's potential profit. Alternatively, the issuer can delta hedge their positions.<sup>5</sup> The advantage of delta hedging is that it involves transacting in the ASX stock market which is much more liquid than the ETO market. The disadvantage of delta hedging is that it is less precise than option hedging and usually has greater transactions costs.

## Data and analysis

Data for this study was accessed from IRESS, a commercial provider of contemporaneous trading data. The warrant and ETO data for a particular stock was collected within the shortest possible time interval (usually a two- or three-minute period) in an attempt to minimise the problem of data non-synchronicity.

The study compares warrants and ETOs over four underlying shares: BHP, CBA, RIO and WPL, and the sample data collection was limited to 12 specific days.<sup>6</sup> Warrants over these four shares account for approximately three-quarters of the trading in standard equity warrants by value and the value of trades in call warrants exceeded that in puts by a factor of seven or eight. This is not surprising as the retail investor market is generally more comfortable taking positions that benefit from share market rises rather than the reverse.

TABLE 2: Snapshot of the ASX warrants market on 17 May 2011

| Stock  | Warrants on Issue |     |       | Warrants with a Bid and Ask Quote |       |        |        |                        | Bid, Ask Quote Details |       |        |        |
|--------|-------------------|-----|-------|-----------------------------------|-------|--------|--------|------------------------|------------------------|-------|--------|--------|
|        | Call              | Put | Total | Call*                             | Put*  | Total* | Spread | Bid Value <sup>#</sup> | Ask Value <sup>#</sup> |       |        |        |
| BHP    | 24                | 17  | 41    | 17                                | 70.8% | 13     | 76.5%  | 30                     | 73.2%                  | 0.54% | 67,113 | 64,837 |
| CBA    | 20                | 15  | 35    | 16                                | 80.0% | 12     | 80.0%  | 28                     | 80.0%                  | 0.79% | 13,727 | 14,819 |
| RIO    | 21                | 15  | 36    | 15                                | 71.4% | 12     | 80.0%  | 27                     | 75.0%                  | 0.57% | 39,400 | 35,100 |
| WPL    | 20                | 14  | 34    | 14                                | 70.0% | 11     | 78.6%  | 25                     | 73.5%                  | 1.02% | 8,625  | 9,066  |
| Totals | 85                | 61  | 146   | 62                                | 72.9% | 48     | 78.7%  | 110                    | 75.3%                  | 0.72% | 33,672 | 33,103 |

*The data were extracted from an IRESS terminal at approximately 3.30 pm on 17 May 2011.*

*\* % figures represent the ratio of warrants with bid and ask quotes to total warrants on issue.*

*<sup>#</sup> Bid and ask values are the average value of orders at the current best bid and ask quote levels.*

TABLE 3: Snapshot of the ASX ETO market on 17 May 2011

| Stock | Options on Issue |      |       | Options with a Bid and Ask Quote |       |       |        |           | Bid, Ask Quote Details <sup>#</sup> |       |         |         |
|-------|------------------|------|-------|----------------------------------|-------|-------|--------|-----------|-------------------------------------|-------|---------|---------|
|       | Call             | Put  | Total | Call*                            | Put   | Total | Spread | Bid Value | Ask Value                           |       |         |         |
| BHP   | 555              | 547  | 1102  | 97                               | 17.5% | 105   | 19.2%  | 202       | 18.3%                               | 10.9% | 7,217.5 | 6,064.4 |
| CBA   | 417              | 408  | 825   | 48                               | 11.5% | 69    | 16.9%  | 117       | 14.2%                               | 7.7%  | 8,430.7 | 8,164.6 |
| RIO   | 404              | 398  | 802   | 53                               | 13.1% | 46    | 11.6%  | 99        | 12.3%                               | 6.4%  | 5,226.7 | 8,166.7 |
| WPL   | 337              | 329  | 666   | 51                               | 15.1% | 52    | 15.8%  | 103       | 15.5%                               | 14.7% | 5,324.6 | 4,287.5 |
| All   | 1713             | 1682 | 3395  | 249                              | 14.5% | 272   | 16.2%  | 521       | 15.3%                               | 10.3% | 7,161.2 | 6,574.7 |

