The Information Content of Undisclosed Limit Orders Around Broker Anonymity

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Abstract

This paper examines the impact of the submission of undisclosed limit orders and their short-term information content compared to similar disclosed orders. We also examine whether the abolishment of broker identifiers from trading screens on the Australian Securities Exchange affects the short-term information content of various order types. Results indicate that aggressively submitted undisclosed orders, compared to similar disclosed-limit orders, lead to significantly higher short-term price movements. The removal of broker identifiers does not provide consistent evidence of any changes in the short-term information content of large dollar volume orders. This suggests that disclosed orders provide more information to the market than do broker identifiers.

Keywords: Australian Securities Exchange, Market microstructure, Transparency, Undisclosed limit orders, Broker identifiers, Hidden orders

JEL Classification: G11, G14

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1. INTRODUCTION

The role of a limit-order book for a fully order-driven market, such as the Australian Securities Exchange (ASX), is to provide a central trading platform for the simultaneous submission, execution, cancellation and amendment of orders. Investors provide liquidity in an order-driven market through the submission of orders, but are susceptible to a number of exposure risks. For any limit-order trader, various exposure risks can include i) being front-run by other orders, ii) risk of non-execution, iii) revealing their trading intentions to the market and iv) trading with informed traders (D'Hondt, De Winne & Francois-Heude 2003). To overcome the exposure of revealing limit orders in the order book, many exchanges worldwide have introduced a hidden limit order (HLO) type.[2] Hidden orders placed in the order book alter an important attribute of trading, allowing traders to protect their trading intention from other market participants (in particular, actions of herding or mimicking of trades). From an exchanges point of view, the introduction of hidden orders allows greater flexibility for investors, potentially attracting greater depth in the order book. Pardo and Pascual (2003) documented the use of hidden orders within the Spanish Stock Exchange, finding that hidden orders are used as a tool to mitigate information-asymmetry risk for liquidity suppliers. Anand and Weaver (2004) investigated hidden orders on the Toronto Stock Exchange and found that hidden orders increase the inside depth of the order book.

While international markets enable investors to place hidden orders, each exchange differs in its rules of execution and disclosure limits.[3] The characteristics of HLOs on the ASX (undisclosed limit orders (ULOs)), differ from hidden orders (e.g. iceberg-type orders) implemented in many other financial markets in three major areas. First, ULOs do not sacrifice time priority in the order book, while iceberg orders do. Second, after submission of a ULO, the designation '/u' is placed in the quantity field in the order book, while iceberg orders exist as a single disclosed order with a specified quantity. Third, once the ULO dollar value falls below $200,000, it simply exists as a disclosed limit order (DLO).[4] Iceberg orders exist as a limit order with a partial fraction of the total volume disclosed in the order book. Once this disclosed portion is executed, the iceberg order replenishes itself in the order book and this process continues until the order quantity is exhausted.

Several papers examine the use of HLOs on the ASX. Aiken et al. (1996) found that in 1993 a total of 6% of all submitted orders were hidden, accounting for 28% of total volume. Aitken et al. (2001) found that the use of hidden orders on the ASX reduces the option value of limit orders; specifically, that the submission of ULOs is negatively related to the relative tick size and trading activity, but positively related to volatility and order value. They also found no evidence that ULOs are more frequently used by informed traders than DLOs. Aiken et al. (2003) observed that the main determinants of the size of a submitted ULO are confounded by both price volatility and liquidity levels. They suggested that the occurrence of a ULO in stocks may provide a signal of the possibility of a new information event in the market. Allen et al. (2007) examined the price impact of the submission of ULOs and matched these orders to similar DLOs and MOs. Their findings suggest that large-dollar orders have a significant price impact on the order book (for the first ten minutes), but when

[2] Hidden orders represent both iceberg and undisclosed order types.

[3] See for example, Comerton-Forde and Rydge (2006) for details about hidden order properties used within Asia-Pacific Stock exchanges.

[4] The minimum dollar order value of a ULO is $200,000. See Aiken et al. (2001) for changes in undisclosed threshold limits on the ASX.

comparing ULOs to similar DLOs and MOs, no significant return differences are evident.

