# Online Appendix

# Expected Return, Volume, and Mispricing

This appendix provides additional tests and discussions.

## A1 Single sort on trading volume

This section shows that a single sort on trading volume produces an insignificant volume-return relation. At the end of each month, we form value-weighted quintile portfolios based on trading volume, and hold them for one month. A long-short spread portfolio that buys stocks with the highest trading volume and sells stocks with the lowest trading volume is denoted as H-L. Table A1 reports the average returns and FF5 alphas. Over the 1965:07–2019:12 sample period, the average returns of the extreme quintile portfolios are very similar (0.53% vs. 0.56%), making the average return of the H-L portfolio as small as 0.03% ($t$-value $= 0.15$). The FF5 alpha of the H-L portfolio is 0.19% ($t$-value $= 1.47$). This result is consistent with Hou, Xue, and Zhang (2020), who define trading volume as the average daily share turnover over the prior six months and find that the H-L portfolio (including microcaps) earns a monthly average return of $-0.15\%$ ($t$-value $= 0.54$).

## A2 Volume and number of firms at portfolio formation

Table A2 reports the summary statistics of portfolios independently sorted by MISP and trading volume.

Panel A reports the average trading volumes at portfolio formation. We calculate the value-weighted trading volume within each portfolio each month and then average them across the sample period. Although trading volume monotonically increases in MISP, from 9.95% for underpriced stocks to 10.44% for overpriced stocks, the cross-sectional variation is so small that it is unlikely to be a good mispricing measure.

Panel B reports the average mispricing scores. In the MISP-volume double sort, the mispricing scores are flat with respect to volume among underpriced stocks (31.97 for low volume stocks and 31.44 for high volume stocks), and slightly increase in volume among overpriced stocks (66.64 for low volume stocks and 68.42 for high volume stocks). The MISP difference between the low and high volume stocks is so small that it is negligible compared to the MISP difference between the underpriced and overpriced stocks.

Panel C reports the average number of stocks within each portfolio. On average, each portfolio contains at least 50 individual stocks and can be viewed as well diversified. Over the 1965–2019 sample period, we cover 1,530 individual stocks on average within each month, close to the 1,532 stocks in Hou, Xue, and Zhang (2020) over the 1967–2016 period.

## A3 Microcap stocks

Recent studies, such as Hou, Xue, and Zhang (2020), suggest that arbitrage costs are a dominant factor in driving mispricing among microcap stocks. This is the reason why our main analyses focus on all-but-microcap stocks. However, since microcap stocks have greater mispricing than others, it will be of interest to see if our conclusion holds for this subsample.

We apply the same MISP-volume double sort procedure to the microcap stocks, and report the FF5 alphas in Table A3. As expected, the magnitude of mispricing is larger among the microcap stocks than that among the non-microcap stocks. More importantly, the volume-return relation remains the same as Table 1: the FF5 alpha increases in trading volume among the underpriced stocks and decrease among the overpriced stocks. As a result, the FF5 alpha is 0.98% for the low volume UMO portfolio and 1.65% for the high volume UMO portfolio, with the volume amplification effect equal to 0.67% ($t$-value $= 2.71$). Thus, the main finding that volume amplifies mispricing is robust to microcap stocks.

## A4 Alternative portfolio formations

In complementarity with the earlier portfolio formation, we consider two alternatives. The first is to form portfolios using breakpoints of the NYSE stocks, and the second is to use a sequential sort. Panel A of Table A4 considers the MISP-volume double sort with NYSE breakpoints. The results are similar to those without using NYSE breakpoints. For example, the FF5 alpha increases from 0.25% for the low volume UMO portfolio to 0.94% for the high volume UMO portfolio, making the volume amplification effect as large as 0.69% ($t$-value $= 3.38$).

Panel B of Table A4 considers a sequential double sort on MISP and trading volume. Specifically, we first sort stocks into five groups based on MISP, and then within each MISP group, we sort stocks into five

subgroups based on trading volume. All portfolios are value-weighted and rebalanced monthly. Among the underpriced stocks, the FF5 alpha increases from $-0.03\%$ for the low volume portfolio to $0.54\%$ for the high volume portfolio. Among the overpriced stocks, the FF5 alpha decreases from $-0.24\%$ for the low volume portfolio to $-0.80\%$ for the high volume portfolio. As a result, the FF5 alpha of the UMO portfolio monotonically increases from $0.20\%$ for the low volume portfolio to $1.34\%$ for the high volume portfolio. It should be mentioned that we use value-weighting throughout. As in most studies, results with equal-weighting are stronger and they are omitted here for brevity. As such, the volume amplification is $1.13\%$, with a $t$-value of 5.26. In summary, Table A4 shows that our results are not affected by the alternative portfolio formation methods.

## A5 Additional analyses on CAPM alpha

This section explores whether CAPM alpha is robust to an estimate with five-year rolling windows.

In calculating CAPM alpha, we follow Amihud and Goyenko (2013) and use a two-year rolling window approach. In the literature, Grundy and Martin (2001) also use five-year windows to calculate alpha for constructing the alpha (stock-specific return) momentum strategies. For robustness, in Table A5, we consider five-year rolling windows and find qualitatively similar results. For example, in the double sort on CAPM alpha and trading volume, the FF5 alpha increases from $0.23\%$ for the low volume UMO portfolio to $0.81\%$ for the high volume UMO portfolio, with the difference (i.e., the amplification effect) equal to $0.58\%$ ($t$-value $= 2.64$). In a concurrent paper, Horenstein (2020) shows a CAPM alpha reversal pattern, which is opposite to ours. One possible reason is that he forms portfolios annually, at the end of each December, and holds them for the next one year. In contrast, we form portfolios monthly and hold them only for one month. Hence, alpha may be persistent in a short horizon and reverting in a medium horizon.

## A6 Size and IVOL effect

The subsection performs a triple sort on size (IVOL), MISP, and volume to examine if the volume amplification effect is driven by firm size or IVOL. The results in Table A6 show that the volume amplification effect is not affected by firm size, but IVOL. One possible explanation is that IVOL is also a measure of investor disagreement (Diether, Malloy, and Scherbina, 2002), and therefore, contains some

information in trading volume.

## A7 Non-proportional thinking

In a concurrent paper, Shue and Townsend (2020) show that investors partially think about stock price changes in dollar rather than percentage changes and are more likely to overreact to news for low price stocks. They conclude that this non-proportional thinking can be an alternative explanation to both the IVOL and size effects. To assess whether the volume amplification effect can be also explained by this behavioral bias, Table A7 presents the FF5 alphas of portfolios sorted by stock price, MISP, and volume. The results show that the non-proportional thinking is unlikely to be an explanation, because the volume amplification effect exists among both the low and high price stocks.

## A8 Alternative portfolio formation and holding periods

Table A8 shows that the amplification effect is robust to alternative portfolio formation and holding periods. For example, when the formation and holding periods are both six months, the FF5 alpha increases from 0.19% for the low volume UMO portfolio to 1.08% for the high volume UMO portfolio, and in this case, the amplification effect is 0.89% ($t$-value $= 4.64$).