*The data was taken from an IRESS terminal at approximately 3.30 pm on 17 May 2011.*

*\* % figures represent the ratio of ETOs with bid and ask quotes to issues warrants.*

*<sup>#</sup> Bid and ask values are the average value of orders at the current best bid and ask quote levels multiplied by the lot size of 100.*

Citigroup, Macquarie Bank and the Royal Bank of Scotland (RBS) were the issuers of the 146 standard warrant series written over the four stocks. Each issuer had a similar spread of warrant issues across the four stocks in question but only 28 (19 per cent of the 146 warrants) were duplicates of another series. Trading data in the warrant and ETO markets, as at approximately 3.30 pm on 17 May 2011, are presented in Tables 2 and 3, respectively.

Three-quarters (110) of the warrants had active bid and offer prices and they had a narrow bid-ask spread of less than 1 per cent (Table 2, third-last column).

Table 3 provides a snapshot of ETO trading activity. Observe in Table 3 that of the 3,395 option series available for trade on 17 May 2011 only 521 (15.3 per cent) maintained an extant bid and offer quote. Note the relatively low liquidity in the ETO series with bid and ask values, on average, being less than \$10,000.

### Price analysis

To test the relationship between warrant and option prices, we filtered the data for matching series where each instrument had valid bid and ask quotes, leaving a data set consisting of 571 records on 90 matched warrant and ETO contacts.

We found a number of arbitrage opportunities existed between the two markets. A long-arbitrage transaction is the simultaneous purchase of a warrant contract (at the

ask price) and the sale of an equivalent options contract (at the bid). Conversely, an immediate short-arbitrage opportunity exists if the warrant bid price exceeds the ETO ask price. Table 4 presents data that decomposes each simultaneous observation on the warrant and option markets into three categories: long arbitrage, no arbitrage or short arbitrage. Short-arbitrage opportunities existed for 92.6 per cent of the observations and the majority of stocks exhibited short-arbitrage conditions for more than 90 per cent of the observations.

Next we examine the value of the arbitrage opportunities. The data in Table 5 show the average difference in value of the warrants compared to the value of the equivalent ETO expressed as a percentage of the ETO price on a mid-price (of the bid-ask spread) basis and an arbitrage price basis (using the warrant bid price and the option ask in the percentage overpricing estimate).

The data in Table 5 indicate that these warrants (on average) are overpriced by 49.4 per cent on a mid-price basis and 41.7 per cent on an arbitrage-price basis.<sup>7</sup> The law of one price does not apply to warrants and their equivalent ETO, and the extent of the overpricing of warrants is consistent with, but exceeds, the overpricing results obtained by Lee (2000) using 1995 to 1999 ASX data.

### Volatility analysis

Another method for comparing the valuation of warrants and their equivalent options is to examine their implied

TABLE 4: Warrant/option price arbitrage opportunities

|     | Long Arbitrage |      | No Arbitrage |       | Short Arbitrage |       | Total |
|-----|----------------|------|--------------|-------|-----------------|-------|-------|
| BHP | 5              | 2.4% | 16           | 7.5%  | 191             | 90.1% | 212   |
| CBA |                | 0.0% | 7            | 3.0%  | 225             | 97.0% | 232   |
| RIO | 1              | 2.0% | 6            | 12.0% | 43              | 86.0% | 50    |
| WPL |                | 0.0% | 7            | 9.1%  | 70              | 90.9% | 77    |
| All | 6              | 1.1% | 36           | 6.3%  | 529             | 92.6% | 571   |

A short arbitrage opportunity exists if the warrant bid price exceeds the option ask price. A long arbitrage opportunity exists if the option bid price exceeds the warrant ask price. Otherwise no arbitrage opportunity exists.

