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The impact of derivatives hedging on the stock market: Evidence from Taiwan's covered warrants market

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ABSTRACT

We examine the impact of derivatives hedging on the spot market using accurate hedge ratios of covered warrants traded in the Taiwan Stock Exchange (TWSE). Results present significant positive abnormal returns and trading volumes before the announcement of a warrant's issuance, and the effect is stronger when the hedging demand is larger. Moreover, a significantly positive relationship exists between stock return volatility and the *price elasticity of hedging demand*. Finally, we observe a significantly negative price effect upon the underlying stock after a call warrant has expired in-the-money due to the liquidation of hedging portfolios.

1. Introduction

Over the past few decades, global derivatives markets have experienced very rapid growth, both in the types of derivatives and trading volumes.[1] An important research question in the finance literature has arisen as to the extent to which derivatives markets impact their underlying stocks markets. There are at least two possible sources of the impacts: market incompleteness and market frictions. When the market is incomplete, Ross (1976) shows that stock prices are generally affected by the introduction of options, because these options span additional states of nature in the Arrow–Debreu economy. Other theoretic models, such as in Hakansson (1982), Detemple (1990), and Detemple and Selden (1991), also predict that stock prices may change when stock options begin trading. Some theoretic models, such as in Jarrow (1994), Frey and Stremme (1997), and Schönbucher and Wilmott (2000), present that option trading and hedging activities may affect the underlying stock price and/or volatility due to market frictions.

Aside from the above theoretical predictions, many empirical studies document that derivatives markets have significant impacts on the underlying assets, including the option introduction effect (Bansal et al., 1989; Conrad, 1989; Detemple and Jorion, 1990; Bollen, 1998; Sorescu, 2000), the pervasive impact on underlying stock prices (Pearson et al., 2008), and the effect of option expirations (Klemkosky, 1978; Officer and Trennepohl, 1981; Ni et al., 2005). However, only a few papers (e.g., Ni et al., 2005; Pearson et al., 2008; Henderson and Pearson, 2010) empirically investigate whether and to what extent that hedging activities impact the spot market. One possible reason is because it is difficult to identify which investors are hedgers and how much are their hedging positions, in order to measure the level of hedging demand and the subsequent impact. Thus, the existing literature makes strong assumptions to conduct the empirical tests. For example, by assuming that either market makers or market makers plus firm proprietary traders are likely delta hedgers, Pearson et al. (2008) find a statistically and economically significant negative

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[1] According to the statistics on option trading activities in the Chicago Board Options Exchange (CBOE), available from the CBOE's website (http://www.cboe.com/), the average daily trading volume was 209,158 contracts in 1980, growing to more than 4,500,000 contracts by 2009.

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relationship between stock return volatility and net purchased option positions of likely delta hedgers.[2]

To overcome the problems in prior studies, this paper utilizes a comprehensive dataset of covered warrants[3] traded in the Taiwan Stock Exchange (TWSE) and examines whether the hedging activities impact the underlying stock market during the life of a warrant, including the introduction effect, the pervasive (continuation) effect, and the expiration effect. There are several advantages to applying data on Taiwan's warrants and stocks to investigate the hedging impact of warrants on the stock market. First of all, the type of warrants traded in the TWSE are covered warrants where the issuers are required to conduct dynamic hedging in the spot market over the life of the warrant. Therefore, we can precisely estimate the daily hedging demands of the issuers, because the number of warrants outstanding and the hedge ratios are known.[4] Second, since most warrants are sold to and traded by individual investors who are mainly noise traders without sophisticated trading strategies,[5] their hedging demands, if any, have a negligible impact on the underlying stock prices. Thus, we can attribute most of the impact to the hedging demands of the warrant issuers. Third, there exist relatively minor microstructure issues, such as the non-synchronized trading problem, because both warrants and stocks in this study are traded in the same market, i.e. the TWSE.

We summarize our main findings and contributions as follows. First of all, the introduction of call warrants leads to a significantly positive price effect on the underlying stocks. The regression result suggests that the cumulative abnormal return of the underlying stock is larger when the hedging demand (measured by the standardized delta-hedging position, see Eq. (2)) is stronger. The introduction effect due to hedging is economically significant, because the cumulative abnormal returns for the period of day −20 to the announcement date are 0.904% (equivalent to 10.85% per year) on average. Moreover, we also find that there exist significantly positive abnormal trading volumes before the announcement dates of warrants' issuances.[6]

Second, we find a significantly pervasive effect of hedging demand on both the volatility of the underlying stock and the trading volume during the life of a warrant. For example, when we regress stock return volatility on the *price elasticity of hedging demand* (defined as the percentage of shares bought or sold for rebalancing a hedge portfolio when the underlying stock price changes 1%), the regression coefficient is significantly positive.[7] Our empirical results are consistent with the theoretical predictions of Jarrow (1994), Frey and Stremme (1997), Platen and Schweizer (1998), and Schönbucher and Wilmott (2000) concerning the hedging impact on the volatility of the underlying stock.