## A9 Raw investor sentiment and the volume amplification effect

This section examines whether the result that the volume amplification is stronger in the high orthogonalized sentiment periods is robust to the raw sentiment index of Baker and Wurgler (2006). Specifically, we define a high (low) sentiment dummy that equals one if the value of the raw sentiment index at the end of the prior month is above (below) the median value and zero otherwise, rerun regression (2), and report the results in Table A9. Consistent with Table 8, the volume amplification effect is 1.25% ($t$-value $= 3.71$) in high sentiment periods and 0.65% ($t$-value $= 2.12$) in low sentiment periods, with the difference equal to 0.60% ($t$-value $= 1.41$). Although this value is only statistically significant at the 10% level with a one-sided test, it is economically sizeable. Thus, we conclude that the volume amplification effect is stronger in the high raw sentiment periods.

## A10 Aggregate disagreement and the volume amplification effect

This section examines how aggregate disagreement, measured by aggregate trading volume, affects the cross-sectional volume amplification effect. We define aggregate trading volume in month $t$ as the value-weighted trading volume minus its previous four-year moving average, so that the potential time-series trend is removed. A month is defined as a high (low) disagreement period if the aggregate trading volume of the prior month is above the median value. We run regression (2) by replacing the high (low) investor sentiment dummy with the high (low) disagreement dummy, and report the FF5 alphas in Table A10. The result shows that the volume amplification effect is 1.48% ($t$-value = 3.67) in high disagreement periods and 0.59% ($t$-value = 0.59) in low disagreement periods, with the difference equal to 0.89% ($t$-value = 2.05). Therefore, the volume amplification effect is stronger in the high disagreement periods.

## A11 Other possible explanations: robustness

In Section 4.3, we consider four alternative explanations (i.e., arbitrate cost, illiquidity, investor attention, and private information) to trading volume and proxy them by using IVOL, bid-ask spread, abnormal trading volume, and net arbitrage trading, respectively. In this section, we show that the results are robust to alternative proxies. In particular, we proxy (residual) institutional ownership for arbitrage cost, Amihud measure for illiquidity, analyst coverage for attention, and institutional sell and PIN for private information.

Table A11 reports the results from the Fama-MacBeth regressions of one-month-ahead stock returns on MISP, volume, and their interaction, as well as controlling for the alternative explanation proxies one by one. Four observations stand out. First, the coefficient on the interaction between MISP and institutional ownership is positive and significant, which is consistent with Nagel (2005) that high institutional ownership indicates low arbitrage cost. However, this effect does not weaken the volume amplification effect. The coefficient on the interaction between MISP and volume becomes even larger in magnitude. Hence, trading volume is different from institutional ownership and seems unlikely capturing arbitrage cost.

Second, analyst coverage loses power in predicting future stock returns once controlling for the volume amplification effect. Third, the interaction between Amihud measure and MISP is significant but does not affect our result. Finally, institutional sell is unable to predict future stock returns, and PIN has a wrong

forecasting sign if it is viewed as a private information measure.

Collectively, Table A11 confirms Table 10 that the four alternative explanations are unlikely to be the drivers of trading volume, which in turn suggests that investor disagreement seems a sensible explanation.

## A12 Portfolio rebalance effect

As an additional check, we examine whether liquidity needs or portfolio rebalancing can explain our results. In a concurrent paper, Hrdlicka (2020) show that if investors maintain a target beta for their portfolio, any change in beta will lead to a trade, which seems a common feature among individual investors (Calvet, Campbell, and Sodini, 2009). On the other hand, Etula, Rinne, Suominen, and Vaittinen (2019) show that because of monthly repeated payments such as pensions and dividends, the excess demand for cash raises trading volume dramatically at the end of each month. They find that a subset of institutions are systematically selling on days $T-8$ to $T-4$ and buying on days $T-3$ to $T$. This is perhaps due to the 3-day settlement requirement in the U.S. stock market, and thus an institution that needs cash on the morning of the last day of the month ($T$) must sell securities at least 4 business days before the month end.

We perform two tests. First, we explore the volume amplification effect by filtering out the target beta-induced trading. Specifically, each month, we run a cross-sectional regression of trading volume on the absolute value of change in market beta, and use the residual and MISP to perform a double sort as in Table 1, where the market beta of a stock is estimated using the past one-year daily returns, with a requirement of at least 100 observations. Second, motivated by Etula, Rinne, Suominen, and Vaittinen (2019), we calculate trading volume by excluding the last eight-day trading volume and perform a double sort with MISP. We report the results in Table A12, and find that the volume amplification effect is robust to these adjustments.

## A13 Additional results on composite alpha

In this subsection, we provide additional results on the composite alpha. First, we show that the volume amplification effect remains strong when using the composite alpha to measure mispricing and using the SY4 model to assess the performance. Panel A of Table A13 reports the abnormal returns of portfolios sorted by the composite alpha and volume. The volume amplification effect is 0.88% ($t$-value $= 3.80$),

which is remarkably close to the FF5 alpha in Table 2 (0.85% with $t$-value = 3.83). Panel B reports a similar result when volume is replaced by the IVOL and size adjusted volume. The volume amplification effect is now 0.92% ($t$-value = 3.88).

Second, we show that the composite alpha is robust to our economic interpretation that trading volume is largely a measure of investor disagreement. Specifically, by using the composite alpha as a mispricing measure, we examine whether the volume amplification effect is subsumed by the interaction of the composite alpha with arbitrage costs, liquidity, investor attention, information asymmetry, or investor disagreement. We measure them with IVOL, bid-ask spread, abnormal volume, net arbitrage trading, and analysts' return forecast dispersion, respectively. To make our interpretation consistent with MISP, we follow Stambaugh, Yu, and Yuan (2015) and transform the composite alpha into a score measure ($\alpha$_Score) so that a high score refers to overpricing and a low score refers to underpricing. To be consistent, the other five competing variables are also transformed into percentiles. All explanatory variables are normalized in the cross-section.

Table A14 presents the Fama-MacBeth regression results in predicting future returns. The coefficient of primary interest is the one on $\alpha$_Score*Volume, which captures the volume amplification effect. The first regression includes $\alpha$_Score, volume, and their interaction, but not other competing variables. The coefficient is significant at the 1% level, thereby suggesting that the volume amplification effect is robust to this composite alpha measure. The second regression controls for the IVOL effect. Interestingly, the coefficient on the interaction of $\alpha$_Score with IVOL is close to zero in this case, whereas the volume amplification effect remains significant at the 5% level and the coefficient on $\alpha$_Score*Volume decreases slightly in magnitude from $-0.14$ to $-0.11$. This result suggests that the volume amplification effect is not dramatically affected by the IVOL effect documented in Stambaugh, Yu, and Yuan (2015).

