Motivations Behind Fleeting Orders

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Abstract

Algorithmic trading allows investors to respond the markets intensively within a millisecond. Hasbrouck and Saar (2009) propose that fleeting orders, the limit orders cancelled within 2 seconds after submission, play an important role in nowadays. The goal of this study is to investigate the motivation behind fleeting orders. By using index futures data in Taiwan, our results indicate that different types of investors act dissimilarly regarding limit order cancellation. Chasing winner effects are obvious for individuals. On the contrary, institutional investors place a less aggressive same side order after a cancellation. This confirms that free option cost is important for institutional investors.

Keywords: fleeting order, futures markets, limit orders, cancellation, investor types

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1. Introduction

The limit order is an order which assigns number of shares at a specified price, but may not be executed immediately. On the contrary, a market order will cause an immediate execution but the price is uncertain. Therefore, a trader is defined as a liquidity supplier when he places a limit order but a liquidity demander when he places a market order.

However, the increasing pace of technology improvement has caused significant impact on the financial trading environment. The usage of algorithmic trading changes the way people trade in the markets. Algorithmic trading allows investors to respond the markets intensively within a millisecond. They are able to do frequent, repeated, and ongoing interaction with the markets, rather than submit a limit order then sit back and wait to be executed. Active trading investors have altered how the markets view the role of limit orders.

In recent years, many studies work on the impact of high frequency trading on the market environment. Hasbrouck and Saar (2013) define low-latency activity as strategies that react to events in the millisecond environment. They document that low-latency activity actually improves markets’ quality. With high frequency trading, market depth improves with a drop of bid-ask spread. More surprisingly, low-latency activity actually assists to decrease short-term volatility.

With the arising of algorithmic trading, another phenomenon has attracted attention of the markets: a tremendous large portion and fast speed of limit order cancellation. Hasbrouck and Saar (2009) investigate data on INET. The data shows that there are 90% of orders on INET are limit orders. Among limit orders, there are 93% of them are cancelled or revised. For those cancelled, more than one third limit orders are cancelled within 2 seconds after submission. They call these orders as “fleeting orders”. The highly frequent and fast cancellation calls into question the role of limit orders in the markets.

Several studies have been working on exploring the motivations behind limit order cancellation. According to Hasbrouck and Saar (2009), fleeting orders can be explained by chasing winner, cost-of-immediacy, and searching effects. When the market moves away from the original limit price, traders cancel original limit orders and resubmit more aggressive same side limit orders. This is chasing winner effects. The intention of chasing winner effects is to get executed. Cost-of-immediacy hypothesis predicts that traders cancel original limit orders and switch to market orders when cost of
immediate execution reduces. Searching hypothesis is to look for latent liquidity.

Fong, and Liu (2010) document two risks, non-execution risk and free option risk, to explain why traders revise or cancel limit orders. They provide evidences that limit order cancellation is affected mostly by the intention to improve execution probability. Moreover, changes in market conditions, changes in the traders’ inventories of their investing stocks, and its correlated stocks can influence their cancellation behavior (Raman and Yadav (2013)).

However, data in the above studies does not identify the person who places the orders. The assumption of immediate following orders submitted by the same person brings up the doubts of evidence accuracy. In other words, the identification of strategies usage is ambiguous for each investor. In addition, the previous studies do not consider the fundamental differences between individual and institutional investors.

Early work on the comparison with individual and institutional investors indicates that trade size in shares varies with investors. Individuals and institutions are the two major groups of investors in the financial market. Most institutional investors are professional specialists or managers, who tend to be informed and have more financial asset resources than average individual investors. Conversely, the average individual investor tends to trade small quantities of shares, and small trades tend to be less informed (Easley and O’Hara (1987), Lin, Sanger,Booth (1995), and Grullon, Kannatas, and Weston (2004)).