Third and finally, we find that the expiration effects due to delta-hedging activities depend on the moneyness of the call warrants on the expiration date. Due to the liquidation of hedging portfolios, there exists a significantly negative price effect to the underlying stock after a call warrant has expired in-the-money. The expiration effect is also economically significant. For example, in the sample of call warrants expiring in-the-money, the cumulative abnormal returns of the underlying stocks are −0.296% within 6 business days (i.e. −12.43% per year) after warrant issuers start to unwind their hedging portfolios.

Although some of our results are not new to the literature concerning derivatives' market impact on the market of the underlying assets, we provide direct and clear evidence of the impacts due to hedging. For example, although Chen and Wu (2001) also find a negative price effect after expiration for in-the-money derivative equity warrants traded on the Stock Exchange of Hong Kong,[8] they cannot verify how much of the impact is due to hedging. In contrast, our regression results clearly quantify the expiration effect that can be attributed to the hedging activities of warrant issuers. To the best of our knowledge, this study is the first one to quantify the hedging impact on the underlying stocks during the life of the warrants, including the introduction period, the continuation period, and the expiration period.

The remainder of this paper is organized as follows. Section 2 develops the hypotheses of the hedging impact. Section 3 summarizes the variables and empirical methodology, and Section 4 describes the data. Section 5 presents the empirical results. Section 6 concludes the paper.

2. Hypothesis development of the hedging impact

2.1. Hedging impact around the announcement date

As requested by the TWSE, most, if not all, warrant issuers in Taiwan conduct a delta-neutral strategy to hedge their risk on short positions of warrants.[9] When warrant issuers trade in the underlying stock market for hedging purposes, such activities may significantly alter the behavior of the cash market. In fact, one would expect that the price impact should be the strongest before the day of issuance, as issuers have to buy or short a sufficient amount of the underlying stocks to hedge their warrant issuance. One can also conjecture that the impact will be larger when the amount of warrants

[2] The other difficulty is due to the fact that the likely delta hedger's (e.g. market maker's) net option positions may be affected by the trading activities of investors with private price or volatility information. Thus, it is difficult to disentangle the price impact of the hedging activity from the price impact of the information trading. To overcome this problem, Pearson et al. (2008) assume that changes in the hedge demand mainly comes from the "old" option positions held by the likely delta hedgers from the previous period and thus are uncorrelated with trading based on private information about price or volatility movement.

[3] The term "covered warrants" is officially used by the Taiwan Stock Exchange (TWSE) to describe the warrants issued by third party financial institutions such as banks and broker-dealers. We thank an anonymous reviewer for bringing our attention to this point.

[4] Note that the issuing amount of the warrant is fixed at the announcement date. Although the covered warrants traded in the TWSE are typically American-style, they are essentially European-style, because the strike price and the contract size are adjusted accordingly when the underlying asset has discrete dividend payments. Even if the warrants are exercised early, the number of exercised warrants is known, and thus we can calculate the exact number of outstanding warrants during the life of a warrant.

[5] For example, Barber et al. (2009) document that individual investors in the Taiwan stock market incur large trading losses and propose that these traders are uninformed and overconfident. Chang et al. (2009) also find that the trading activities of individual investors in the Taiwan index option market convey no information content.

[6] The effect is especially large from day −4 to day −1, probably because the warrant issuer starts to build the hedging portfolio four trading days before the announcement date.

[7] Our results suggest that the hedging effect depends on the liquidity and firm size of the underlying stocks. We find that the impact of dynamic hedging on stock return volatility and trading volume is stronger when the underlying stocks become more illiquid (the result is based on the illiquidity measure of Amihud (2002)). Similarly, we also find that the hedging impact is stronger for small firms than for large firms. These results are not reported in the paper, but are available from the authors upon request.

[8] It should be noted that more than 80% of derivative equity warrants in Hong Kong are call warrants (based on the historical data downloaded from the following website of the Hong Kong Exchanges and Clearing Limited: http://www.hkex.com.hk/eng/dwrc/download/dnfile.asp). That is probably the reason why the expiration effect for in-the-money call warrants in the Taiwan market is similar to that in the Hong Kong market.

[9] According to Item 5 of Taiwan Stock Exchange Corporation Rules for Review of Call (Put) Warrant Listings and its attachment 3, the difference between the total actual and the theoretical hedge positions for each call (put) warrant should not exceed 20% when warrant issuers adopt hedging strategies to offset foreseeable risk. For details, please refer to the following website: http://eng.selaw.com.tw/FLAWDAT01.asp?LSID=FL023925, and then click "Article Content".