The third regression shows that the volume amplification effect is not affected by liquidity, because the bid-ask spread and its interaction with $\alpha$_Score have insignificant coefficients in the regression. The fourth regression presents an interesting result when we control for investor attention. The volume amplification effect remains the same, although the interaction between $\alpha$_Score and abnormal volume—the measure of investor attention—has a significant and positive coefficient. The fifth regression shows that net arbitrage trading predicts future stock returns, and its interaction with $\alpha$_Score has an insignificant coefficient.

The last column of Table A14—the sixth regression—confirms Table 6 that the volume amplification

effect is subsumed by the disagreement effect. Specifically, once controlling for analysts' return forecast dispersion, the volume amplification effect becomes insignificant. The slope coefficient on the interaction of volume and $\alpha$_Score is now 0.02 ($t$-value $= 0.17$), whereas the slope coefficient on the interaction of disagreement and $\alpha$_Score is $-0.30$ ($t$-value $= -2.97$). Hence, the volume amplification effect is largely driven by disagreement. Overall, the results consistently suggest the existence of the significant amplification effect.

## A14 A Placebo Test

To examine whether trading volume contains incremental information about future stock returns beyond MISP, we run a placebo test. In the MISP-volume double sort, we replace volume with each of the 11 anomalies in Stambaugh, Yu, and Yuan (2015) and explore the resulting amplification effect. The results in Table A15 show that none of the 11 anomaly variables can generate am amplification effect. Thus, the interaction of MISP with volume is special: only trading volume can have the amplification effect, not any of the 11 anomalies.

**Table A1 Average returns and FF5 alphas of portfolios sorted by trading volume**

This table reports the average (excess) returns and FF5 alphas of quintile portfolios sorted by trading volume, where trading volume is measured by the average turnover in the past three months. Portfolios are value-weighted and held for one month. Firms with market capitalization below the NYSE 20 percentile breakpoints are excluded. H-L refers to the high-minus-low volume spread portfolio. The sample period is 1965:07–2019:12.

| Portfolio | Return | $t$-value | FF5 alpha | $t$-value |
|---|---|---|---|---|
| Low volume | 0.53 | 3.73 | −0.05 | −1.00 |
| 2 | 0.54 | 3.36 | −0.12 | −2.71 |
| 3 | 0.58 | 3.29 | −0.05 | −1.27 |
| 4 | 0.57 | 2.74 | 0.00 | 0.00 |
| High volume | 0.56 | 2.01 | 0.14 | 1.47 |
| H-L | 0.03 | 0.15 | 0.19 | 1.47 |

**Table A2 Summary statistics in the double sort on MISP and trading volume**

This table reports the value-weighted trading volumes, mispricing scores, and the average numbers of stocks of portfolios sorted by MISP and trading volume, where trading volume is measured by the average turnover in the past three months. Firms with market capitalization below the NYSE 20 percentile breakpoints are excluded throughout the paper. The sample period is 1965:07–2019:12.

| Panel A: Trading volume | | | | | | |
|---|---|---|---|---|---|---|
| | Low volume | 2 | 3 | 4 | High volume | Average |
| Underpriced | 3.53 | 5.61 | 8.02 | 11.47 | 21.13 | 9.95 |
| 2 | 3.44 | 5.63 | 8.03 | 11.54 | 21.42 | 10.01 |
| 3 | 3.19 | 5.67 | 8.03 | 11.63 | 21.83 | 10.07 |
| 4 | 3.30 | 5.65 | 8.07 | 11.72 | 22.28 | 10.20 |
| Overpriced | 3.39 | 5.69 | 8.10 | 11.78 | 23.26 | 10.44 |
| Panel B: MISP | | | | | | |
| | Low volume | 2 | 3 | 4 | High volume | H-L |
| Underpriced | 31.97 | 31.76 | 31.56 | 31.48 | 31.44 | -0.53 |
| 2 | 41.38 | 41.45 | 41.58 | 41.61 | 41.63 | 0.26 |
| 3 | 48.46 | 48.38 | 48.44 | 48.41 | 48.61 | 0.16 |
| 4 | 55.73 | 55.70 | 55.74 | 55.76 | 55.91 | 0.18 |
| Overpriced | 66.64 | 66.68 | 67.14 | 67.53 | 68.42 | 1.78 |
| UMO | -34.67 | -34.92 | -35.58 | -36.05 | -36.97 | -2.31 |
| Panel C: Number of stocks | | | | | | |
| | Low volume | 2 | 3 | 4 | High volume | Total |
| Underpriced | 65 | 68 | 65 | 58 | 50 | 306 |
| 2 | 66 | 67 | 64 | 59 | 50 | 306 |
| 3 | 65 | 64 | 63 | 61 | 55 | 306 |
| 4 | 61 | 58 | 60 | 62 | 65 | 306 |
| Overpriced | 50 | 50 | 54 | 66 | 86 | 306 |
| Total | 306 | 306 | 306 | 306 | 306 | 1,530 |

**Table A3 Alphas of portfolios sorted by MISP and volume: Among microcap stocks**

This table reports the FF5 alphas of portfolios sorted by MISP and trading volume, where trading volume is measured by the average turnover in the past three months. Firms with market capitalization above the NYSE 20 percentile breakpoints are excluded at portfolio formation. $t$-values are reported in parentheses. Underpriced refers to the quintile with the lowest MISP (most underpriced), and overpriced refers to the quintile with the highest MISP (most overpriced). UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low volume) spread portfolio. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Underpriced | 0.38 | 0.46 | 0.56 | 0.56 | 0.66 | 0.28 (1.42) |
| 2 | 0.08 | 0.10 | 0.13 | 0.15 | 0.11 | 0.02 (0.12) |
| 3 | 0.01 | −0.01 | 0.03 | 0.02 | 0.09 | 0.08 (0.46) |
| 4 | −0.16 | −0.34 | −0.13 | −0.33 | −0.08 | 0.08 (0.40) |
| Overpriced | −0.60 | −0.69 | −0.96 | −0.78 | −0.99 | −0.39 (−1.98) |
| UMO | 0.98 | 1.16 | 1.52 | 1.35 | 1.65 | 0.67 (2.71) |
| | (6.87) | (8.45) | (10.29) | (7.79) | (8.00) | |