Several studies examine HLOs from many internationally recognised exchanges. First, Harris (1996) showed that 74% of all submitted orders for 300 stocks traded on the Paris Bourse are not fully disclosed when the order size is greater than FF500,000. Degryse (1999) found that on the Brussels CATS, hidden orders account for over 16% of all submitted orders in the order book. Furthermore, Hasbrouck and Saar (2002) found that approximately 3% of all hidden orders are executed on the Island Electronic Communication Network (ECN). This small percentage, however, equates to 12% of all order executions. For stocks belonging to the CAC40 index, D'Hondt, De Winne and Francois-Heude (2003) found that approximately 5% of all submitted orders contain a hidden component. Additionally, they found that hidden depth accounts for over 45% of total depth available at the best five quotes. Finally, Anand and Weaver (2004) found that on the Toronto Stock Exchange, submitted hidden orders account for approximately 7% of total submitted volume.

This paper departs from previous studies by examining the short-term price impact of hidden orders surrounding the introduction of broker anonymity on the ASX. The impact of broker anonymity is thoroughly documented in the literature. Foucault, Moinas and Thiessen (2007) examined the effect of broker anonymity on Paris Euronext and found that quoted bid-ask spreads decline and quoted depth decreases when broker IDs are withheld. Similarly, Comerton-Forde and Tang (2009) examined market quality when the ASX moved to an anonymous regime and found three major improvements in market quality: i) reduction in quoted spreads, ii) increase in quoted depth and iii) greater order flow. The ASX removed broker identifiers from orders on November 28, 2005, thus providing a natural experiment to examine whether the reduction in pre-trade transparency affects the preference (and information content) of hidden orders.

The rationale for abolishing broker identifiers on the ASX was to create an anonymous trading arena for traders; this was in line with many international exchanges moving to opacity.[5] Broker identifiers provide valuable information in the limit-order book; for example, they explicitly offer free information in the trading process (O'Hara 1995). The information content revealed through broker identifiers is another example of exposure risk that a limit-order trader faces. Intuitively, the submission of a hidden order in the post-anonymity period should serve as a 'double' concealment from exposure risk, as both the broker identity and order quantity are concealed. The focus of this study is to assess the market's response to the submission of hidden orders around this market reform.

Results indicate that aggressively placed hidden orders incur significant price impact compared to similar DLOs within the first 10 minutes of submission. Further examination of hidden orders around broker anonymity finds limited evidence that additional information is contained in broker identifiers for large-dollar orders. Numerically, return differences are negligible after the removal of broker identifiers across both order directions and all levels of order aggressiveness. Finally, the results for comparable hidden orders surrounding the change to anonymity reveal inconclusive evidence for the value of broker identifiers. Return differences for

[5] The exception has been the Korean Stock Exchange (KSE), which moved from opacity to a transparent market by revealing broker identifiers on October 25, 1999.

hidden orders are insignificant across both order directions and across all levels of order aggressiveness.

The remainder of the paper is organised as follows: Section 2 describes the data and method and develops several testable hypotheses. Section 3 discusses the empirical results, while Section 4 concludes.

2. DATA DESCRIPTION

The order-by-order data are provided by the Security Industry Research Centre of Asia-Pacific (SIRCA), which allows for the full reconstruction of the limit-order book during the sample period. The data include every order submitted on all traded equity securities on the ASX from 30 May, 2005 to 26 May, 2006. For each order, the data comprise information on price, order quantity, timestamp (to the nearest hundredth of a second), direction (either a buy or a sell), prevailing best bid and ask at the time the order was submitted and an identifier indicating how the order was submitted (either as an ULO, MO or DLO).[6] Since the ASX opens with a pre-auction (at 10am) and closes with a pre-close auction (at 4pm), the dataset captures normal trading activity from 10:30 to 15:30 to avoid any potential bias from these auctions.