In comparison of the stock returns between individual and institution investors, Barber, Lee, Liu, and Odean (2009) show that the performance of individuals is comparatively poor due to aggressive orders. Institution investors earn an annual 1.5 percentage point with well training in investment and market-timing. In most developed countries, individuals usually act as contrarian and institutions as momentum investors (Ng and Wu (2007)). Raman and Yadav (2013) indicate that informed investors perform better due to aggressive act of revision and cancellation of orders, which results in the decrease of portfolio’s execution costs.

Given the preceding discussion, the goal in this paper is to investigate motivation behind fast speed limit order cancellation by investor types. Furthermore, we will discuss buy and sell side orders separately. To differentiate our work from previous studies, we use a unique data set from the future markets in Taiwan that contains all orders and trades of each individual and institutional investor. Our
data allow us to identify submitted orders made by each person. By using this data, we are able to identify whether they are individual or institutional investors. Furthermore, each institutional investor can be designed as domestic institution, proprietary, or foreigners. Therefore, each investor can be assigned into one of the four categories: individuals, domestic institutions, proprietary, and foreigners.

We are the first to provide this arrangement of investors’ trade records to test individual and institutional investor’s behaviors regarding limit order cancellations in the future markets in Asia. We contribute to the literature by providing evidences of limit order cancellation among individual and institutional investors. Consistent with our predication, different types of investors act dissimilarly. Individual investors chase the winner when the price moves away from the original limit price. In other words, they cancel the original limit order and place another more aggressive same side order in order to get executed. However, domestic institutions and proprietary act the opposite way. They cancel a limit order and place a less aggressive side order. This is confirmed that institutional investors are relatively more concerned about price impact costs.

The rest of this paper is organized as follows. The next section discusses our sample and TAIFEX data, and Section 3 describes methodology. In Section 4, we present our results and conclude in section 5.

2. Sample and data

The sample we use for this study is the records of quotes, trades, and best bid and ask prices on the limit order book in the Taiwan Futures Exchange (TAIFEX). The data includes detailed investor type and identity information which allows us to study investors’ order submission behaviors and performance. Limit order book includes the best five bid and ask prices and volume for every second from open to close.

We examine contracts of Taiwan Stock Exchange Index Futures (TXF) expired in September, 2008. The front month is usually the most active. Therefore, we only include the most active days from August 1, 2008 to September 17, 2008.

Table 1 presents summary statistics for TAIFEX orders. This table includes frequency and trade volume information for limit and market orders. In addition, we also show information regarding
Individual investors place 285,393 market orders with total 536,800 contracts. Among 1,124,852 limit orders they submitted during this period, 431,771 orders were cancelled. Cancellation ratio for individual investors is 37.8%. The major institutional players in this market are proprietary who submit 99.8% limit orders. Among these limit orders, 79% of them were cancelled. For domestic institutions and foreigners, cancellation ratios are 28.4% and 73.9%.

< Insert Table 1 >

In Table 2, we further demonstrate execution status in this market. Around 62.6% limit orders submitted by individuals are partially or fully executed. The execution rate for domestic institutions is 74.02%. However, the execution rate for proprietary is only 18.79%. Foreigners also have low execution rate, which is 16.45%. The main institutional investors in this market are proprietary. Cancellation rate for proprietary is twice of the rate for individual investors. Therefore, it is very important to identify investors’ type if we want to study investors’ behaviors regarding order cancellation. Each type of investor has fundamental difference in their cancellation behaviors.

< Insert Table 2 >

To extend Hasbrouck and Saar (2009)'s research, we present estimated cumulative probabilities of cancellation within different time intervals in Table 3. According to Hasbrouck and Saar (2009), fleeting orders are defined as limit orders cancelled within 2 seconds after submission. Our finding indicates that different types of investors reverse the results regarding fleeting orders. For proprietary, 48.2% of limit orders are cancelled within 2 seconds after submission. Linked with previous statistics, proprietary submits 99.8% limit orders. Among limit orders, 79% of them are cancelled. For these cancelled, almost of half of them are cancelled within 2 seconds. Such a high portion of fleeting orders makes proprietary a very unique type of investors in this market. Foreigner is another type of investors who cancel fast. One third of their cancellation occurs within 2 seconds after submission. However, fleeing orders are not frequently placed by individuals and domestic institutions. This again confirms our prediction that different types of investors will act differently.