**Table A4 Alphas of portfolios with alternative sorting methods**

This table reports the FF5 alphas of portfolios sorted by MISP and trading volume with NYSE-breakpoints in Panel A and with sequential sort in Panel B, respectively. $t$-values are reported in parentheses. Trading volume is measured by the average turnover in the past three months. Underpriced refers to the quintile with the lowest MISP (most underpriced), and overpriced refers to the quintile with the highest MISP (most overpriced). UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low volume) spread portfolio. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Panel A: Sort with NYSE breakpoints | | | | | | |
| Underpriced | −0.05 | 0.04 | 0.14 | 0.25 | 0.45 | 0.50 (3.09) |
| 2 | −0.04 | −0.08 | −0.15 | 0.07 | 0.38 | 0.42 (2.59) |
| 3 | −0.07 | −0.25 | −0.04 | −0.07 | 0.24 | 0.30 (1.87) |
| 4 | −0.08 | −0.20 | −0.02 | −0.14 | −0.08 | 0.00 (−0.01) |
| Overpriced | −0.31 | −0.19 | −0.28 | −0.50 | −0.49 | −0.19 (−1.11) |
| UMO | 0.25 | 0.23 | 0.42 | 0.75 | 0.94 | 0.69 (3.38) |
| | (2.03) | (1.75) | (3.27) | (5.22) | (5.49) | |
| Panel B: Sequential sort with mispricing first | | | | | | |
| Underpriced | −0.03 | −0.02 | 0.11 | 0.32 | 0.54 | 0.57 (3.52) |
| 2 | 0.02 | −0.06 | −0.09 | 0.02 | 0.37 | 0.35 (2.21) |
| 3 | −0.05 | −0.23 | −0.13 | 0.02 | 0.14 | 0.18 (1.09) |
| 4 | −0.08 | −0.18 | −0.07 | −0.20 | −0.16 | −0.08 (−0.42) |
| Overpriced | −0.24 | −0.19 | −0.17 | −0.40 | −0.80 | −0.56 (−2.97) |
| UMO | 0.20 | 0.18 | 0.29 | 0.72 | 1.34 | 1.13 (5.26) |
| | (1.61) | (1.37) | (2.28) | (4.91) | (7.31) | |

**Table A5 Double sort on CAPM alpha and trading volume: five-year rolling windows**

This table reports the FF5 alphas of portfolios sorted by CAPM alpha and trading volume, where CAPM alpha is calculated with the past five-year observations. Portfolios are value-weighted and held for one month. PMN (H-L) refers to the positive-minus-negative (high-minus-low) spread portfolio. The sample period is 1968:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Positive | 0.01 | 0.24 | 0.19 | 0.34 | 0.41 | 0.40 (2.22) |
| 2 | −0.02 | −0.18 | −0.06 | 0.07 | −0.01 | 0.01 (0.07) |
| 3 | −0.04 | −0.15 | −0.11 | 0.13 | 0.19 | 0.23 (1.43) |
| 4 | −0.07 | −0.16 | −0.15 | −0.26 | 0.00 | 0.07 (0.42) |
| Negative | −0.23 | −0.04 | −0.11 | −0.37 | −0.40 | −0.18 (−1.05) |
| PMN | 0.23 | 0.29 | 0.31 | 0.71 | 0.81 | 0.58 (2.64) |
| | (1.34) | (1.58) | (1.77) | (4.25) | (4.19) | |

**Table A6 The IVOL and size effects**

This table reports the FF5 alphas of portfolios in the $2 \times 5 \times 5$ triple sort on IVOL (size), MISP, and volume. $t$-values are reported in parentheses. Underpriced refers to the quintile with the lowest MISP (most underpriced), and overpriced refers to the quintile with the highest MISP (most overpriced). UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low volume) spread portfolio. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Panel A: Triple sort on IVOL, MISP, and volume | | | | | | |
| | | | Low IVOL stocks | | | |
| Underpriced | −0.07 | −0.02 | 0.07 | 0.21 | 0.23 | 0.30 (1.85) |
| 2 | −0.03 | 0.00 | −0.12 | 0.00 | 0.14 | 0.18 (1.16) |
| 3 | 0.01 | −0.05 | −0.16 | −0.01 | 0.07 | 0.06 (0.34) |
| 4 | −0.08 | −0.12 | −0.22 | −0.05 | −0.01 | 0.06 (0.37) |
| Overpriced | −0.12 | −0.14 | −0.11 | −0.24 | −0.32 | −0.20 (−1.15) |
| UMO | 0.05 | 0.12 | 0.18 | 0.45 | 0.56 | 0.50 (2.35) |
| | (0.36) | (0.89) | (1.25) | (3.04) | (3.40) | |
| | | | High IVOL stocks | | | |
| Underpriced | −0.06 | 0.08 | 0.48 | 0.51 | 0.77 | 0.83 (3.54) |
| 2 | −0.03 | −0.21 | −0.06 | 0.34 | 0.20 | 0.23 (1.00) |
| 3 | −0.08 | −0.26 | 0.14 | −0.02 | 0.13 | 0.21 (1.02) |
| 4 | −0.30 | −0.08 | −0.40 | 0.07 | −0.02 | 0.28 (1.27) |
| Overpriced | −0.58 | −0.53 | −0.55 | −0.55 | −1.04 | −0.46 (−1.93) |
| UMO | 0.53 | 0.61 | 1.03 | 1.06 | 1.81 | 1.29 (4.26) |
| | (2.77) | (3.10) | (5.28) | (5.38) | (7.43) | |
| Panel B: Triple sort on size, MISP, and volume | | | | | | |
| | | | Small stocks | | | |
| Underpriced | 0.16 | 0.03 | 0.11 | 0.30 | 0.56 | 0.40 (2.09) |
| 2 | 0.14 | 0.09 | 0.14 | 0.15 | 0.50 | 0.36 (1.93) |
| 3 | −0.07 | 0.15 | 0.07 | 0.04 | 0.34 | 0.41 (2.15) |
| 4 | −0.21 | −0.05 | 0.03 | 0.10 | −0.05 | 0.16 (0.85) |
| Overpriced | −0.65 | −0.39 | −0.32 | −0.44 | −0.81 | −0.16 (−0.80) |
| UMO | 0.81 | 0.42 | 0.43 | 0.74 | 1.37 | 0.55 (2.35) |
| | (6.55) | (3.3) | (3.11) | (4.92) | (6.61) | |
| | | | Large stocks | | | |
| Underpriced | −0.05 | 0.08 | 0.17 | 0.31 | 0.47 | 0.53 (2.97) |
| 2 | −0.05 | −0.12 | −0.06 | 0.09 | 0.59 | 0.64 (3.61) |
| 3 | −0.08 | −0.17 | 0.01 | 0.03 | 0.25 | 0.33 (1.86) |
| 4 | −0.15 | −0.09 | −0.17 | 0.02 | 0.14 | 0.29 (1.57) |
| Overpriced | −0.14 | −0.23 | −0.17 | −0.33 | −0.46 | −0.31 (−1.63) |
| UMO | 0.09 | 0.31 | 0.34 | 0.64 | 0.93 | 0.84 (3.58) |
| | (0.63) | (2.30) | (2.30) | (4.01) | (4.82) | |