The method for examining the information content of ULOs stems from the methodology described in Allen et al. (2007), who examined the information content of ULOs based on various levels of order aggressiveness categories. Instead of examining trades, they considered order placement to be more informative. Empirical studies such as Biais, Hillion and Spatt (1995), Pascual and Veredas (2003) and Ranaldo (2004) all considered order flow as informative at various levels of aggressive trading strategies. Coppejeans and Domowitz (2002) showed that trades in the order book have different information content compared to submitted orders, and highlighted the information content behind order cancellations. Walsh (1997) provided empirical evidence suggesting that order flow is more informative in terms of information content than trades on the ASX. Harris and Panchapagesan (2005) and Kaniel and Liu (2006) suggested that the order book contributes to price discovery.

Price submission reaction is likely to differ for various order types at various levels of aggressiveness. Three explicit levels of order aggressiveness are examined in this paper:

1) Aggressive limit order (ALO) – orders submitted at or better than the best price on the same side of the book, but less than the best price on the opposite side;
2) Less-aggressive limit order (LALO) – orders submitted behind the best price, but within two ticks of the best price on the same side of the book;
3) Aggressive limit order cancellation (ALOC) – orders cancelled while positioned at the best price of the order book.

This paper matches a submitted ULO to a similar DLO and MO, where the only defining difference is how the orders are submitted. A successful match of a DLO or MO must be 1) within 10 percent of dollar volume to the submitted ULO; 2) submitted within 30 days of the ULO but be within 10 minutes of the submitted ULO; 3) be in the same direction to the ULO (i.e. the same side of the order book); 4) submitted in the same position of the order book as the ULO; and 5) the same order category as the ULO (i.e. the matching order to the ULO is either submitted, as with

[6] We also have order number in the dataset, thus allowing us to identify how the order progresses in the order book.

an ALO or LALO, or deleted, as with an ALOC).[7] Additionally, we extend the Allen et al. (2007) methodology by matching on stock code (i.e. the matching DLO or MO is the same stock as the ULO), keeping the information content between orders firm-specific. Finally, we match by event period: the successful matched order is submitted in the same event period, either before or after the removal of broker identifiers. Any ULOs that do not satisfy all of the above criteria are deleted.

Short-term returns are calculated at intervals of 1, 2, 5 and 10 minutes by capturing the price movement on the opposite side of the order book of the submitted order. The use of the opposite-side quotes avoids the problem of capturing improvements in the original quote resulting from an increased supply of liquidity of new limit orders, as this improvement does not necessarily reflect any new order information in the order book (Aiken et al. 2001).

For buy orders, the short-term order return is:

$$\text{Return}_{\text{buy}} = \ln\left(\frac{\text{Prevailing Ask Price}_t}{\text{Prevailing Ask Price}_0}\right)$$

and for sell orders the short-term order return is:

$$\text{Return}_{\text{sell}} = \ln\left(\frac{\text{Prevailing Bid Price}_t}{\text{Prevailing Bid Price}_0}\right)$$

where t = 1, 2, 5 and 10 minutes after the submission of the ULO. For market orders, the same-side quote is used to calculate the short-term return; in other words, for a buy order the log of the prevailing bid price after 1, 2, 5 and 10 minutes is divided by the log of the prevailing bid price when the order was initially submitted. Finally, the day-close return is calculated as:

$$\text{Return}_{\text{close}} = \ln\left(\frac{\text{Daily Closing Price}}{(\text{Prevailing Bid Price}_0 + \text{Prevailing Ask Price}_0)/2}\right)$$

Refining the matched order dataset, any returns greater than 10% within the first 10 minutes are removed from the matched dataset. Any returns greater than 10% are not likely linked with the submission of the ULO, but rather attributable to a firm-specific announcement or an unwarranted trading activity. Also, we remove orders that have a current stock prevailing bid price below $1.50.[8]

2.1 Hypothesis Development

In an order-driven market, limit orders are essential for liquidity provision. However, liquidity suppliers/demanders are faced with various types of exposure risk when submitting limit orders at their desired price and quantity. The likely candidates using ULOs in their strategies are informed traders or large, patient traders covering their trading position by taking advantage of the hidden element of the order type (Allen et

[7] These matching criteria originate from Aiken et al. (2001), and were developed to measure the information content of ULOs compared to DLOs.