TABLE 5: Overpricing of warrants as indicated by prices

|     | Mid Price Overpricing* |       |       | Arbitrage Price Overpricing# |       |       |
|-----|------------------------|-------|-------|------------------------------|-------|-------|
|     | Call                   | Put   | Total | Call                         | Put   | Total |
| BHP | 33.5%                  | 47.8% | 39.1% | 26.9%                        | 39.0% | 31.7% |
| CBA | 66.2%                  | 81.2% | 71.7% | 60.1%                        | 72.3% | 64.6% |
| RIO | 54.4%                  | 86.8% | 68.4% | 45.5%                        | 71.7% | 56.9% |
| WPL | 21.1%                  | 45.3% | 22.9% | 14.4%                        | 30.8% | 15.6% |
| All | 42.1%                  | 64.2% | 49.4% | 35.4%                        | 54.3% | 41.7% |

\*The mid-prices are the average of the bid and ask prices. Mid-price overpricing percentage is computed as the difference between the warrant mid-price and the equivalent option mid-price as a proportion of the option mid-price.

# Arbitrage overpricing is computed as the warrant bid price less the option ask price expressed as a proportion of the option price asking price.

TABLE 6: Overpricing of warrants as indicated by average implied volatility

|              | Mid Implied Volatility Difference* |       |       | Arbitrage Implied Volatility Difference# |      |       |
|--------------|------------------------------------|-------|-------|--|------|-------|
|              | Call                               | Put   | Total | Call                                     | Put  | Total |
| BHP          | 7.4%                               | 6.9%  | 7.2%  | 7.1%                                     | 6.6% | 6.9%  |
| CBA          | 8.9%                               | 8.4%  | 8.7%  | 8.6%                                     | 8.0% | 8.3%  |
| RIO          | 11.1%                              | 10.6% | 10.8% | 10.5%                                    | 9.7% | 10.1% |
| WPL          | 3.6%                               | 6.0%  | 4.0%  | 3.0%                                     | 5.4% | 3.4%  |
| All          | 7.5%                               | 7.9%  | 7.7%  | 7.1%                                     | 7.5% | 7.3%  |
| Probability* | 3.3%                               | 4.1%  | 3.7%  | 5.1%                                     | 6.1% | 5.6%  |

\* The mid price is the average of the bid and ask implied volatilities. Mid price overpricing percentage is computed as the average difference between the implied volatility of a warrant and the equivalent option's implied volatility.

# Arbitrage overpricing is computed using warrant bid implied volatility less the option ask implied volatility.

\* The probability that there is no difference between warrant and ETO implied volatility under an assumption of normality.

TABLE 7: Implied volatilities relative to historic volatility\*

|              | Warrant IV - 30D<br>Historic Volatility | ETO IV - 30D<br>Historic Volatility | Warrant IV - 90D<br>Historic Volatility | ETO IV - 90D<br>Historic Volatility |
|--------------|---|-------------------------------------|---|-------------------------------------|
| BHP          | 10.3%                                   | 3.1%                                | 10.7%                                   | 3.5%                                |
| CBA          | 13.9%                                   | 5.2%                                | 11.9%                                   | 3.2%                                |
| RIO          | 15.0%                                   | 4.2%                                | 13.6%                                   | 2.7%                                |
| WPL          | 6.9%                                    | 2.8%                                | 10.8%                                   | 6.7%                                |
| All          | 11.7%                                   | 4.0%                                | 11.4%                                   | 3.8%                                |
| Probability* | 1.1%                                    | 15.1%                               | 0.6%                                    | 16.4%                               |

\*IV = implied volatility, 30D = 30 day, 90D = 90 day.

