The Impact of Option Listing on the Underlying Market: Evidence from the Australian Stock Exchange*

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Abstract

This study investigates the impact of option listings on the underlying market quality. Cumulative Abnormal Returns (CARs) on ETO-listed stocks rise about 20 days prior to the event, then drops below zero subsequently. In contrast, CARs on Flex-listed stocks increase only after the introduction of options. Return volatility of both types of stocks remains unchanged after option introductions. This paper also provides evidence that the price impact of large trades for Flex-listed stocks fall after option introductions. Finally, a significant portion of informed trading occurs in the market for Flex options after the introduction of options.

Keywords: Market microstructure; Options markets

JEL Classification: G10

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1. Introduction

The economics of financial derivatives has always been a contentious issue due to its complex risk profiles. The recent debacle over credit default swaps (a type of financial derivative) has only increased concern about the risk of financial derivatives.[3] The most widely accepted argument against financial derivatives is that they undermine the underlying market since these instruments encourage traders to take more risks than they would have otherwise. However, taking more risks does not necessarily lead to less stable capital markets. The more relevant question in this issue is how efficiently derivatives markets price these risks. Furthermore, there is no firm evidence that support this argument against financial derivatives.

Of a range of financial derivatives, options are the most widely used exchange-traded financial instruments. The effect of option listings on the underlying stock market quality is extensively investigated in the financial economics literature. However, they are mostly confined to a particular type of options of which listing decisions are determined by options exchanges. On the Australian Options Market (AOM), there is a class of stock options that are listed upon request from market participants, registered brokers on behalf of their clients, referred to as Flex Options. This type of instrument is yet to be investigated in the option listing literature. The objective of this study is to bridge this gap in the option listing literature by investigating Flex options as well as ordinary stock options on the AOM.

The extant literature on the impact of option introductions on the underlying market quality is largely inconclusive. The theoretical literature suggests that option listings are beneficial for the underlying market. On the other hand, the empirical literature has not reached a unanimous conclusion on this issue. Earlier empirical studies find that option listings are associated with a decrease in the return volatility of the underlying stocks (for

[3] See, for example, 'The Great Untangling', *the Economist*, 6 November 2008.

example, Conrad, 1989, and Skinner, 1989). In contrast, more recent empirical research concludes that option listings have no impact on the underlying market volatility.[4] These studies argue that the conclusions in earlier studies are not reliable since the impact of option listings become insignificant after controlling for selection bias embedded in the process of selecting stocks for option listing by options exchanges (for example, Mayhew and Mihov, 2004, and Danielsen et al., 2007).

The presence of Flex options on the AOM, which are listed upon request from market participants, provides a unique opportunity to investigate the effect of option introductions on the underlying market quality without a particular type of selection bias due to option exchanges' endogenous listing decisions. Mayhew and Mihov (2004) argue that the conclusions drawn from the earlier empirical studies are not reliable since they do not explicitly control for selection bias in their empirical analyses. Selection bias is a critical issue in this line of research since stocks for option listing are not randomly selected. Stocks for most option listings are selected by options exchange officials whose goal is to maximise their trading business profits. In contrast, Flex options on the AOM are listed upon request from registered brokers on behalf of themselves and/or their clients.

Differences between the microstructure of equity markets examined in prior studies, mostly U.S. equity markets, and the ASX also warrants re-examination of the effect of option listings on the underlying market quality. Most prior empirical studies examine U.S. markets where designated market makers play a dominant role in providing liquidity in both equity (underlying) and options markets. On the other hand, liquidity is supplied by public limit order traders on the ASX (equity market) while designated market makers dominate liquidity provision on the AOM (options market). It is reported that most market makers on the AOM hedge their numerous risk exposures using other options, underlying stocks, or index futures

[4] See, for example, Bollen (1998).

contracts.[5] It follows that the inter-market information dissemination process in the Australian capital market is of a distinctive form. The market microstructure literature suggests that a substantial portion of information is channelled through options markets (for example, Chakravarty et al., 2004, and Pan and Poteshman, 2006).

