Correction (first published 25 October 2021)

What makes for a wise crowd?

Analyzing information content of stock order flows

- Are order flows informative for future stock performances? If so, which type of order flow should we follow? By employing novel methodologies and datasets, we are able to go beyond simple market and limit order types and analyze their signalling effects at more granular levels.

- Consistent with our previous research, our backtesting of **retail market orders** were found to be positive predictors of future stock returns cross sectionally.

- On the other hand, we find **non-retail market orders** to be a contrarian signal in the subsequent one-day to one-week periods.

- **Limit orders** were found to be leading indicators, implying that they tend to be used by informed traders.

- We subset limit orders further by isolating **reserve limit orders**, also known as iceberg orders, and show they are more informed than generic limit orders.

Big Data, AI and High Frequency Strategy

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Introduction

Are order flows informative for future stock performances? If so, which type of order flow should we follow? By employing novel methodologies and datasets, we are able to go beyond simple market and limit order types and analyze their signalling effects at more granular levels.

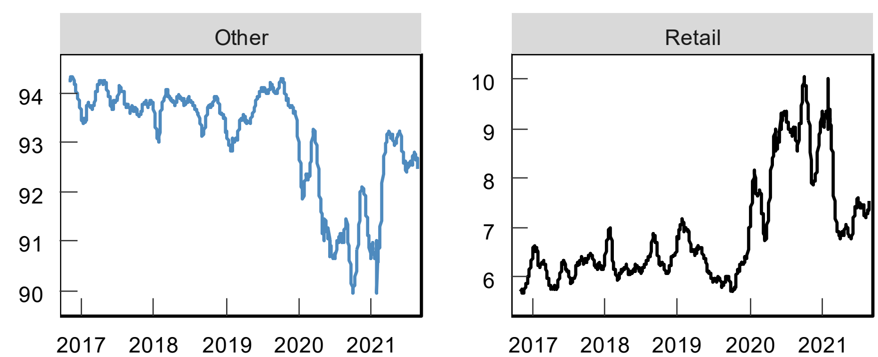
Data

Using transaction and order book data, we can infer investor type and trade directions at the tick level. In this section, we discuss the definition of each order type. In this section, we briefly describe our methodologies and data sources. Note that the discussions below pertain only to trades that take place during market hours. Pre- and post-market trades as well as open and closing auctions are excluded. A separate study on market on close (MOC) orders can be found here.

Retail vs. institutional orders: using public transaction level data, we can identify retail market orders using the BJZZ algorithm[1]. The trades that meet these conditions account for approximately 8% of the total market volume (Figure 1).

The investor type for the remaining ~90% of the trades are may be much more heterogeneous, including institional investors, broker dealers, corporate treasuries, and other market participants. Therefore we label these trades simply as “Other” or “Non-Retail.”

Figure 1: US equity market share of Retail vs. non-Retail orders



Source: J.P. Morgan

Market vs. limit orders: As discussed above, all the retail trades we identify are market orders, and the direction of the trades are esetimated using the closest round penny rule. For non-retail trades, we assume market orders to be the side that crosses the NBBO. The directions are estimated using the Lee-Ready[2] algorithm from the perspective of the market order. Limit orders and their directions are defined as the opposing side of the market orders.

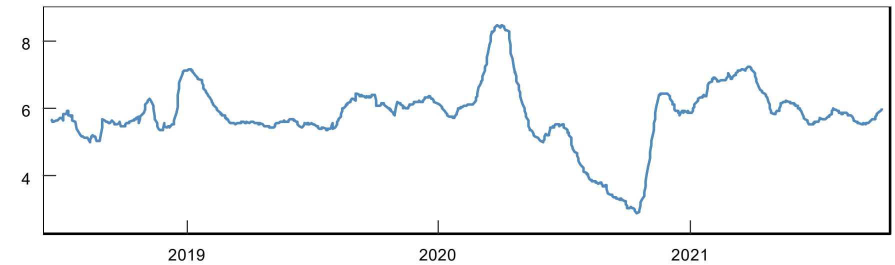
Reserve limit orders: We can also subset the limit orders further by isolating the reserve orders, also known as iceberg orders. The dataset, containing estimated reserve orders on US equities from 2018 onward, is supplied to us by Exegy, which