[8] There is no explicit reason why the prevailing bid price is used as a reference. Removing the stocks with prevailing bids below $1.50 removes only 3% of all matching orders from the dataset. Stocks with prevailing bid prices below $1.50 are mostly illiquid stocks on the ASX that exhibit strong deviations in returns in the short horizon. To further test this we remove stocks with prevailing bid prices below $2.00; the results mimic that of the presented analysis.

al. 2007). Distinctively on the ASX, the order quantity of a ULO is hidden, not the submission.[9] We hypothesise that the submission of ULOs contains additional information, specifically in terms of the short-term price movement, in comparison to matched DLOs and MOs, while keeping the level of pre-trade transparency constant. Specifically, we hypothesise:

H_1: The mean price reaction between ULOs and matching DLOs or MOs is significantly different (keeping transparency constant).

The removal of broker identifiers is commonplace across exchanges worldwide. The question arises in this study whether the movement by the ASX to a more opaque regime causes any changes in the information content between the matched orders. Before broker anonymity, traders could identify the submission of orders by brokers; this in turn gave market participants a more educated guess about whether orders were possibly informed. Since the removal of broker identifiers from trading screens, the question proposed is whether the information content of hidden orders changes when the market cannot infer which brokers are taking these positions. Specifically, we hypothesise:

H_2: The mean price reaction between ULOs and matching DLOs or MOs is significantly different surrounding the removal of broker identifiers.

The use and availability of hidden orders are important for exchanges as they allow investors to take large positions without disclosing their total order volume to the market. The removal of broker identifiers from trading screens allows us to examine whether the short-term price reaction of ULOs differs with the switch to anonymity:

H_3: The mean price reaction to ULOs is significantly different with the removal of broker identifiers.

3. RESULTS

Table 1 reports the number of matches from the criteria described in Section 2. Results are reported for before ("pre") and after ("post") the event, across both trade directions of the submitted order (buy and sell) and across the levels of order aggressiveness (ALO, LALO, ALOC and MO).[10] In total, there are 5,170 matched orders between ULOs and both DLOs and MOs. Table 2 presents summary statistics for all orders that are matched across the entire dataset.[11] Univariate results shows similarity for various order-placement strategies across a number of measures. The average trade size is $902,000 for ULOs, $822,000 for DLOs and $423,000 for MOs. Execution costs measured by dollar-quoted spreads are $0.0135 for ULOs, $0.0130 for DLOs and $0.0125 for MOs.

[9] The flagging of the symbol "/u" in the order book highlights the presence of a ULO order with a dollar volume of at least $200,000.
[10] For market orders the only order-aggressiveness type is ALO.
[11] "Matching orders" refers to matches between ULO and DLO and between ULO and MO.

Table 1
Number of Matches

This table reports the number of matches that result between ULOs and DLOs, and between ULOs and MOs. Figures are reported for six months before ("pre") and after ("post") the event date of anonymity across each order direction and order-aggressiveness type. The various levels of order aggressiveness examined are aggressive limit order (ALO), less-aggressive limit order (LALO), aggressive limit order cancellation (ALOC) and market order (MO), respectively.

Order Aggressiveness Type	Event Period	Number of Matches
Panel A: Buys		
ALO	PRE	877
	POST	939
LALO	PRE	163
	POST	234
ALOC	PRE	38
	POST	56
MO	PRE	199
	POST	192
Panel B: Sells		
ALO	PRE	848
	POST	794
LALO	PRE	134
	POST	208
ALOC	PRE	28
	POST	46
MO	PRE	219
	POST	195

Tables 3 and 4 examine the differences in percentage returns from placing a ULO compared to a similar disclosed order.[12] The differences in returns capture the additional information content that the market perceives from the submission of ULOs. Table 3 provides results of the mean differences in percentage returns for buy orders. The ALO type indicates strong statistical disparity between matched orders (i.e. ULOs and DLOs). The positive mean return differences indicate, on average, a greater movement in the best ask price after the submission of ULOs compared to DLOs. We find these significant differences are consistent in both the pre- and post-anonymity periods. This possibly signals the presence of informed traders or a new information event not reflected in current prices. For the other order-aggressiveness types (LALO, ALOC and MO), no significance return differences are documented.