< Insert Table 3 >
3. Methodology

We employ the standard measure of proportional hazard rate model proposed by Cox (1972) by using survival analysis. Followed by the statistics of model structure from Hasbrouck and Saar (2009), cancellation stands for event of interest. The survival function is \( S(t) = Pr(T > t) \), where \( T \) is when a limit order is cancelled. According to Allison (2010), the hazard rate model for limit order \( i \) of investor \( j \) is written as

\[
I_{jt}^? (t) = I_{0j}^? (t) e^{X_{i,j,t}l^2_j}
\]

where \( I_{0j}^? (t) \) is a baseline hazard rate for investor \( j \), which is unspecified and non negative. \( X_{i,j,t} \) are explanatory variables at time \( t \). To be specific, the model we are using is

\[
I_{jt}^? (t) = I_{0j}^? (t) \exp \left[ I_{1a}^{\text{Same}} + I_{1b}^{\text{Relative}} + I_{23} \left( \text{Order}_{i,j} \right)^{\text{Lagged Fleeting}} + I_{24} \left( \text{Volume}_{i,j} \right)^{\text{Lagged Volume}} + I_{25} \left( \text{Return}_{i,j} \right)^{\text{Lagged Return}} + I_{26} \left( \text{Interest}_{i,j} \right)^{\text{Open}} + I_{27} \left( \text{Spread}_{i} \right)^{\text{BBO Spread}} \right]
\]

To control investor specific and market conditions, we include the following explanatory variables:

- \# Lagged Fleeting Orders\(_{i,j}\): number of limit orders are cancelled within 2 seconds after submission ten seconds prior limit order \( i \) submission of investor \( j \).
- Lagged Volume\(_{i,j}\): total trade volume 5 minutes prior limit order \( i \) submission.
- |Lagged Return\(_{i,j}\)|: market volatility 5 minutes prior limit order \( i \) submission.
- \# Open Interest\(_{i,j}\): number of open interest prior limit order \( i \) submission of investor \( j \). Negative means short selling.
- BBO Spread\(_{i}\): Best bid and ask price spread prior limit order \( i \) submission.

The key variables in this study are \( a??q_{i,j,t}^{\text{Same}} \) and \( p_{i,j}^{\text{Relative}} \). To test chasing winner hypothesis,
we directly observe if an investor places a more aggressive same side limit order after a cancellation. For a limit buy order, $q_{i,j,t}^{\text{Same}} = \left( (\text{limit price}_{i,j,t}) - (\text{limit price}_{i,j,t=0}) \right) / (\text{limit price}_{i,j,t=0})$, where $t=0$ indicates time of order submission and $t$ stands for time of placement of following same side limit order. We expect uninformed investors will follow chasing winner hypothesis. However, informed or sophisticated investors tend to consider cost of free option. Therefore, uninformed investors will place more aggressive same side orders after a cancellation, but informed investors will not. So we predict a positive relation with fleeting orders for individual investors but the opposite direction for institutional ones. To test a sell limit order, the aggressiveness will be associated with a lower quoted price.

\[ p_{i,j}^{\text{Relative}} \] is to test the relation between aggressiveness and cancellation. For a limit buy order, $p_{i,j}^{\text{Relative}} = \left( (\text{limit price}_{i,j}) - (\text{Bid}_{i,j,t=0}) \right) / (\text{Bid}_{i,j,t=0})$, where $\text{Bid}_{i,j,t=0}$ is the best bid price at submission. To test a sell limit order, the aggressiveness will be associated with a lower quoted price. All of the variables are normalized with zero mean and unit variance.

4. Results

We report the results by investor types. In Table 4, individuals are presented in panel A. Institutional investors, including domestic institutions, proprietary, and foreigners, are shown in panel B.

The evidence confirms our prediction that not all investors behave the same. In contrast to Hasbrouck and Saar (2009)’s results, our findings indicate that only individual investors chase the market trend. Domestic institutions and proprietary does not follow the winners. Instead of placing a more aggressive same side order, they cancel original limit orders and resubmit a less aggressive same side order.