**Table A7 Test the non-proportional thinking effect**

This table reports the FF5 alphas of $2 \times 5 \times 5$ portfolios sorted by stock price, MISP, and trading volume, where trading volume is measured by the average turnover in the past three months. Underpriced refers to the quintile with the lowest MISP (most underpriced), and overpriced refers to the quintile with the highest MISP (most overpriced). UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low volume) spread portfolio. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Panel A: Low price stocks | | | | | | |
| Underpriced | 0.11 | 0.27 | 0.12 | 0.45 | 0.47 | 0.36 (1.69) |
| 2 | 0.03 | 0.06 | 0.02 | 0.22 | 0.18 | 0.16 (0.79) |
| 3 | 0.01 | 0.01 | 0.08 | 0.20 | −0.14 | −0.16 (−0.79) |
| 4 | −0.06 | 0.02 | −0.04 | −0.07 | −0.17 | −0.11 (−0.53) |
| Overpriced | −0.39 | −0.20 | −0.18 | −0.45 | −1.04 | −0.65 (−3.28) |
| UMO | 0.51 | 0.46 | 0.30 | 0.90 | 1.51 | 1.01 (3.66) |
| | (3.16) | (2.55) | (1.60) | (4.61) | (6.14) | |
| Panel B: High price stocks | | | | | | |
| Underpriced | −0.03 | −0.05 | 0.10 | 0.40 | 0.66 | 0.69 (3.56) |
| 2 | −0.07 | −0.09 | −0.04 | −0.05 | 0.54 | 0.61 (2.99) |
| 3 | −0.10 | −0.21 | −0.01 | 0.13 | 0.43 | 0.53 (2.62) |
| 4 | −0.06 | −0.26 | −0.01 | −0.23 | 0.28 | 0.34 (1.56) |
| Overpriced | −0.28 | −0.41 | −0.33 | −0.29 | −0.36 | −0.08 (−0.35) |
| UMO | 0.25 | 0.36 | 0.43 | 0.69 | 1.02 | 0.77 (2.76) |
| | (1.44) | (2.34) | (2.72) | (4.11) | (4.69) | |

**Table A8 Double sort on MISP and volume: Alternative portfolio formation and holding periods**

This table reports the FF5 alphas of portfolios sorted by MISP and trading volume. Similar as Jegadeesh and Titman (1993), $(i, j)$ indicates that trading volume is measured by the average turnover in the past $i$ months and the portfolio holding period is $j$ months. Underpriced refers to the quintile with the lowest MISP (most underpriced), and overpriced refers to the quintile with the highest MISP (most overpriced). UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low) spread portfolio. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L | |
|---|---|---|---|---|---|---|---|
| Panel A: Volume formation and portfolio holding periods are $(1,1)$ | | | | | | | |
| Underpriced | −0.02 | −0.01 | 0.08 | 0.29 | 0.51 | 0.52 | (3.30) |
| 2 | 0.03 | −0.10 | −0.14 | 0.03 | 0.38 | 0.36 | (2.26) |
| 3 | −0.05 | −0.14 | −0.09 | 0.01 | 0.17 | 0.22 | (1.41) |
| 4 | −0.04 | −0.18 | −0.10 | −0.12 | 0.07 | 0.11 | (0.63) |
| Overpriced | −0.23 | −0.21 | −0.27 | −0.50 | −0.61 | −0.38 | (−2.26) |
| UMO | 0.21 | 0.20 | 0.36 | 0.78 | 1.11 | 0.90 | (4.65) |
| | (1.75) | (1.64) | (3.19) | (5.94) | (6.78) | | |
| Panel B: Volume formation and portfolio holding periods are $(3,6)$ | | | | | | | |
| Underpriced | −0.04 | −0.01 | 0.07 | 0.27 | 0.50 | 0.55 | (3.58) |
| 2 | −0.03 | −0.11 | −0.12 | 0.06 | 0.41 | 0.44 | (2.92) |
| 3 | −0.02 | −0.11 | −0.10 | −0.01 | 0.16 | 0.18 | (1.19) |
| 4 | −0.10 | −0.21 | −0.10 | −0.12 | 0.05 | 0.15 | (0.92) |
| Overpriced | −0.22 | −0.18 | −0.30 | −0.48 | −0.56 | −0.33 | (−2.09) |
| UMO | 0.18 | 0.18 | 0.36 | 0.75 | 1.06 | 0.88 | (4.78) |
| | (1.58) | (1.56) | (3.55) | (6.10) | (6.95) | | |
| Panel C: Volume formation and portfolio holding periods are $(6,6)$ | | | | | | | |
| Underpriced | −0.04 | −0.01 | 0.08 | 0.30 | 0.49 | 0.52 | (3.31) |
| 2 | −0.06 | −0.13 | −0.08 | 0.04 | 0.44 | 0.50 | (3.19) |
| 3 | −0.01 | −0.13 | −0.06 | −0.05 | 0.18 | 0.19 | (1.21) |
| 4 | −0.09 | −0.22 | −0.11 | −0.12 | 0.05 | 0.14 | (0.88) |
| Overpriced | −0.22 | −0.16 | −0.30 | −0.46 | −0.59 | −0.37 | (−2.26) |
| UMO | 0.19 | 0.15 | 0.39 | 0.77 | 1.08 | 0.89 | (4.64) |
| | (1.57) | (1.25) | (3.66) | (5.98) | (6.87) | | |

**Table A9 The volume amplification effect in high and low sentiment periods: robustness**

At the end of each month, we independently form $5 \times 5$ portfolios based on MISP and trading volume, where trading volume is measured by the average turnover in the past three months. Portfolios are value-weighted and held for one month. UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low) spread portfolio. Alphas are estimates of $a_H$ and $a_L$ in the regression

$$R_{i,t} = a_H d_{H,t} + a_L d_{L,t} + b\text{MKT}_t + c\text{SMB}_t + d\text{HML}_t + e\text{RMW}_t + f\text{CMA}_t + \varepsilon_{i,t},$$