[12] Effects from differences in firm size are negligible in this study: 75.9% of orders fall under the category of the top 20 actively traded ULOs in the dataset. Anand and Weaver (2004) suggest that hidden-limit orders occur in the most active stocks, where the chance of non-execution is small. Since the dataset is dominated by the top 20 ULO stocks, which consequently are highly liquid stocks on the ASX, differences in firm capitalisation are not likely to affect results.

Table 2
Summary Statistics: Matched Orders

This table reports summary statistics for all matched orders. The summary statistics capture average dollar volume, bid-ask spread, proportional bid-ask spread and daily volume across the mean, standard deviation, minimum and maximum for each order type, respectively.

	Mean	Standard Deviation	Minimum	Maximum	Number of Obs.
Panel A: Average volume ('000) (per order)					
ULO	822	1028	200	12030	5170
DLO	902	1155	200	11700	4365
MO	423	369	200	4052	805
Panel B: Bid-ask spread (dollars)					
ULO	0.0135	0.0097	0.0010	0.1400	5170
DLO	0.0130	0.0096	0.0010	0.1500	4365
MO	0.0125	0.0072	0.0050	0.1000	805
Panel C: Proportional bid-ask spread (%)					
ULO	0.17	0.22	0.01	4.88	5170
DLO	0.17	0.23	0.01	4.65	4365
MO	0.12	0.11	0.01	1.05	805
Panel D: Daily average volume ('000) (per day)					
ULO	777	314	249	2433	251
DLO	851	356	285	2182	251
MO	394	295	201	3090	251

The results for sell orders in Table 4 are consistent with the findings for buy orders. The significant differences in returns are witnessed within the ALO type across both event periods. The negative mean return differences indicate, on average, a greater movement in the best bid price after the submission of ULOs compared to DLOs. Neither LALOs, ALOCs nor MOs show any evidence of returns differences.

The second hypothesis examines whether the change in pre-trade transparency has any effects on the short-term information content between ULOs to DLOs and ULOs to MOs. Table 5 presents results for buy and sell orders across all order aggressiveness types. For ALO-type buy orders, there is no conclusive evidence that the reduction in pre-trade transparency affects return differences. That is, the differences in returns in the information content of ULOs compared to DLOs before and after the removal of broker identifiers is negligible. For instance, the change in mean return differences for aggressive matched orders at the 1-minute interval is -0.004%, at 2 minutes 0.011%, at 5 minutes -0.017% and at 10 minutes 0.009%. The only significant difference in returns (at the 10% significance level) is attributable to market orders at the 5- and 10-minute intervals. As with buy orders, sell-order results indicate no significant changes in the short-term information content after the removal of broker identifiers. This suggests that broker identifiers provide no additional information for large-dollar orders if order quantity is concealed.

Table 3
Buy Orders: Mean Difference in Returns

This table summarises the results of the mean return differences across all order-aggressiveness types for the matches established between ULOs to DLOs for buy orders. Panel A (Panel B) presents the result for the pre- (post-) anonymity period. The levels of order aggressiveness examined are aggressive limit order (ALO), less-aggressive limit order (LALO), aggressive limit order cancellation (ALOC) and market order (MO). Values in parentheses are t-values for the null hypothesis that the difference in the mean is zero. All return differences are expressed as percentages.