This also confirms our predictions that free option cost is important for institutional investors. Transaction costs represent significant drag on trading performance. Many efforts by competing markets are to seek lowest transaction costs across all order quantities. Among transaction costs, institutional investors are relatively more concerned with spread and price impact costs. On the other hand, individual investors that do not trade much are relatively more concerned with commission costs or explicit costs. This can be the explanation why institutional investors do not aggressively chase the markets, but individuals do. The results also confirm Raman and Yadav (2013)’s claims that informed investors
perform better due to aggressive act of revision and cancellation of orders, which results in the decrease of portfolio’s execution costs.

\[ a? \ q^{same}_{i,j,t} \] is positive for individual and foreign investors (buy side only). The possible explanation is positive feedback. According to DeLong, Shleifer, Summers, and Waldmann (1990), positive feedback investors buy stocks when prices rise and sell when prices fall. The reason why positive feedback investors exist in the stock market is that investors like to chase the trend even the price goes up. When rational investors have good news, they buy the stocks to reflect the information on the price. However, they know that the increase of the prices will trigger positive feedback trading. Therefore, they buy more stocks today and drive the prices higher than fundamentals. Those uninformed positive feedback investors chase the trend and drive the prices even higher. Although the rational investors sell stocks and try to stabilize the prices, the positive feedback investors keep the prices from fundamentals.

The informed rational investors anticipate more price rise in the future and they drive the prices from fundamentals by themselves in order to make profits. Therefore, the rising of the prices is due to part of the positive feedback investment, and part of the rational investors’ anticipation of positive feedback investment. This could be the explanation the why chasing winner effects exist simultaneously for both individual and foreign investors.

The coefficient on price aggressiveness, \( p_{i,j}^{Relative} \), is significantly positive for all of investor types. The more aggressive order has higher chance to be cancelled immediately. This is consistent with searching hypothesis. However, hidden orders are not allowed in TAIFEX. The motivation behind these cancellations can be explained by searching for hidden market orders which has not been placed. For some investors, they don’t submit order and wait for being executed. Rather, they watch closely and wait for the right timing to place market orders. To searching for these potential orders, investors place a more aggressive limit order in order to obtain the first execution priority. If no market orders hit these aggressive orders, investors cancel them immediately.

The non-price explanatory variables, \( \#\ Lagged\ Fleeting\ Orders_{i,j} \), \( Lagged\ Volume_{i} \), and \( |Lagged\ Return_{i}| \), give consistent results for all investor types. All of the coefficients are significantly positive. Investors tend to cancel limit orders fast if they get use to use fleeting orders. The more trading volume and higher return in the markets contribute the usage of fleeting orders. The only exception is individual investors’ buy side orders.
5. Conclusion

Limit orders are patient liquidity suppliers. However, the improvement of technology has changed the way people trade. High frequency trading is one of the phenomena resulted from algorithmic trading. Recent researches indicate that a significant proportion of limit order cancellation exists in the markets. We use a unique data set from the future markets in Taiwan that contains all orders and trades of each individual and institutional investor. Our results demonstrate that different types of investors act dissimilarly regarding limit order cancellation. Chasing winner effects are obvious for individual investors and foreign investors (buy side only). The possible explanation is positive feedback. Institutional investors, on the other hand, act the opposite way. Domestic institutions, proprietary, and foreigner (sell side) place a less aggressive same side order after a cancellation. This confirms that free option cost is important for institutional investors.

Transaction costs represent significant drag on trading performance. Many efforts by competing markets are to seek lowest transaction costs across all order quantities. Among transaction costs, institutional investors are relatively more concerned with spread and price impact costs. On the other hand, individual investors that do not trade much are relatively more concerned with commission costs or explicit costs. This can be the explanation why institutional investors do not aggressively chase the markets, but individuals do.