The remainder of the paper is structured as follows. Section 2 provides institutional details of the AOM and descriptions of traded options examined in the study. Section 3 presents the sample. Section 4 outlines the research design and presents the empirical results. The ultimate section concludes.

2. Institutional Background

The Australian Securities Exchange (ASX) provides numerous automated trading platforms for a number of financial instruments. The Australian Options Market (AOM), one of the most actively used trading platforms, provides a trading system that employs a centralised limit order book with designated market makers. The Integrated Trading System (ITS), a screen based trading system, facilitates trading financial options on the AOM.[6] The AOM offers a trading facility for options on a range of underlying assets such as equities, fixed income securities, and commodities. Of these financial instruments, equity options are most actively traded. All equity options are of American type, and are classified according to a set of predetermined (by the AOM rule makers) exercise prices, contract rights (call or put) and maturity dates.

There are two types of equity options available to investors on the AOM: Exchange Traded Options (ETOs) and Flex options. There are a number of differences between these options. Listing of ETOs is determined by the AOM officials while that of Flex options is

[5] See http://www.asx.com.au/products/options/trading_information/RoleOptionMarketMakers.html for more detailed information.
[6] The Australian Options Market (AOM) is one of the trading platforms provided by the Australian Securities Exchange (ASX).

initiated by market participants (registered brokers on behalf of their clients). This distinction in listing practice may affect how the underlying market responds to the AOM's listing decisions since the AOM and brokers have different motivations. The objective of the AOM is to maximise trading volume since it is their main revenue source. On the other hand, there are various reasons why market participants request for option listings: hedging and speculation and so on. Furthermore, designated market makers are assigned to ETOs whereas the centralised limit order book is the only liquidity source for Flex options. As a result, the market for Flex options is substantially less liquid than that for ETOs. About 25% of listed Flex options have never traded. Of traded Flex options, about 30% of them traded less than ten times during their entire lives. To be eligible for listing on the AOM, the underlying stocks must satisfy the following minimum requirements.[7] These requirements apply to both ETOs and Flex options.

1. The underlying securities must have an issued capital of at least $200 million domestic capitalisation;

2. The liquidity of the underlying securities, including off market trades, must be greater than 20% over the 6 months prior to consideration or since it was first listed (if it has been listed for less than 6 months). This figure calculated by dividing the total value of turnover by the average domestic market capitalisation.

3. The maximum holding of the top 20 shareholders in the underlying securities must not exceed 80% of the total shareholding at the time of consideration; and

4. The underlying securities price must be at least $1.00 at the time of consideration.

[7] See http://www.asx.com.au/products/pdf/options_listing_guidelines.pdf

3. Data

The Reuters intra-day data used are sourced from the Securities Industry Research Centre of Asia Pacific (SIRCA). And, they are cross-checked with the data internally supplied from the ASX. The original data consist of trade-level variables from 1992 (2000) to 2007 (2008) for ETO-listed stocks (Flex-listed stocks).[8] This study selects 150 days prior (subsequent) to the introduction of options as the pre-event period (post-event period). For ETO-listed stocks, the event date is defined as the date when options start being available to traders. On the other hand, for Flex-listed stocks, the event date is the date when options start trading. The reason is that all ETOs start trading on the first eligible date whereas most Flex options do not do trade immediately. Each transaction is matched with its corresponding trade-level variables such as price, volume, and prevailing bid-ask quotes.

For the empirical analysis, several standard filters are applied. This study selects stocks that trade at least for 150 trading days both prior and subsequent to the introduction of the corresponding options. Only continuously traded, on a daily basis, stocks are selected, meaning that the sample stocks trade at least once per trading day during the sample period. Only one stock is removed as a result, implying that the stocks selected for option listings are relatively active. Ten trading days surrounding the event date are removed since it may take time for traders to adapt to a new trading regime. Table I presents the number of listings in the sample after filtering.