Buy Orders	Order Type	Time Interval				
		1 min	2 min	5 min	10 min	Day Close
Panel A: Pre-anonymity						
(ULOs - DLOs)	*ALO*	0.027	0.038	0.024	0.034	-0.024
		(2.92)	(3.78)	(1.97)	(2.34)	(-0.60)
	LALO	0.023	0.022	0.034	0.065	0.136
		(1.39)	(1.54)	(1.25)	(2.10)	(1.45)
	ALOC	-0.018	-0.022	0.021	0.000	0.114
		(-0.37)	(-0.41)	(0.60)	(0.00)	(0.73)
(ULOs - MOs)	MO	0.017	0.022	-0.039	-0.032	0.042
		(1.36)	(1.35)	(-1.10)	(-1.46)	(0.54)
Panel B: Post-anonymity						
(ULOs –- DLOs)	*ALO*	0.031	0.027	0.041	0.024	-0.112
		(4.42)	(3.31)	(4.15)	(2.07)	(-2.49)
	LALO	0.001	-0.006	-0.008	0.002	0.071
		(0.11)	(-0.49)	(-0.53)	(0.08)	(0.83)
	ALOC	0.015	0.050	-0.008	0.057	0.256
		(0.36)	(0.95)	(-0.19)	(0.76)	(1.17)
(ULOs - MOs)	MO	0.007	-0.003	0.034	0.034	-0.136
		(0.54)	(-0.25)	(1.58)	(1.49)	(-1.22)

Table 4
Sell Orders: Mean Difference in Returns

This table summarises the results of the mean return differences across all order-aggressiveness types for the matches established between ULOs to DLOs for sell orders. Panel A (Panel B) presents the result for the pre- (post-) anonymity period. The levels of order aggressiveness examined are aggressive limit order (ALO), less-aggressive limit order (LALO), aggressive limit order cancellation (ALOC) and market order (MO). Values in parentheses are t-values for the null hypothesis that the difference in the mean is zero. All return differences are expressed as percentages.

Sell Orders	Order Type	Time Interval				
		1 min	2 min	5 min	10 min	Day Close
Panel A: Pre-anonymity						
(ULOs - DLOs)	*ALO*	-0.023	-0.019	-0.033	-0.058	-0.083
		(-3.40)	(-2.14)	(-2.67)	(-3.74)	(-1.97)
	LALO	-0.009	-0.009	-0.004	-0.009	0.131
		(-1.11)	(-0.81)	(-0.25)	(-0.44)	(1.11)
	ALOC	0.003	-0.020	-0.030	-0.081	-0.052
		(0.05)	(-0.38)	(-0.41)	(-0.61)	(-0.25)
(ULOs - MOs)	MO	-0.010	-0.014	-0.022	-0.028	-0.104
		(-1.58)	(-1.58)	(-1.57)	(-1.60)	(-1.39)
Panel B: Post-anonymity						
(ULOs - DLOs)	*ALO*	-0.027	-0.036	-0.043	-0.029	-0.030
		(-3.83)	(-4.51)	(-4.40)	(-2.16)	(-0.71)
	LALO	-0.009	-0.004	0.000	0.025	0.024
		(-0.70)	(-0.31)	(0.01)	(0.96)	(0.29)
	ALOC	0.010	0.032	-0.002	0.039	0.191
		(0.21)	(0.54)	(-0.04)	(0.67)	(1.38)
(ULOs - MOs)	MO	-0.014	-0.019	-0.017	-0.021	-0.117
		(-1.22)	(-1.31)	(-0.94)	(-0.79)	(-1.10)

The final hypothesis tests whether the same information content is attributable within hidden orders surrounding anonymity. Table 6 presents the results for buy and sell orders across various levels of order aggressiveness. For both buy and sell orders we find no significant differences in returns for hidden orders across all order-aggressiveness types. This confirms that broker identifiers do not add additional information for ULOs.

Table 5

Buys and Sells Mean Difference in Returns: Pre/Post Broker Anonymity

This table summarises the results of buy and sell mean price reaction for ULOs and matched DLOs/MO around the event date of the removal of broker identifiers. The difference in returns between the matched orders before and after removal of broker identifiers is examined for each order aggressiveness type (ALO, LALO, ALOC and MO). Values in parentheses are t-values for the null hypothesis that the difference in the mean is zero. All return differences are expressed as percentages.