Reference

Bloomfield, R., O’Hara, M., Saar, G., 2005. The “Make or Take” Decision in an Electronic Market:
College, Oxford University.
Lin, J. C., Sanger, G. C., and Booth, G. G., 1995, Trade Size and Components of the Bid-Ask Spread,
Review of Financial Studies, 8, 1153-1183.
Journal of Banking & Finance 31:2695-2710
Order Trading. Presented at the European Finance Association Annual Conference.
53 -74.
Finance 33: 1153-1172.
Table 1 Summary Statistics for TAIFEX Orders

In this table, we present summary statistics on the orders submitted on TAIFEX. We analyze the futures contract of September, 2008 of Taiwan Stock Exchange Futures (TXF). We report variables of market orders, limit orders, and cancelled orders. Each variable is reported by total frequency and volume. Frequency is number of orders. Volume is number of contracts. Two groups of investors are reported: individuals and institutions. Three subgroups of institutions include domestic institutions, proprietary, and foreigners.

<table>
<thead>
<tr>
<th></th>
<th>Market Order</th>
<th></th>
<th>Limit Order</th>
<th></th>
<th>Cancellation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Volume</td>
<td>Frequency</td>
<td>Volume</td>
<td>Frequency</td>
<td>Volume</td>
</tr>
<tr>
<td>Individuals</td>
<td>285,393</td>
<td>536,800</td>
<td>1,124,852</td>
<td>2,394,676</td>
<td>431,771</td>
<td>901,168</td>
</tr>
<tr>
<td>Institutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic institutions</td>
<td>1,176</td>
<td>3,805</td>
<td>3,022</td>
<td>10,614</td>
<td>803</td>
<td>2,719</td>
</tr>
<tr>
<td>Proprietary</td>
<td>2,495</td>
<td>9,410</td>
<td>1,039,315</td>
<td>2,179,208</td>
<td>854,885</td>
<td>1,570,472</td>
</tr>
<tr>
<td>Foreigners</td>
<td>3,537</td>
<td>5,748</td>
<td>274,218</td>
<td>789,735</td>
<td>230,563</td>
<td>562,037</td>
</tr>
</tbody>
</table>
Table 2 Limit Order Submission Frequency and Filled Rates

In this table, we present summary statistics on the order mix and fill rate of limit orders on TAIFEX. We analyze the futures contract of September, 2008 of Taiwan Stock Exchange Futures (TXF). We report variables of percentage of limit orders and filled rates. Percentage of limit orders is calculated by number of limit orders divided by number of total orders. Two different fill rates are shown here. Partially executed filled rate considers limit orders that were at least partially executed. Fully executed filled rate considers limit orders that were fully executed. Two groups of investors are reported: individuals and institutions. Three subgroups of institutions include domestic institutions, proprietary, and foreigners.

<table>
<thead>
<tr>
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<th>Percentage of Limit Orders</th>
<th>Filled Rate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Partially Executed</td>
</tr>
<tr>
<td>Individuals</td>
<td>79.76%</td>
<td>1.06%</td>
</tr>
<tr>
<td>Institutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Institutions</td>
<td>71.99%</td>
<td>0.89%</td>
</tr>
<tr>
<td>Proprietary</td>
<td>99.76%</td>
<td>1.20%</td>
</tr>
<tr>
<td>Foreigners</td>
<td>98.73%</td>
<td>0.56%</td>
</tr>
</tbody>
</table>
Table 3 Cancellation Rate of Limit Orders

In this table, we present estimated cumulative probabilities of cancellation within different time intervals from limit orders on TAIFEX. We analyze the futures contract of September, 2008 of Taiwan Stock Exchange Futures (TXF). Two groups of investors are reported: individuals and institutions. Three subgroups of institutions include domestic institutions, proprietary, and foreigners.