[Table I]

4. Empirical Analysis and Results

[8] The AOM started listing ETOs in 1978. However, relevant data for the underlying stocks of ETOs are available only from 1992. Note that Flex options have been listed since 2000.

For this line of research, the ideal research design is to conduct a controlled experiment where option listed stocks are compared to otherwise identical stocks. However, since past data are used, this type of controlled experiments is not feasible. In other words, the counterfactual cannot be tested. An alternative is to construct a control sample that contains stocks with similar characteristics, but not affected by the event of interest. As clearly demonstrated in Mayhew and Mihov (2004), there is another critical issue that must be taken into account in this particular line of research. Mayhew and Mihov (2004) notice that prior option listing studies fail to isolate the effect of option listings on the underlying market quality since stocks for option listings are not selected at random. This selection bias is caused by the exchange industry practice that stock selection for option listings are determined by the exchange officials at their discretion. For example, they conjecture that options exchanges select stocks for option listings in anticipation of increases in return volatility of the underlying stocks since an increase in return volatility will add to the demand for option trading.

Matched portfolio method is employed in this study to better control for selection bias in the process of selecting stocks for option listings. The ideal control sample would include identical stocks with the exception of the existence of associated options. However, since it is not feasible to do so, a control sample is constructed by selecting non-optioned stocks that: (1) meet the minimum requirements for option listings and (2) are highly likely to be selected for option listings. Mayhew and Mihov (2004) use estimated probability of being selected for option listings as the control variable. Probability of listing is estimated using logit model that incorporates variables that are likely to affect listing decision making. This study uses an alternative approach that captures the essence of the idea in Mayhew and Mihov (2004) since the sample size is too small to implement it.

The matching portfolio method in this study is a simplified version of Mayhew and Mihov (2004). The first step is to identify a number of most relevant variables that are likely to influence on listing decision making. Of the variables used in Mayhew and Mihov (2004), market capitalisation (market cap) and trading volume are selected for matching variables.[9] The matching procedure is as follows. First, non-optioned stocks that are eligible for option listings (eligible non-optioned stocks) are identified. After being sorted by market capitalisation, they are grouped into quartiles. Then, within each market cap group, stocks are categorised into quartiles based on daily trading volume. Subsequently, each optioned-stock is matched with a control portfolio based on market cap, and then trading volume. This process generates: (1) the event sample that includes optioned-stocks and (2) the control sample that consists of portfolios of eligible non-optioned stocks. For the empirical analysis, a market quality measure for each control portfolio is obtained by calculating the equally-weighted (EW) average of stocks in the portfolio.

4.1 Abnormal Returns

Abnormal returns on the underlying stocks surrounding option introductions are investigated extensively in the options listing literature (for example, Conrad, 1989, and Skinner, 1989). Prior studies find that abnormal returns increase after option introductions. In these studies, abnormal returns are computed using market or market-adjusted model. This particular method does not explicitly account for the fact that stocks for option listings are not selected at random. This study uses (daily) cumulative abnormal returns (CARs) to investigate how option introductions affect the returns on the underlying stocks using matched portfolio method. In estimating CARs, the first step is to define Abnormal Returns (ARs) since CARs are simply calculated summing ARs. Abnormal return (AR) is defined as

[9] Discussions with the exchange officials confirm that market capitalisation and trading volume are the most important factors that affect listing decisions.

the difference between the return on the event stock and that on the corresponding matched portfolio. Then, time-series ARs on a particular stock are summed to calculate CAR for a pre-determined time period. Statistical inferences are drawn from the results of standard paired t-test.

Figure 1 depicts cumulative returns (CRs) and CARs on ETO-listed stocks and the control sample. Red (green) line represents cross-sectional average CR for the event (control) sample. Blue line represents the cross-sectional average CAR, which is the difference between CR for the event sample and that for the control sample. It shows that CAR rises about 20 days prior to the event, and then levels off at around the event date. Finally, it drops to zero about 50 days subsequent to the event. Figure 2 is identical to Figure 1 except that the lines are drawn for Flex-listed stocks. This figure shows a considerably different pattern from that for ETO-listed stocks. CAR starts increasing about 35 days before the event, but it does not drop until the end of the sample period unlike the pattern in Figure 1.