	Time Interval				
	1 min	2 min	5 min	10 min	Day Close
Panel A: Aggressive limit order cancellation					
Buys					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	-0.033	-0.072	0.030	-0.057	-0.142
t-statistic	(-0.18)	(-0.70)	(1.17)	(-0.24)	(-0.48)
Sells					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	-0.007	-0.052	-0.028	-0.120	-0.243
t-statistic	(-0.26)	(-0.86)	(-0.74)	(-0.68)	(-1.01)
Panel B: Aggressive limit orders					
Buys					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	-0.004	0.011	-0.017	0.009	0.088
t-statistic	(-0.36)	(0.83)	(-1.08)	(0.50)	(1.47)
Sells					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	0.004	0.017	0.010	-0.029	-0.053
t-statistic	(0.39)	(1.43)	(0.64)	(-1.42)	(-0.88)
Panel C: Less-aggressive limit orders					
Buys					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	0.022	0.029	0.042	0.063	0.065
t-statistic	(1.24)	(1.36)	(1.49)	(1.52)	(0.63)
Sells					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	-0.001	-0.004	-0.004	-0.035	0.107
t-statistic	(-0.15)	(-0.09)	(-0.18)	(-0.94)	(0.67)
Panel D: Market orders					
Buys					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	0.009	0.025	-0.073	-0.066	0.178
t-statistic	(0.50)	(1.24)	(-1.83)	(-1.95)	(1.30)
Sells					
$(ULOs - DLOs)_{PRE} - (ULOs - DLOs)_{POST}$	0.004	0.005	-0.006	-0.008	0.012
t-statistic	(0.28)	(0.31)	(-0.31)	(-0.46)	(0.09)

Table 6
Buys and Sells Mean Difference in Returns: Hidden Orders

This table summarises the results of buy and sell mean return difference for ULOs. The difference in returns between matched ULOs before and after removal of broker identifiers is examined for each level of order aggressive type (ALO, LALO and ALOC). Values in parentheses are t-values for the null hypothesis that the difference in the mean is zero. All return differences are expressed as percentages.

	Time Interval				
	1 min	2 min	5 min	10 min	Day Close
Panel A: Aggressive limit order cancellation					
Buys					
$ULOs_{PRE}$ - $ULOs_{POST}$	-0.005	-0.015	-0.034	-0.002	-0.017
t-statistic	(-0.22)	(-0.66)	(-1.35)	(-0.06)	(-0.15)
Sells					
$ULOs_{PRE}$ - $ULOs_{POST}$	0.032	0.034	0.017	0.046	0.127
t-statistic	(1.54)	(1.30)	(0.60)	(1.35)	(1.42)
Panel B: Aggressive limit orders					
Buys					
$ULOs_{PRE}$ - $ULOs_{POST}$	-0.001	0.002	-0.016	0.011	-0.017
t-statistic	(-0.05)	(0.24)	(-1.39)	(0.55)	(-0.39)
Sells					
$ULOs_{PRE}$ - $ULOs_{POST}$	0.015	0.006	0.015	0.002	0.067
t-statistic	(1.51)	(1.19)	(1.26)	(0.12)	(1.51)
Panel C: Less-aggressive limit orders					
Buys					
$ULOs_{PRE}$ - $ULOs_{POST}$	0.003	0.021	0.019	0.014	0.040
t-statistic	(0.34)	(1.60)	(1.40)	(0.62)	(0.61)
Sells					
$ULOs_{PRE}$ - $ULOs_{POST}$	0.017	0.010	0.011	-0.005	0.078
t-statistic	(1.40)	(0.54)	(0.55)	(-0.26)	(1.01)

4. CONCLUSION

This paper examines the information content of ULOs on the ASX, as well as assessing the effects of removing of broker identifiers from trading screens on the information content between various order-placement strategies. Results from this analysis demonstrate three key findings. First, the submission of an aggressive ULO leads to a greater price movement in the opposite quote comparable to a similar DLO when keeping the level of pre-trade transparency constant. Second, the removal of broker identifiers has no significant impact on the level of information content between the matched orders. This result is consistent across both order direction and the level of order aggressiveness. Third, there is no evidence that broker identifiers contain additional information within hidden orders for the first 10 minutes after order submission. This suggests that undisclosed orders provide more information to the market than do broker identifiers.

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