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Investor Sentiment and Return Comovements: Evidence from Stock Splits and Headquarters Changes*

ALOK KUMAR[1], JEREMY K. PAGE[2] and OLIVER G. SPALT[3]

[1] *University of Miami;* [2] *Brigham Young University;* [3] *Tilburg University*

Abstract. This paper examines whether the trading activities of retail and institutional investors *cause* comovements in stock returns. Using stock splits and headquarters changes events and a variety of trading-based measures, we show *directly* that retail investors generate excess comovements in stock returns. Specifically, around stock splits, retail trading correlations decrease with stocks in the pre-split price range and increase with the post-split price range. Further, shifts in retail trading correlation influence return comovement changes around stock splits. In the cross-section, excess return comovements among low-priced stocks are amplified when retail trades are more correlated. We find similar patterns among local stocks and when firms change their corporate headquarters. These comove-

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ment patterns are stronger when uncertainty is high and behavioral biases are amplified. In contrast to retail trading, institutional trading attenuates return comovements.

JEL Classification: D14, G11, G14

stock splits and headquarters changes

1. Introduction

One of the fundamental goals of asset pricing theory is to understand the sources of common variation in security prices. The traditional asset pricing theory posits that return comovements arise from correlated fundamentals, i.e., cash flows or discount rates. However, a large literature in finance demonstrates the existence of return comovements that are not easily explained by these fundamentals.[1] Some of the cleanest evidence for excess comovements comes from analyzing comovement changes around stock splits. A stock split is a large discrete change in the nominal price of a stock that is unlikely to be related to firm fundamentals. As Green and Hwang (2009) show, stocks comove more with stocks in the new price range and comove less with stocks in the old price range after a split event.

While the Green and Hwang (2009) results provide strong evidence of comovement shifts that are unrelated to changes in fundamentals, they do not fully explain what factors drive these comovement shifts. In particular, they do not identify which mechanisms cause these comovement shifts and whether those shifts are induced by changes in investors' trading activities (e.g., level of trading or trading correlations). In this study, we use a variety

[1] Evidence of excess comovements has been provided for equity indices (Shiller, 1989; Greenwood, 2008), closed-end funds (Lee et al., 1991), commodities (Pindyck and Rotemberg, 1993), twin stocks (Froot and Dabora, 1999), index inclusions (Barberis et al., 2005; Boyer, 2011), and firm headquartered in the same area (Pirinsky and Wang, 2006).

of trading-based measures and examine *directly* to what extent retail and institutional trading activities generate excess comovements in stock returns.

Specifically, we focus on stock splits and corporate headquarter changes events to test whether habitat-based trading generates excess comovements in stock returns. While previous research has documented changes in comovement around these events, we introduce several measures of investor trading behavior that allow us to directly identify the impact of investor trading on return comovements. We also examine the relative roles of retail and institutional investors in generating excess comovements in stock returns.

Our empirical tests are motivated by the habitat-based return comovements framework proposed in Barberis et al. (2005).[2] In this setup, investors with certain attributes are attracted toward stocks with certain characteristics and investor clienteles emerge. Consequently, investors concentrate their trading within specific stock categories (i.e., habitats) and correlated trading activities of investor clienteles within their respective habitats can induce comovements in stock returns, especially when arbitrage costs are high.

In our empirical exercise, we relate trading activities of retail and institutional investors and return comovements directly. This approach is in sharp contrast to prior studies that test the theoretical predictions of the habitat-based model indirectly by studying return patterns around exogenous events or the relation between comovements and trading in the cross-section. Our tighter identification strategy allows us to better establish the existence

[2] Barberis et al. (2005) propose a test of the habitat-based theory based on S&P 500 index inclusions. However, this test has been subject to some criticism in the literature on the basis that (i) the change in comovements might be related primarily to changes in holding of S&P 500 index funds and are therefore not generalizable (Green and Hwang (2009)) and that (ii) S&P500 additions and deletions could coincide with a change in fundamentals (e.g., Denis et al., 2003; Boyer, 2011). We propose stock splits as an alternative and potentially cleaner test of their theory. We rely on the theoretical framework laid out in Barberis et al. (2005) and, in more detail, the NBER working paper version of this paper (Barberis et al., 2002). Note that unlike our study, Barberis et al. (2005) do not use trading or holdings data to directly test their theoretical predictions.

of non-fundamental, trading-based comovements in stock returns and the causal relation between trading and return comovements.

To establish the trading-comovement relation, we focus on comovement changes around stock splits. First, we construct new measures of trading correlations within price categories and show that certain price categories are the preferred habitats of retail and institutional investors. Then, we establish that following splits in stock prices, retail trading correlations within the new price category increases, while their trading correlations with the old price category decreases. These trading patterns mirror the patterns in comovement shifts documented in Green and Hwang (2009). In addition, the proportion of retail trades in a stock increases after it experiences a split. We employ a difference-in-difference approach to show that both changes in retail trading as well as changes in retail trading correlations significantly affect the magnitude of return comovement shifts around stock splits. These findings provide direct support for the predictions of the habitat-based return comovements framework.

We provide additional results to support the trading-induced comovement hypothesis. First, we extend the stock splits analysis to the cross-section and show that our new trading correlation measures are systematically related to measures of comovement used in the prior literature. In particular, we find that return comovements are high among stocks that are actively traded by retail investors and when retail trades within a stock are more strongly correlated. We present results from a large number of robustness checks to ensure that these results are not explained by standard firm-level or market-level attributes.