[1] Boehmer, E., C. M. Jones, X. Zhang, X. Zhang, 2021, Tracking Retail Investor Activity, Journal of Finance, Vol 76, 5

[2] Lee, C.M.C, M. J. Ready, 1991, Inferring Trade Direction from Intraday Data, Journal of Finance 46

uses a proprietary algorithm to identify reserve orders. Based on its estimates, the order type makes up approximately 4% of the total market and 6% of the volume during market hours (Figure 2).

Figure 2: Reserve orders make up ~6% of the market hour volume



Source: J.P. Morgan

What we know about information content of order types

Retail market orders are relatively well understood, given the abundant literature on behavioural finance[3]. They are consistently found to be positively predictors of future stock returns cross sectionally. We have also confirmed this result in our previous research.

Academic studies have found market orders to be contrarian in the subsequent one-day to one-week periods. However retail market orders are generally not separated out from these studies and therefore may be a confounding factor. In this report, we examine separately the information content of retail and non-retail market orders.

The corollary from the result on generic market orders is that generic limit orders are leading indicators over the one-day to one-week period. The effects are not fully explained by simple transaction costs or liquidity premium. This suggests that informed traders tend to use limit orders, especially if the information is long lived (e.g., over one day) [4].

Empirical studies on reserve orders in the US are scarce. However, theoretical models and empirical results from international markets suggest that they should be employed by informed traders[5]. In this report, the Exegy dataset allows us to conduct in-depth studies of the effects of reserve orders. The results for all aforementioned order types are shown in the next section.

Back test results

We collect transaction level data on Russell 3000 stocks over the last 5 years (since 2016), aggregate them at the daily frequency, and define the imbalance signal to be the following:

[3] Barber, M., T. Odean, N. Zhu, 2009, Do Retail Trades Move Markets? Review of Financial Studies, Vol 22, 1
[4] Kaniel, R., H. Liu, 2006, So What Orders Do Informed Traders Use? Journal of Business, Vol 79
[5] Kumar, K. K., R. S. Thirumalai, P. Yadav, 2021, Pre-Trade Opacity, Informed Trading, and Market Quality, working paper

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$$B_t = \sum_{i=0}^{4} \$\, buy\ orders_{t-i}$$

$$S_t = \sum_{i=0}^{4} \$\, sell\ orders_{t-i}$$

$$imbalance_t = \frac{B_t - S_t}{B_t + S_t}$$

On a given day, the Russell 3000 stocks are sorted cross sectionally by their imbalance signal. Based on our discussion in the previous section, we hypothesize that retail market, generic limit, and reserve limit orders are leading indicators, and therefore we would go short the bottom (most sold) quintile, and long the top (most bought) quintile. For non-retail market orders, we would go long the bottom quintile and short the top quintile, given our assumption that it is a contrarian indicator. The portfolios are equally weighted.

The results shown in **Error! Reference source not found.** assume the trades are entered on a daily basis at T+1 market open and held for five business days. Therefore on any given day there are five overlapping portfolios. All results are presented before transaction costs.