[Figure 1 and Figure 2]

Table II presents the results of CAR analysis. In panel A, results from the test on ETO-listed stocks are reported. Paired t-test results indicate that CAR is marginally significant only prior to the event at the 10% level. The cross-sectional average CAR from day -50 to day -1 is 0.0508, which is statistically significant at the 10% level. On the other hand, after the event, CARs are indistinguishable from zero. Results also reveal that the sign of CAR reverses after the event, implying that the (statistically) significant positive CAR is temporary at most only prior to the event. This result is in contrast to prior studies. Conrad (1989) finds that the introduction of options results in a permanent price increase in the underlying stock using U.S. data from 1974 to 1980. Sorescu (2000) also documents that

there is a positive effect of option listings on the stock prices. In contrast, using a different sample period (from 1981 to 1995), Sorescu (2000) finds that option introductions cause a permanent price decrease in the underlying stock. On the contrary, this study finds that option listings have no permanent impact on the underlying stock prices.

Panel B reports CAR analysis results for Flex-listed stocks. This panel depicts a completely different pattern of CARs. CAR is only statistically significant only for 50 days after the event. In contrast to the results for ETO-listed stocks, CAR is not significant prior to the event. The cross-sectional average CAR from day 0 through day 50 is 0.0339, which is statistically significant at the 5% level. Contrary to the results for ETO-listed stocks, the sign of CAR remains the same after the run-up in price.

4.2 Return Volatility

Regarding financial derivatives, the central focus so far is on whether the use of these instruments destabilise the underlying market. A popular argument against financial derivatives is that they may increase volatility of the underlying market since they facilitate excessive levels of speculative trading. Essentially, this is a market inefficiency argument. The reason is that the excessive trading argument becomes irrelevant if increased risk is priced efficiently in the market. On the other hand, the rational expectations models suggest that financial derivatives reduce excess volatility. Grossman (1988) argues that financial options reduce the volatility of the underlying market since traders are better able to manage risk using the information on risk from the prices of traded options. Brennan and Cao (1996) also argue that the introduction of options curb excess volatility since options increase traders' incentive to collect information. Therefore, the impact of financial derivatives on the volatility of the underlying market is an empirical question.

Despite the extensive academic research on this issue, results are largely inconclusive. The volatility effect of options is re-examined in this study using Flex-listed options, which are requested by market participants for option listings. Two widely-used volatility measures are examined: daily return variance and squared return. For the variance test, the daily return variance is calculated for each event stock, separately for pre- and post-period. Then, the ratio of the variance in the post-period (post-variance) to that in the pre-period (pre-variance) is computed for each event stock. Finally, the same procedure is applied to the control sample.

After the variance test is conducted for each sample, the variance ratio for the event sample (event-ratio) and that for the control sample (control-ratio) are compared using standard paired t-test. When it is conducted for each sample, the null hypothesis is that the mean variance ratio is one. To compare the event sample to the control sample, the null hypothesis that the mean difference between the event ratio and the control ratio is zero is tested. For the squared return test, the same procedure is applied except that the time series average daily squared return is used for each stock (and each matched portfolio) instead of daily return variance.

Table III presents the volatility test results. In Panel A, the variance test results are reported for both ETO-listed stocks and Flex-listed stocks. For ETO-listed stocks, the mean event sample variance ratio is 1.0505, suggesting that the variance of the event sample increases after the structural change. However, this change is not statistically significant. Furthermore, the mean control sample variance ratio is also greater than one (1.0654), which means that the increase in return variance is not attributable to the introduction of options. The difference of means test confirms that the difference between the variance ratios of ETO-listed and Flex-listed stocks is not statistically significant. For Flex-listed stocks, the mean event sample variance ratio is 1.2033, suggesting there is an increase in return variance for Flex-listed stocks. However, it is not statistically significant. The mean control sample

variance ratio is also greater than one (1.1072), but not statistically significant. The difference of means test reveals that the difference between them is not statistically significant. The implication is that the introduction of Flex-options has no impact on the underlying market return variance.