where $d_{H,t}$ and $d_{L,t}$ are dummy variables indicating high and low sentiment periods, and $R_{i,t}$ is the excess return of portfolio $i$ in month $t$. A high (low) sentiment month is one in which the value of the Baker and Wurgler (2006) raw sentiment index at the end of the previous month is above (below) the median value for the 1965:07–2018:12 sample period. Panels A, B, and C report $a_H$, $a_L$, and their difference, respectively.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Panel A: High sentiment periods | | | | | | |
| Underpriced | 0.05 | 0.10 | 0.03 | 0.48 | 0.64 | 0.59 (2.02) |
| 2 | −0.05 | −0.14 | −0.05 | −0.18 | 0.58 | 0.63 (2.22) |
| 3 | −0.10 | −0.11 | −0.14 | 0.15 | 0.26 | 0.35 (1.47) |
| 4 | 0.08 | −0.29 | 0.13 | −0.21 | −0.02 | −0.10 (−0.37) |
| Overpriced | −0.33 | −0.28 | −0.38 | −0.45 | −0.99 | −0.66 (−2.57) |
| UMO | 0.38 | 0.38 | 0.41 | 0.93 | 1.63 | 1.25 (3.71) |
| | (2.05) | (1.81) | (2.12) | (3.89) | (5.35) | |
| Panel B: Low sentiment periods | | | | | | |
| Underpriced | −0.09 | −0.09 | 0.18 | 0.23 | 0.45 | 0.54 (2.56) |
| 2 | −0.03 | −0.07 | −0.13 | 0.10 | 0.36 | 0.39 (1.67) |
| 3 | −0.14 | −0.22 | −0.07 | −0.03 | 0.34 | 0.49 (2.09) |
| 4 | −0.13 | −0.12 | −0.18 | −0.21 | 0.27 | 0.40 (1.58) |
| Overpriced | −0.26 | −0.31 | −0.22 | −0.33 | −0.37 | −0.11 (−0.44) |
| UMO | 0.17 | 0.22 | 0.40 | 0.56 | 0.82 | 0.65 (2.12) |
| | (0.92) | (1.22) | (2.20) | (2.93) | (3.31) | |
| Panel C: Difference between high and low sentiment periods | | | | | | |
| Underpriced | 0.14 | 0.18 | −0.15 | 0.25 | 0.19 | 0.05 (0.15) |
| 2 | −0.02 | −0.07 | 0.08 | −0.28 | 0.22 | 0.24 (0.72) |
| 3 | 0.05 | 0.11 | −0.07 | 0.18 | −0.08 | −0.13 (−0.41) |
| 4 | 0.21 | −0.17 | 0.31 | 0.00 | −0.29 | −0.50 (−1.41) |
| Overpriced | −0.07 | 0.03 | −0.16 | −0.12 | −0.62 | −0.55 (−1.55) |
| UMO | 0.21 | 0.16 | 0.01 | 0.37 | 0.81 | 0.60 (1.41) |
| | (0.83) | (0.60) | (0.03) | (1.31) | (2.28) | |

**Table A10 The volume amplification effect in high and low disagreement periods**

At the end of each month, we independently form $5 \times 5$ portfolios based on MISP and trading volume, where trading volume is measured by the average turnover in the past three months. Portfolios are value-weighted and held for one month. UMO (H-L) refers to the underpriced-minus-overpriced (high-minus-low) spread portfolio. Alphas are estimates of $a_H$ and $a_L$ in the regression

$$R_{i,t} = a_H d_{H,t} + a_L d_{L,t} + b\text{MKT}_t + c\text{SMB}_t + d\text{HML}_t + e\text{RMW}_t + f\text{CMA}_t + \varepsilon_{i,t},$$

where $d_{H,t}$ and $d_{L,t}$ are dummy variables indicating high and low aggregate disagreement periods, and $R_{i,t}$ is the excess return of portfolio $i$ in month $t$. A high (low) aggregate disagreement month is one in which the value of the value-weighted aggregate trading volume index at the end of the previous month is above (below) the median value. To remove the potential trend, the aggregate trading volume in month $t$ is defined as its realization minus its previous four-year moving average. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L | |
|---|---|---|---|---|---|---|---|
| Panel A: High disagreement periods | | | | | | | |
| Underpriced | −0.01 | −0.12 | 0.02 | 0.42 | 0.75 | 0.76 | (2.42) |
| 2 | −0.02 | −0.11 | 0.02 | −0.08 | 0.73 | 0.75 | (2.50) |
| 3 | −0.13 | −0.11 | −0.19 | 0.19 | 0.30 | 0.43 | (1.62) |
| 4 | 0.00 | −0.21 | −0.08 | −0.14 | 0.27 | 0.27 | (0.95) |
| Overpriced | −0.13 | −0.25 | −0.28 | −0.44 | −0.85 | −0.72 | (−2.40) |
| UMO | −0.12 | −0.13 | −0.30 | −0.86 | −1.60 | 1.48 | (3.67) |
| | (−0.56) | (−0.54) | (−1.42) | (−3.37) | (−4.55) | | |
| Panel B: Low disagreement periods | | | | | | | |
| Underpriced | −0.05 | 0.07 | 0.17 | 0.18 | 0.29 | 0.34 | (1.75) |
| 2 | −0.03 | −0.12 | −0.14 | −0.11 | 0.11 | 0.14 | (0.63) |
| 3 | −0.05 | −0.21 | −0.07 | −0.08 | 0.27 | 0.31 | (1.48) |
| 4 | 0.10 | −0.15 | −0.11 | −0.30 | −0.09 | −0.19 | (−0.83) |
| Overpriced | −0.36 | −0.29 | −0.25 | −0.32 | −0.61 | −0.25 | (−1.16) |
| UMO | −0.32 | −0.37 | −0.42 | −0.50 | −0.90 | 0.59 | (2.35) |
| | (−1.94) | (−2.21) | (−2.39) | (−2.71) | (−4.43) | | |
| Panel C: Difference between high and low disagreement periods | | | | | | | |
| Underpriced | 0.04 | −0.20 | −0.14 | 0.24 | 0.46 | 0.42 | (1.25) |
| 2 | 0.01 | 0.01 | 0.17 | 0.03 | 0.62 | 0.61 | (1.77) |
| 3 | −0.09 | 0.10 | −0.12 | 0.27 | 0.03 | 0.12 | (0.36) |
| 4 | −0.10 | −0.06 | 0.03 | 0.16 | 0.37 | 0.47 | (1.31) |
| Overpriced | 0.24 | 0.05 | −0.03 | −0.12 | −0.23 | −0.47 | (−1.32) |
| UMO | −0.20 | −0.24 | −0.11 | 0.37 | 0.69 | 0.89 | (2.05) |
| | (−0.76) | (−0.90) | (−0.45) | (1.28) | (1.90) | | |

**Table A11 Results from regressing returns on MISP and volume with controls: Robustness**

This table reports the results from the Fama-MacBeth regressions of one-month-ahead stock returns on MISP, trading volume, their interactions, and other controls. Newey-West robust $t$-statistics with four lags are reported in parentheses. Intercepts and coefficients on firm controls (firm size and book-to-market) are not reported for brevity. $^{*}$, $^{**}$, and $^{***}$ denote significance at the 10%, 5%, and 1% levels, respectively.

| | Dependent variable: one-month-ahead excess returns (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| MISP | $-0.33^{***}$ | $-0.14^{***}$ | $-0.12^{***}$ | $-0.14$ | $-0.12^{*}$ |
| | $(-4.88)$ | $(-3.21)$ | $(-3.02)$ | $(-1.40)$ | $(-1.73)$ |
| Volume | $0.62^{***}$ | $0.51^{***}$ | $0.39^{***}$ | $0.64^{**}$ | $0.68^{***}$ |
| | (4.93) | (4.02) | (3.73) | (2.13) | (2.98) |
| MISP*Volume | $-0.78^{***}$ | $-0.63^{***}$ | $-0.51^{***}$ | $-0.80^{***}$ | $-0.63^{***}$ |
| | $(-7.03)$ | $(-5.89)$ | $(-5.55)$ | $(-3.24)$ | $(-2.86)$ |
| Institutional ownership | $-0.34^{***}$ | | | | |
| | $(-4.62)$ | | | | |
| MISP*institutional ownership | $0.45^{***}$ | | | | |
| | (4.75) | | | | |
| Analyst coverage | | 0.00 | | | |
| | | (0.06) | | | |
| MISP*Analyst coverage | | 0.07 | | | |
| | | (0.97) | | | |
| Amihud | | | 0.01 | | |
| | | | (1.38) | | |
| MISP*Amihud | | | $-0.25^{***}$ | | |
| | | | $(-3.59)$ | | |
| Institutional sell | | | | 0.11 | |
| | | | | (0.46) | |
| MISP*Institutional sell | | | | $-0.34$ | |
| | | | | $(-1.24)$ | |
| PIN | | | | | $-0.55^{***}$ |
| | | | | | $(-3.80)$ |
| MISP*PIN | | | | | $0.31^{**}$ |
| | | | | | (2.43) |
| Controls | yes | yes | yes | yes | yes |
| adj. $R^2$ | 0.05 | 0.05 | 0.05 | 0.07 | 0.06 |
| Start | 1980:04 | 1976:03 | 1965:08 | 1997:02 | 1993:01 |
| End | 2019:12 | 2016:12 | 2019:12 | 2011:03 | 2012:12 |