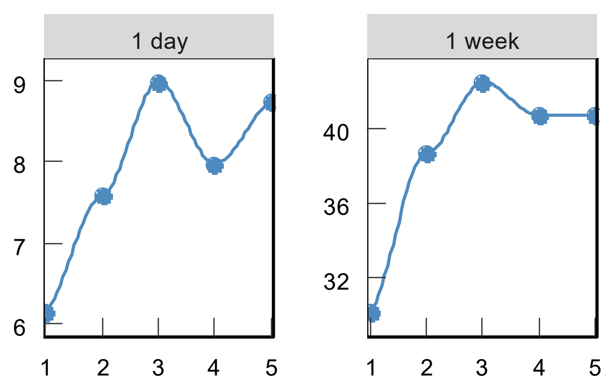
Table 1: Back test results

		Annualized					
Order Type	Direction	Return	Volatility	Sharpe	Skew	WDD	Period
Retail Market	Leading	2.9%	2.9%	1.0	0.3	-3.8%	Since 2016
Non-retail Market	Contrarian	4.3%	3.8%	1.2	1.1	-3.6%	Since 2016
Generic Limit	Leading	4.2%	3.7%	1.1	1.0	-3.6%	Since 2016
Reserve Limit	Leading	16.8%	4.7%	3.5	2.5	-1.9%	Since 2018

Source: J.P. Morgan

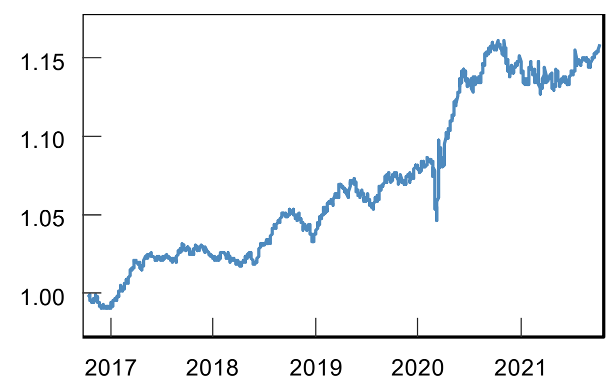
Retail market orders

Figure 3: Holding period returns by imbalance quintile (5 = most bought, 1 = most sold)



Source: J.P. Morgan

Figure 4: Cumulative performance of weekly rebalanced long/short strategy (Sharpe = 1.0)



Source: J.P. Morgan

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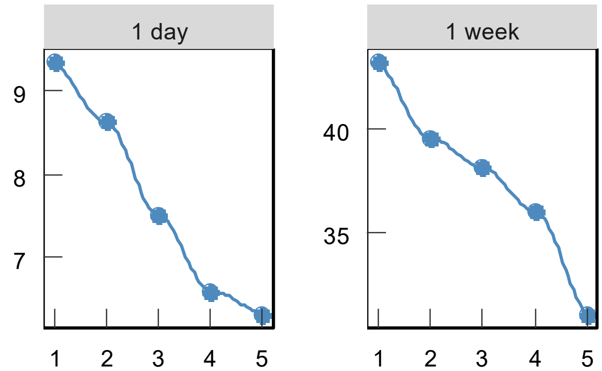
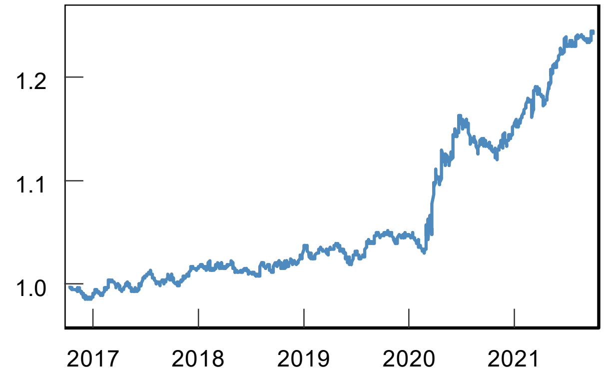
Non-retail market orders

Figure 5: Holding period returns by imbalance quintile (5 = most bought, 1 = most sold)



Source: J.P. Morgan

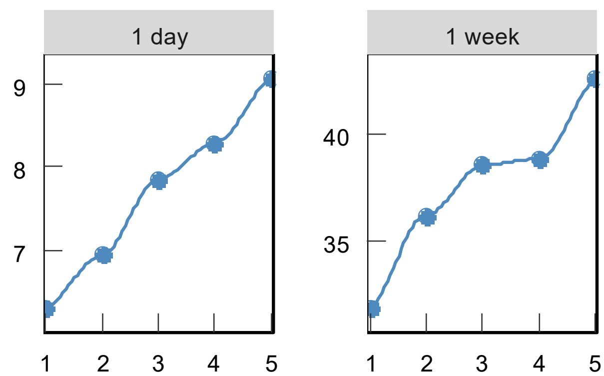
Figure 6: Cumulative performance of weekly rebalanced long/short strategy (Sharpe = 1.2)