<table>
<thead>
<tr>
<th>Time</th>
<th>Individuals</th>
<th></th>
<th>Institutions</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Domestic Institutions</td>
<td>Proprietary</td>
<td>Foreigners</td>
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<tr>
<td>0.3 seconds</td>
<td>0.000</td>
<td>0.000</td>
<td>0.158</td>
<td>0.018</td>
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<td>0.5</td>
<td>0.000</td>
<td>0.000</td>
<td>0.223</td>
<td>0.099</td>
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<td>1</td>
<td>0.004</td>
<td>0.000</td>
<td>0.344</td>
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<td>2</td>
<td>0.021</td>
<td>0.000</td>
<td>0.482</td>
<td>0.341</td>
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<td>5</td>
<td>0.090</td>
<td>0.007</td>
<td>0.669</td>
<td>0.562</td>
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<td>10</td>
<td>0.200</td>
<td>0.026</td>
<td>0.785</td>
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<tr>
<td>1 minutes</td>
<td>0.551</td>
<td>0.385</td>
<td>0.944</td>
<td>0.909</td>
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<tr>
<td>2</td>
<td>0.661</td>
<td>0.504</td>
<td>0.972</td>
<td>0.953</td>
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<td></td>
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<tr>
<td>10</td>
<td>0.848</td>
<td>0.771</td>
<td>0.997</td>
<td>0.983</td>
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<tr>
<td>1 hours</td>
<td>0.964</td>
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</table>
Table 4 Results of Proportional Hazard Rate Model

In this table, we present estimated cumulative probabilities of cancellation within different time intervals from limit orders on TAIFEX. We analyze the futures contract of September, 2008 of Taiwan Stock Exchange Futures (TXF). Panel A provides the results of individuals. Panel B summarizes the findings of institutional, including domestic institutions, proprietary, and foreigners. The survival function is 

\[ S(t) = Pr(T > t), \]  

where \( T \) is when a limit order is cancelled. For limit order \( i \) of investor \( j \):

\[
I_{i,j}(t) = I_{0,j} \exp \left[ I_{21} a_i q_{i,j,t}^{Same} + I_{22} p_{i,j}^{Relative} + I_{23} \left( A?Orders_{i,j} \right) + I_{24} \left( \text{Lagged Fleeting} \right) + I_{25} \left( \text{Lagged volume}_i \right) + I_{26} \left( \text{Open Interest}_{i,j} \right) + I_{27} \left( \text{BBO Spread}_i \right) \right]
\]

where \( I_{0,j}(t) \) is a baseline hazard rate for investor \( j \), which is unspecified and non negative. \( X_{i,j,t} \) are explanatory variables at time \( t \). For a limit buy order, \( a_i q_{i,j,t}^{Same} = \frac{(\text{limit price}_{i,j}) - (\text{limit price}_{i,j,t=0})}{(\text{limit price}_{i,j,t=0})} \), where \( t=0 \) indicates the time of order submission and \( t \) stands for the time of placement for the following same side limit order. \( p_{i,j}^{Relative} = \frac{(\text{limit price}_{i,j}) - (\text{Bid}_{i,j,t=0})}{(\text{Bid}_{i,j,t=0})} \), where \( \text{Bid}_{i,j,t=0} \) is the best bid price at submission. For a sell limit order, the change should be opposite. \# Lagged Fleeting Orders_{i,j}: \ number of limit orders are cancelled within 2 seconds of submission in the ten seconds prior limit order \( i \) submission of investor \( j \). \# Lagged volume_{i}: total trade volume 5 minutes prior limit order \( i \) submission. \# Lagged return_{i}: market volatility 5 minutes prior limit order \( i \) submission. \# Open Interest_{i,j}: \ number of open interest prior limit order \( i \) submission of investor \( j \). Negative means short selling. \# BBO Spread_{i}: Best bid and ask price spread prior limit order \( i \) submission. All of the variables are normalized with zero mean and unit variance.

*, ** indicate significantly different from zero at the 5% and 1% levels, respectively.
<table>
<thead>
<tr>
<th></th>
<th>$a_i^{\text{fame}}$</th>
<th>$q_{i,j}^{\text{fame}}$</th>
<th>$p_{i,j}^{\text{Relative}}$</th>
<th>Fleeting Orders</th>
<th>Lagged $i_j$</th>
<th>Lagged $i_j$</th>
<th># Open</th>
<th>BBO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Individual</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
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