**Table A12 Alphas of portfolios sorted by MISP and adjusted volume: Mitigating the portfolio rebalancing concern**

This table reports the FF5 alphas of portfolios sorted by MISP and adjusted trading volume. To mitigate the portfolio rebalancing concern, in Panel A volume is the residual from the cross-sectional regression of trading volume on absolute value of change in market beta, and in Panel B volume is constructed by excluding the last eight-day trading volume of each month. Market beta is estimated with the past one-year daily returns with a requirement of at least 100 observations. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L | |
|---|---|---|---|---|---|---|---|
| Panel A: Adjusted by the absolute value of change in market beta | | | | | | | |
| Underpriced | 0.08 | −0.00 | 0.07 | 0.26 | 0.49 | 0.41 | (2.45) |
| 2 | 0.02 | −0.07 | −0.13 | −0.18 | 0.38 | 0.37 | (1.96) |
| 3 | 0.12 | −0.19 | −0.16 | −0.03 | 0.10 | −0.01 | (−0.07) |
| 4 | −0.09 | −0.21 | −0.23 | −0.06 | −0.15 | −0.07 | (−0.37) |
| Overpriced | −0.33 | −0.29 | −0.30 | −0.54 | −0.78 | −0.44 | (−2.36) |
| UMO | 0.42 | 0.29 | 0.37 | 0.79 | 1.27 | 0.85 | (3.58) |
| | (2.42) | (1.84) | (2.44) | (5.24) | (6.54) | | |
| Panel B: Excluding month-end volume | | | | | | | |
| Underpriced | −0.04 | 0.03 | 0.08 | 0.32 | 0.51 | 0.55 | (3.22) |
| 2 | −0.07 | −0.06 | −0.07 | −0.02 | 0.41 | 0.48 | (2.78) |
| 3 | −0.12 | −0.17 | −0.07 | −0.01 | 0.36 | 0.48 | (2.85) |
| 4 | −0.04 | −0.18 | −0.07 | −0.17 | 0.05 | 0.09 | (0.51) |
| Overpriced | −0.34 | −0.20 | −0.30 | −0.41 | −0.60 | −0.26 | (−1.43) |
| UMO | 0.29 | 0.22 | 0.38 | 0.73 | 1.11 | 0.81 | (3.70) |
| | (2.22) | (1.69) | (2.92) | (5.13) | (5.97) | | |

**Table A13 SY4 alphas of portfolios sorted by composite alpha and (adjusted) volume**

This table reports the Stambaugh and Yuan (SY4, 2017) four-factor alphas of portfolios sorted by composite alpha and volume or adjusted volume, where adjusted volume is the residual from the cross-sectional regression of trading volume on IVOL and size. Portfolios are value-weighted and held for one month. The sample period is 1965:07–2019:12.

| | Low volume | 2 | 3 | 4 | High volume | H-L |
|---|---|---|---|---|---|---|
| Panel A: Sorted by composite alpha and volume | | | | | | |
| Positive alpha | −0.03 | 0.14 | 0.15 | 0.41 | 0.50 | 0.53 (2.63) |
| 2 | −0.11 | −0.09 | −0.03 | 0.07 | 0.00 | 0.11 (0.59) |
| 3 | −0.13 | −0.11 | −0.13 | −0.14 | −0.11 | 0.02 (0.09) |
| 4 | −0.01 | −0.07 | 0.05 | −0.15 | −0.30 | −0.29 (−1.72) |
| Negative alpha | 0.13 | 0.05 | 0.08 | −0.09 | −0.22 | −0.35 (−1.93) |
| PMN | −0.17 | 0.09 | 0.08 | 0.50 | 0.72 | 0.88 (3.80) |
| | (−0.82) | (0.49) | (0.40) | (2.62) | (3.56) | |
| Panel B: Sorted by composite alpha and adjusted volume | | | | | | |
| Positive alpha | 0.02 | 0.43 | 0.31 | 0.43 | 0.56 | 0.54 (2.72) |
| 2 | 0.03 | −0.02 | 0.05 | 0.14 | −0.05 | −0.08 (−0.51) |
| 3 | −0.13 | −0.06 | −0.17 | −0.02 | −0.14 | 0.00 (−0.02) |
| 4 | −0.02 | −0.04 | 0.15 | −0.23 | 0.08 | 0.10 (0.66) |
| Negative alpha | 0.20 | 0.16 | 0.18 | −0.10 | −0.18 | −0.38 (−2.29) |
| PMN | −0.18 | 0.27 | 0.13 | 0.54 | 0.74 | 0.92 (3.88) |
| | (−0.81) | (1.27) | (0.60) | (2.68) | (3.58) | |

**Table A14 Results from regressing stock returns on composite alpha and volume with controls**

This table reports the results of Fama-MacBeth regressions of one-month-ahead stock returns on composite alpha, trading volume, disagreement, their interactions, and other control variables (firm size and book-to-market). Abnormal volume is defined at the monthly frequency following Gervais, Kaniel, and Mingelgrin (2001). Net arbitrage trading is the difference between quarterly abnormal hedge fund holdings and abnormal short interest and measures trading driven by private information (Chen, Da, and Huang, 2019). Disagreement is analyst's return forecast dispersion. To make the interpretation consistent with MISP, following Stambaugh, Yu, and Yuan (2015) we transform composite alpha into a score measure ($\alpha$_Score) so that a high $\alpha$_Score refers to overpricing and a low $\alpha$_Score refers to underpricing. Newey-West $t$-values with four lags are reported in parentheses. Intercepts and coefficients on controls are not reported for brevity. $^{*}$, $^{**}$, and $^{***}$ denote significance at the 10%, 5%, and 1% levels, respectively.