In sum, results reveal that for both types of options there is no significant change in return variance for both ETO-listed and Flex-listed stocks. Furthermore, the results are robust to the alternative method: squared return test.

[Table III]

4.3 Liquidity

Option introductions can have a profound effect on the market microstructure variables (such as spreads and depth) on the underlying market depending on the traders' response to the structural transition. In particular, there is extensive literature that examines how informed traders formulate their trading strategies in the presence of options market. The literature suggests that a significant portion of informed trading occurs in options market (for instance, Chakravarty et al., 2004). It follows that some informed traders are likely to move to options market after option introductions. Liquidity variables, in turn, will be affected by this transition. To examine how option listings affect liquidity, percentage quoted spreads and percentage effective spreads are used. The percentage quoted spread is defined as the following.

$$\text{PQSpread}_i = \left(Ask_i - Bid_i\right) / MidPoint_i$$

where Ask_i is the prevailing ask quote, Bid_i is the prevailing bid quote, and MidPoint_i is the sum of Ask_i and Bid_i divided by two at the time of i^{th} transaction. The percentage effective spread is defined as the following.

$$\text{PESpread}_i = \frac{|\text{Price}_i - \text{MidPoint}_i|}{\text{MidPoint}_i} \times 2$$

where Price_i is the transaction price, and MidPoint_i is the sum of Ask_i and Bid_i divided by two at the time of i^{th} transaction.

As in the variance ratio test, the time series average spread is calculated for each event stock, separately for pre- and post-period. Then, the ratio of the average spread in the pre-period (pre-spread) to that in the post-period (post-spread) is computed for each event stock. Finally, the same procedure is applied to the control sample. After the spread test is conducted for each sample, the spread ratio for the event sample (event-ratio) and that for the control sample (control-ratio) are compared. When it is conducted for each sample, the null hypothesis is that the cross-sectional mean spread ratio is one. To compare the event sample to the control sample, the null hypothesis that the cross-sectional mean difference between the event ratio and the control ratio is zero is tested.

Table IV reports the percentage spreads test results for both ETO-listed and Flex-listed stocks. Results reveal that percentage (quoted and effective) spreads fall after the event. However, all event ratios are indistinguishable from their corresponding benchmarks. In sum, there is no evidence that option introductions result in lower spreads.

[Table IV]

Bid-ask spreads essentially measure the price impact of a trade from transaction to transaction. However, for relatively large orders that take a substantial time to full execution, spreads do represent only a small portion of the total trading costs. To examine the price impact of a trade over a longer period, the price impact of a trade is used. This price impact measure is defined as the following:

$$\text{Price Impact}_t = \left[\frac{\text{Price}_t - \text{Price}_{t+\gamma}}{\text{Price}_t} \right] \times I_t$$

where I_t is an indicator variable that takes on one if the trade is buyer-initiated and zero otherwise. Here, γ is set to be 5 transactions after the trade.

Table V reports the price impact results. Panel A presents the results for ETO-listed stocks. Although event ratios fall after the event for both the entire sample and all subgroups, they are not significantly different from zero. The results for Flex-listed stocks are reported in Panel B. The results are similar to those for ETO-listed stocks except that, in the largest trade size group, the price impact ratio for the event sample is significantly lower than that for the control sample.

[Table V]

4.4 Probability of Informed Trading (PIN)

To directly examine how informed trading is affected by option introductions, probability of informed trading (PIN), developed in Easley, Kiefer, O'Hara, and Paperman (1996), is used. This measure is developed based on the models in Easley and O'Hara (1987 and 1992). Table VI reports the PIN analysis results. Panel A presents the results for ETO-listed stocks. It indicates that there is no significant change in PIN for ETO-listed stocks after the event. The results for Flex-listed stocks are reported in Panel B. The PIN ratio for the event sample is significantly smaller than that for that for the control sample.