\* The probability that there is no difference between warrant and ETO implied volatility under an assumption of normality.

volatility.<sup>8</sup> In principle, market warrant and option prices change each time there is a change in the price of the underlying security. Implied volatility changes more slowly with changes in perceived underlying asset volatility suggesting that implied volatility differences between the warrant and ETO markets are less likely to be influenced by timing differences during the extraction of the warrants and options data.

Evidence of the overpricing of warrants relative to ETOs in terms of units of implied volatility is presented in Table 6. On average, the warrant mid-point implied volatility is 7.7 per cent higher than that of ETO options. The arbitrage-implied volatility difference, which is computed as warrant-bid-implied volatility less option ask-implied volatility is 7.3 per cent on average. The probability that this level of difference is simply the result of sampling error is very low at 3.7 per cent for the mid-point implied volatility (assuming the volatility differences are normally distributed).

The results presented in Table 5 clearly indicate the presence of a price premium applying to warrants relative to ETOs, however, this does not, by itself, indicate which one is mispriced. Volatility analysis can provide an indication of which market, if any, is fairly priced and which market is overpriced.

In an efficient market the implied volatility of options ought not to stray far from measured historic volatility and thus the difference between implied volatility and historic

volatility provides a measure of fair/efficient pricing. Such data are presented in Table 7 over the most recent 30-day and 90-day periods.

Depending on whether 30-day or 90-day volatility is used, warrant-implied volatility, on average, is 11.7 per cent or 11.4 per cent greater than historic volatility. While the difference between the implied volatility and historic volatility for warrants will fluctuate between stocks, series and days, the probability that there was no difference between the two was either 1.1 per cent or 0.6 per cent. These probabilities are sufficiently low to make the proposition that warrant-implied volatility is comparable to historic volatility implausible.

ETO series also traded at a premium to historic volatility; 4.0 per cent and 3.8 per cent depending on the choice of historic volatility. But the premiums are much lower than the warrant market equivalent and the probability that the difference is zero is 15 per cent or 16 per cent depending on whether 30-day or 90-day historic volatility is used.

The results presented in Table 7 indicate ASX ETOs may be reasonably priced or slightly overpriced but, more importantly, that ASX warrants are definitely overpriced. However, it is difficult to place a dollar figure on the extent of overpricing. There are no statistics on the net warrants sold by issuers as there are no published warrant 'open interest' figures. All that is available are statistics indicating the volume and value of trade. These figures

TABLE 8: Estimate of the overpricing of barrier warrants

| Sample Numbers |      |     | Overpricing                |       |       |                      |       |       |       |
|----------------|------|-----|----------------------------|-------|-------|----------------------|-------|-------|-------|
|                |      |     | Option Implied Volatility* |       |       | Historic Volatility# |       |       |       |
| Stock          | Call | Put | Both                       | Call  | Put   | Both                 | Call  | Put   | Both  |
| BHP            | 7    | 8   | 15                         | 19.1% | 8.0%  | 13.2%                | 18.3% | 8.5%  | 13.1% |
| CBA            | 8    | 7   | 15                         | 38.8% | 22.6% | 31.2%                | 39.1% | 22.3% | 31.3% |
| RIO            | 7    | 9   | 16                         | 13.5% | 41.8% | 29.5%                | 12.9% | 43.4% | 30.1% |
| WPL            | 6    | 5   | 11                         | 22.3% | 29.7% | 25.7%                | 22.0% | 30.0% | 25.7% |
| All            | 28   | 29  | 57                         | 24.0% | 25.8% | 24.9%                | 23.7% | 26.4% | 25.1% |

\*Average implied volatility for each stock was obtained from standard ETO and used to compute theoretical knock-out barrier option prices.

# 60-day historical volatility was used to compute theoretical knock-out barrier option prices.

*The warrant market structure favouring issuers is supported by the ban on warrant short selling. Market forces would immediately return warrant prices to at least ETO levels, if not fair value, if arbitrageurs were allowed to short sell warrants.*

are not sufficient in and of themselves to place a number on the net flow of funds from the warrant holders to the warrant issuers due to overpricing.