| | Dependent variable: one-month-ahead excess returns (%) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\alpha$_Score | 0.03 | 0.05 | 0.07 | −0.05 | 0.05 | 0.08 |
| | (0.54) | (0.90) | (0.85) | (−1.09) | (0.64) | (0.79) |
| Volume | 0.06 | 0.09 | −0.03 | 0.06 | 0.17 | −0.07 |
| | (0.75) | (1.34) | (0.30) | (0.77) | (1.25) | (0.47) |
| $\alpha$_Score*Volume | −0.14$^{***}$ | −0.11$^{**}$ | −0.15$^{**}$ | −0.14$^{***}$ | −0.20$^{**}$ | 0.02 |
| | (−2.65) | (−2.21) | (−2.52) | (−2.59) | (−2.31) | (0.17) |
| IVOL | | −0.08 | | | | |
| | | (−1.18) | | | | |
| $\alpha$_Score*IVOL | | −0.07 | | | | |
| | | (−1.28) | | | | |
| Bid-ask spread | | | −0.19 | | | |
| | | | (−1.56) | | | |
| $\alpha$_Score*bid-ask spread | | | −0.05 | | | |
| | | | (−0.79) | | | |
| Abnormal volume | | | | 0.06$^{*}$ | | |
| | | | | (1.74) | | |
| $\alpha$_Score*Abnormal volume | | | | 0.12$^{***}$ | | |
| | | | | (3.12) | | |
| Net arbitrage trading | | | | | 0.18$^{***}$ | |
| | | | | | (3.64) | |
| $\alpha$_Score*Net arbitrage trading | | | | | 0.06 | |
| | | | | | (0.98) | |
| Disagreement | | | | | | 0.22$^{**}$ |
| | | | | | | (2.12) |
| $\alpha$_Score*Disagreement | | | | | | −0.30$^{***}$ |
| | | | | | | (−2.97) |
| Controls | yes | yes | yes | yes | yes | yes |
| adj. $R^2$ | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | 0.07 |
| Start | 1965:07 | 1965:07 | 1982:12 | 1965:07 | 1990:01 | 1999:04 |
| End | 2019:12 | 2019:12 | 2019:12 | 2019:12 | 2015:12 | 2019:12 |

**Table A15 Average returns of UMO portfolios across each MISP component variable quintiles**

Each month, we perform a $5 \times 5$ double sort on MISP and X, where X is one of the 11 anomaly variables in constructing MISP. This table reports the average returns of the underpriced-minus-overpriced (UMO) portfolios across the X quintiles. Underpriced refers to the quintile with the lowest MISP score (most underpriced), and overpriced refers to the quintile with the highest MISP score (most overpriced).

| Anomaly variable | Low X | 2 | 3 | 4 | High X | H-L |
|---|---|---|---|---|---|---|
| ACC | 0.61 | 0.68 | 0.28 | 0.41 | 0.27 | −0.34 |
| | (2.57) | (3.54) | (1.51) | (1.93) | (1.18) | (−1.20) |
| AG | 0.48 | 0.47 | 0.42 | 0.77 | 0.89 | 0.41 |
| | (1.79) | (2.34) | (2.63) | (4.07) | (4.37) | (1.24) |
| CEI | 0.51 | 0.21 | 0.46 | 1.10 | 0.79 | 0.28 |
| | (2.36) | (1.17) | (2.47) | (5.47) | (3.29) | (0.94) |
| Distress | 0.78 | 0.67 | 0.72 | 0.56 | 1.15 | 0.36 |
| | (4.32) | (3.92) | (4.31) | (3.09) | (4.47) | (1.19) |
| GP | 0.87 | 0.49 | 0.77 | 0.47 | 0.70 | −0.16 |
| | (4.22) | (3.01) | (4.29) | (2.36) | (2.78) | (−0.57) |
| ITA | 0.60 | 0.46 | 0.42 | 0.58 | 0.54 | −0.06 |
| | (2.49) | (1.86) | (1.86) | (3.15) | (2.12) | (−0.19) |
| MOM | 1.03 | 0.52 | 0.43 | 0.48 | 0.50 | −0.53 |
| | (5.13) | (3.59) | (3.00) | (3.27) | (2.86) | (−2.27) |
| NOA | 0.59 | 0.50 | 0.34 | 0.59 | 0.99 | 0.41 |
| | (2.63) | (2.11) | (1.47) | (3.15) | (3.86) | (1.31) |
| NSI | 0.55 | 0.19 | 0.61 | 0.78 | 0.96 | 0.41 |
| | (1.83) | (0.91) | (3.10) | (3.92) | (3.46) | (1.03) |
| O-Score | 0.87 | 0.82 | 0.72 | 0.91 | 1.09 | 0.22 |
| | (3.29) | (4.36) | (4.46) | (5.23) | (3.88) | (0.60) |
| ROA | 0.88 | 0.59 | 0.61 | 0.61 | 0.43 | −0.44 |
| | (3.68) | (3.49) | (3.31) | (2.94) | (1.52) | (−1.42) |

## References


Amihud, Y., Goyenko, R., 2013. Mutual fund's $R^2$ as predictor of performance. Review of Financial Studies 26, 667–694.

Baker, M., Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. Journal of Finance 61, 1645–1680.

Calvet, L. E., Campbell, J. Y., Sodini, P., 2009. Fight or flight? Portfolio rebalancing by individual investors. Quarterly Journal of Economics 124, 301–348.

Chen, Y., Da, Z., Huang, D., 2019. Arbitrage trading: The long and the short of it. Review of Financial Studies 32, 1608–1646.

Diether, K. B., Malloy, C. J., Scherbina, A., 2002. Differences of opinion and the cross section of stock returns. Journal of Finance 57, 2113–2141.

Etula, E., Rinne, K., Suominen, M., Vaittinen, L., 2019. Dash for cash: Monthly market impact of institutional liquidity needs. Review of Financial Studies 33, 75–111.

Gervais, S., Kaniel, R., Mingelgrin, D. H., 2001. The high-volume return premium. Journal of Finance 56, 877–919.

Grundy, B. D., Martin, J. S. M., 2001. Understanding the nature of the risks and the source of the rewards to momentum investing. Review of Financial Studies 14, 29–78.

Horenstein, A. R., 2020. The unintended impact of academic research on asset returns: The CAPM alpha. Management Science, forthcoming.

Hou, K., Xue, C., Zhang, L., 2020. Replicating anomalies. Review of Financial Studies 33, 2019–2133.

Hrdlicka, C. M., 2020. Trading volume and time varying betas. Review of Finance, forthcoming.

Jegadeesh, N., Titman, S., 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. Journal of Finance 48, 65–91.

Nagel, S., 2005. Short sales, institutional investors and the cross-section of stock returns. Journal of Financial Economics 78, 277–309.

Shue, K., Townsend, R., 2020. Can the market multiply and divide? Non-proportional thinking in financial markets. Journal of Finance, forthcoming.

Stambaugh, R. F., Yu, J., Yuan, Y., 2015. Arbitrage asymmetry and the idiosyncratic volatility puzzle. Journal of Finance 70, 1903–1948.

Stambaugh, R. F., Yuan, Y., 2017. Mispricing factors. Review of Financial Studies 30, 1270–1315.