[Table VI]

5. Conclusion

This paper investigates the impact of option listings on the underlying market quality. This study contributes to the option listings literature by: (1) examining listings of a different type of options, Flex options, and (2) using matched portfolio method. Cumulative Abnormal Returns (CARs) for ETO-listed stocks rise about 20 days prior to the event, then drops below zero subsequent to the event. On the other hand, CAR for Flex-listed stocks increases after the event. Volatility for both types of stocks remains unchanged after option introductions. This paper provides evidence that the price impact of large trades for Flex-listed stocks fall after the introduction of options. Finally, a significant portion of informed trading occurs in the market for Flex options after the introduction of options.

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Figure 1

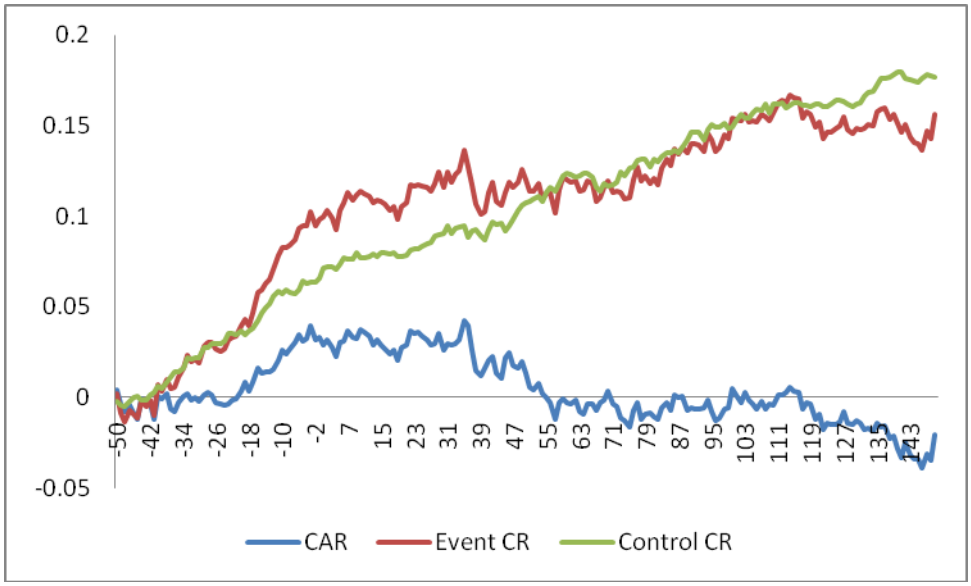

Figure 2

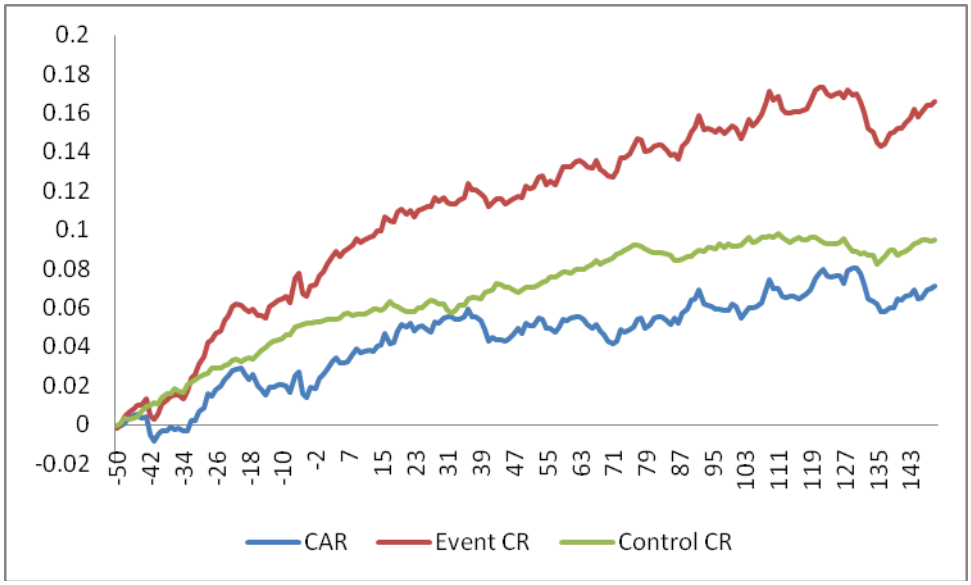

Table I

Option Listing Dates for Sample Firms: from 1993 to 2006

Year	ETO	FLEX
1993	7	n/a
1994	2	n/a
1995	1	n/a
2001	2	1
2002	2	4
2003	10	7
2004	1	7
2005	n/a	11
2006	2	6
2007	n/a	1
Total	27	37

Table II

Cumulative Abnormal Returns (CARs) Surrounding Option Listings

Days	Mean	p-value
Panel A: Exchange Traded Options (ETOs)		
(-50,-1)	0.0508	0.08
(0,10)	0.0031	0.84
(0,30)	-0.0083	0.69
(0,50)	-0.0205	0.59
(0,100)	-0.0376	0.34
Panel B: Flex Options		
(-50,-1)	0.0149	0.54
(0,10)	0.0121	0.17
(0,30)	0.0339	0.02
(0,50)	0.0336	0.10
(0,100)	0.0370	0.27

Table III

Volatility Measures Surrounding Option Listings

Type	Event Sample	Control Sample	Difference