It is clear from the results presented in Table 6 and Table 7 that standard equity warrants are overpriced. But according to the data in Table 1, standard equity warrants represent only 4.7 per cent of the overall warrants market. However, the overpricing of standard equity options may be a manifestation of the general overpricing of option-type warrants. We examined the pricing of equity barrier warrants to investigate this possibility.

Barrier warrants have no direct counterparts in the ETO market. Thus it is not possible to estimate a warrant's overpricing through direct comparison with ETO prices. It is, however, possible to estimate barrier warrant overpricing by comparing the market prices of barrier warrants to theoretical barrier warrant prices using appropriate volatility measures. Table 8 displays the percentage difference between the market mid-price for knockout barrier warrants and the theoretical barrier option price using either (a) implied volatility gleaned from the standard ETO market or (b) 60-day historic volatility.

Surprisingly (given their lack of transparency born of structural complexity) the results presented in Table 8 indicate a lower degree of overpricing for barrier warrants than for standard warrants. Barrier warrants overpricing is of the order of 25 per cent compared with the 50 per cent overpricing prevailing in the standard warrants market.

## Conclusions

There is strong evidence that ASX warrants are overpriced relative to both ETO options and fair value using historic

volatility. A warrant traded at fair value systematically favours neither the buyer nor the seller. However, a warrant traded on an overpriced basis systematically benefits the seller and penalises the purchaser.<sup>9</sup> Warrant trading is a zero-sum game and the ASX warrant market is such that, at any point in time, the net sellers are investment banks only and the net buyers are largely retail investors.

Investment banks are exploiting retail investors by selling them overpriced securities. Warrant-issuing investment banks, while having marketing costs, face very little risk selling overpriced warrants. A warrant issuer can lock-in the profit associated with the sale of an overpriced warrant by either purchasing an identical ETO or by delta hedging their short position by purchasing stock in the share market.

The warrant market structure favouring issuers is supported by the ban on warrant short selling. Market forces would immediately return warrant prices to at least ETO levels, if not fair value, if arbitrageurs were allowed to short sell warrants. The ASX currently provides organisational infrastructure to facilitate short selling in many of its markets.<sup>10</sup> While there would be some additional costs associated with providing traders with the ability to short sell, these costs would be small in comparison with the amount currently being appropriated from retail warrant investors via the systematic overpricing of warrants.

The principle recommendation of this paper is that the warrant short selling be allowed. We also recommend that conversion factors be limited to 1:1 so as to improve the transparency of warrant value. ■



## Notes

1. See Lee, p. 9.
2. American or European exercise style.
3. LEPOS are low exercise call options that have virtually no time value. MINIs are geared undated forward contracts.
4. Any increase (decrease) in the price of the underlying security beyond the exercise price hurts a call (put) warrant issuer.
5. Delta hedging is a name given to the practice of hedging an options position by holding a proportional and opposite position in the underlying security. The quantum of the position held is determined by the option position's sensitivity to changes in the price of the underlying security, i.e. the option's delta.
6. Data was taken from IRESS in the 30 minutes to the close on the following days: 4, 8, 11, 12, 15, 18, 21 and 28 April; and 3, 5, 9 and 17 May 2011.
7. The results when overpricing is weighted by the value of trade in the underlying stocks are essentially the same.
8. This study did not calculate implied volatility measures directly, but rather used the implied volatility numbers generated by IRESS.
9. For example, the probability of a purchaser of an at-the-money, two-month, call warrant (using realistic assumptions in relation to interest rate, dividend rate and volatility) making a profitable trade is 53 per cent. This probability is reduced to 35 per cent if the warrant were purchased at a 25 per cent premium over fair value.
10. For example, the ASX allows short selling in its market for company stock, its ETO market and its futures and associated options market.

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