Source: J.P. Morgan

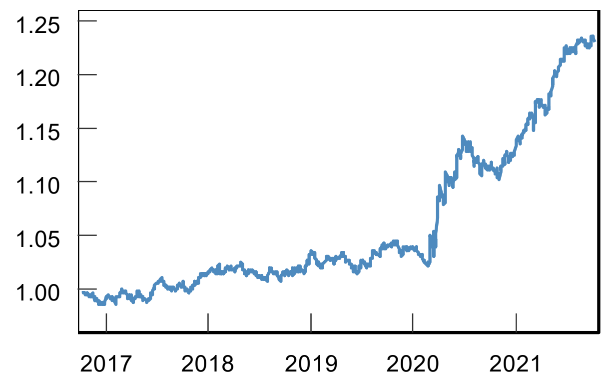
Generic limit orders

Figure 7: Holding period returns by imbalance quintile (5 = most bought, 1 = most sold)



Source: J.P. Morgan

Figure 8: Cumulative performance of weekly rebalanced long/short strategy (Sharpe = 1.1)



Source: J.P. Morgan

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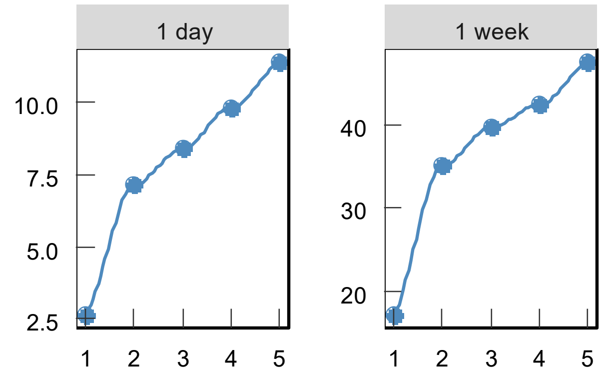
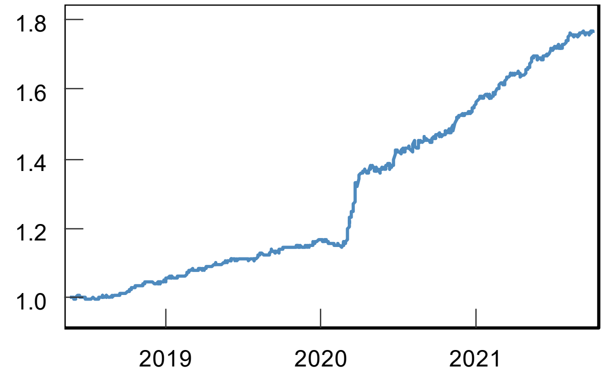
Reserve Limit Order

Figure 9: Holding period returns by imbalance quintile (5 = most bought, 1 = most sold)



Source: J.P. Morgan

Figure 10: Cumulative performance of weekly rebalanced long/short strategy (Sharpe = 3.5)