Panel A: Variance Test			
Mean			
ETO	1.0505	1.0654	-0.0149
FLEX	1.2033	1.1072	-0.0402
Median			
ETO	0.8848	1.1072	-0.2224
FLEX	0.9468	1.0025	-0.0557
Panel B: Squared Return Test			
Mean			
ETO	1.0420	1.0549	-0.0129
FLEX	1.1964	1.2171	-0.0207
Median			
ETO	0.8803	1.0881	-0.2078
FLEX	0.9360	0.9902	-0.0542

Table IV

Percentage Bid-Ask Spreads Surrounding Option Listings

Type	Percentage Quoted Spreads			Percentage Effective Spreads		
	Event	Control	Difference	Event	Control	Difference
			Panel A: Mean			
ETO	0.8549**	0.8504**	0.0045	0.8549**	0.8505**	0.0044
FLEX	0.8693**	0.8933**	-0.0240	0.8694**	0.8934**	-0.0240
			Panel B: Median			
ETO	0.8433**	0.8427**	0.0006	0.8434**	0.8427**	0.0007
FLEX	0.8695**	0.8859**	-0.0164	0.8695**	0.8859**	-0.0164

Table V

Price Impact of a Trade Surrounding Option Listings

	Event Sample	Control Sample	Difference
Panel A: ETOs			
All trade sizes	0.9262**	0.9570**	-0.0308
Size group 1 (Smallest)	0.9001***	0.9382***	-0.0381
Size group 2	0.9059***	0.9393***	-0.0334
Size group 3	0.9182***	0.9434***	-0.0252
Size group 4 (Largest)	0.9082***	0.9469***	-0.0387**
Panel B: FLEX options			
All trade sizes	0.9518***	0.9507***	0.0011
Size group 1 (Smallest)	0.9504***	0.9411***	0.0093
Size group 2	0.9584***	0.9515***	0.0069
Size group 3	0.9584***	0.9593***	-0.0009
Size group 4 (Largest)	0.9505***	0.9725***	-0.0220**

Table VI

Probability of Informed Trading (PIN) Surrounding Option Listings

Type	Event Sample	Control Sample	Difference
	Panel A: Mean		
ETO	0.9550	0.9312	0.0238
FLEX	0.8869**	1.0138	-0.1269**
	Panel B: Median		
ETO	0.8499	0.9024	-0.0525
FLEX	0.9458**	1.0095	-0.0637**