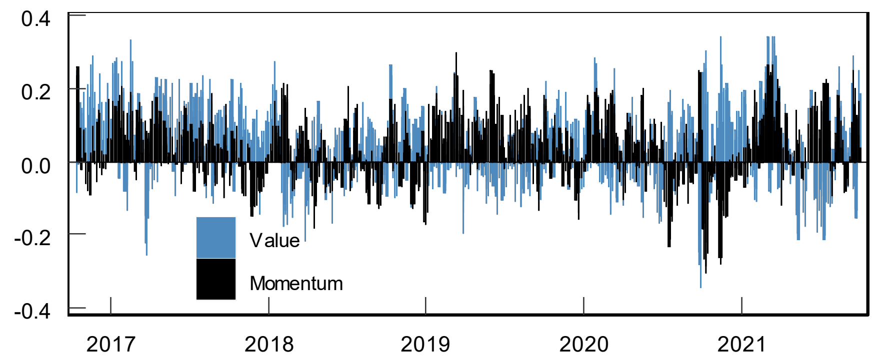


Source: J.P. Morgan

Factor Analysis

For each order type, we compute the net factor exposure of the top/bottom quintiles, in order to understand the potential factor bias. In this section we show only the Value and Momentum exposures for illustrative purposes. For **Retail market order flows**, the factor exposures appear to be largely neutral overall (Figure 11). This is consistent with our previous studies.

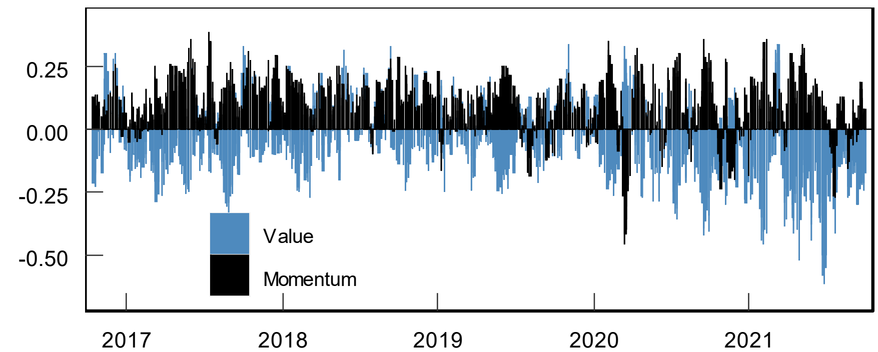
Figure 11: Retail market orders top/bottom quintile net factor exposure



Source: J.P. Morgan

Non-retail market orders exhibit a persistent bias toward long Momentum and short Value (Figure 12). We can infer that much of the users or market orders tend to be Momentum traders. This makes sense as Momentum strategies by definition demand immediacy. **Generic limit order** factor exposures are by definition largely the mirror image of Figure 12 and are therefore not shown here for the sake of brevity.

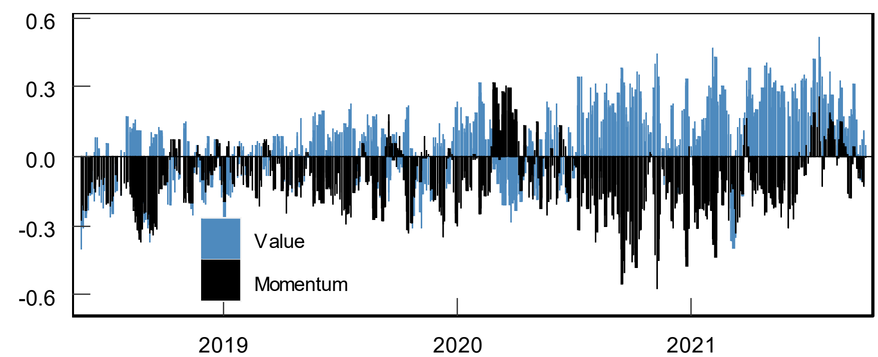
Figure 12: Non-retail market orders top/bottom quintile net factor exposure



Source: J.P. Morgan

Reserve orders also display the opposite factor exposure to market orders by being long Value and short Momentum. This is in-line with our expectaions considering they provide liquidity to the market orders. Compared to the generic limit orders, reserve orders factor exposures show a stronger bias towards shorting Momentum (Figure 13).

Figure 13: Reserver orders top/bottom quintile net factor exposure



Source: J.P. Morgan

Conclusion

Using novel methodologies and datasets, we examined the information content of various market and limit order types. Retail market orders and limit orders generally are found to be leading signals with persistent (at least weekly) information content. Non-retail market orders, on the other hand, which appear to show a strong Momentum bias, appear to be a contrarian indicator in the weekly horizon.

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