We also present results showing that our trading-based measures can be used to study return comovements in other settings. We do this by analyzing changes in trading correlations around corporate headquarter relocations, which have been suggested as another category change that is unlikely to be related to fundamentals (Pirinsky and Wang, 2006). Similar to the stock splits setting, Pirinsky and Wang (2006) show that stocks comove more with stocks in the new location and less with stock in the old location after a move. Consistent with the view that this pattern is also explained by the habitat-based view of investment, we document again that trading correlations with stocks at the new location increases and vice versa. Looking cross-sectionally at excess comovements among stocks in the same MSA we show that these comovements are amplified when local retail trading correlations are larger and when local market participation rates are likely to be high.

Last, we provide evidence suggesting that behavioral biases are important drivers of the correlation patterns in retail trading. Specifically, we posit that trading-induced return comovements get amplified during periods of higher aggregate uncertainty. This conjecture is motivated by the observation that behavioral biases that can induce correlated trading are exacerbated in uncertain environments.[3] Our results show that the impact of the investor trading on return comovements is particularly pronounced when uncertainty proxies suggest that behavioral biases get amplified.

Beyond providing evidence of retail trading induced return comovements, our direct trading-based approach also allows us to examine the relative roles of institutional and retail trading in generating comovement pattterns in stock returns. We find that contrary to what has been suspected in related research, we do not find that correlated institutional trading amplifies comovements. While the presence of retail investors is associated with stronger comovements, the presence of institutional trading attenuates comovements.

[3] Consistent with the theoretical predictions of Hirshleifer (2001), Kumar (2009) shows that investors' behavioral biases such as overconfidence, disposition effect, and familiarity get amplified when uncertainty levels are high, while Barber et al. (2009b) show that behavioral biases induce correlated buying and selling among retail investors.

Taken together, these results extend the recent behavioral finance literature that examines the relation between retail trading and stock returns (e.g., Kumar and Lee, 2006; Kaniel et al., 2008; Hvidkjaer, 2008; Barber et al., 2009a). More broadly, our results contribute to the growing behavioral literature that examines whether non-fundamental factors such as nominal prices, firm location and investor sentiment affect asset prices, including their comovements and liquidity.[4]

The two papers that are most closely related to ours are Green and Hwang (2009) and Kumar and Lee (2006). Green and Hwang (2009) show that return comovements change around stock splits but this finding alone does not constitute evidence for any particular theory of return comovements. In particular, they do not directly analyze the trading behavior of investors and do not identify the mechanisms that induce comovement shifts around stock splits. Our study provides an explanation for their findings and more generally for the theory of habitat-based return comovements.

In a related study, Kumar and Lee (2006) analyze trading patterns and show that retail buy-sell-imbalances are related to return comovements, especially among stocks that are attractive to retail investors. However, their study does not use exogenous shocks to trading and comovements to establish causality. In contrast, our primary identification strategy uses exogenous category changes to establish the causal relation between trading and comovements.

Another important difference between our paper and both the Kumar and Lee (2006) and Green and Hwang (2009) studies is that they do not look at institutional trading, while we examine the relative roles of retail and institutional trades in generating return comovements. Last, unlike previous studies, we study how market uncertainty affects re-

[4] For example, see Froot and Dabora (1999), Barber et al. (2009b), Loughran and Schultz (2004), Loughran and Schultz (2005), Dorn et al. (2008), and Karolyi et al. (2011).

turn comovements and relate the observed comovement patterns to investors' behavioral biases.

The rest of the paper is organized as follows. We describe our data sets and define the main variables in Section 2. In Section 3, we present our main empirical findings. We present additional supporting evidence in Section 4. We conclude in Section 5 with a brief summary.

2. Data and Measures

2.1 Data Sources

We obtain trading data from the Institute for the Study of Security Markets (ISSM) and the Trade and Quote (TAQ) databases. We use small-sized trades (trade size $\leq$ \$5,000) to proxy for retail trades. The sample period is from 1983 to 2000. Like Barber et al. (2009a), we use the ISSM/TAQ data only until 2000 because the assumption that small trades proxy for retail trading is less likely to be valid after 2000. In particular, the introduction of decimalized trading in January 2001 and extensive order-splitting by institutions due to reduced trading costs make small trade size a less reliable proxy for retail trading after 2000.[5]

We obtain stock price, return and trading volume data from the Center for Research on Security Prices (CRSP). We identify stock splits using CRSP distribution code 5523. We use Compustat to obtain measures of firm leverage, market-to-book, and other firm characteristics. We use Compustat as well as Compact Disclosure data sets to obtain historical firm headquarters locations and identify changes in headquarters. Further, we use

[5] See Hvidkjaer (2008) or Barber et al. (2009a) for additional details about the ISSM/TAQ data sets, including the procedure for identifying small trades.

Factiva to validate those corporate headquarters relocations. We obtain the monthly Fama-French factor returns and monthly risk-free rates from Kenneth French's data library.[6]

To study the effects of institutional trading on return comovements, we use data on the quarterly common stock holdings of 13(f) institutions compiled by Thomson Reuters. The sample period for our institutional results is from 1980 to 2005. We infer institutional "trades" from changes in their quarterly portfolio holdings. In some of our tests we use the county-level demographics data from the U.S. Census Bureau. The aggregate market-level sentiment data are from Jeffrey Wurgler's web site, while the retail and institutional confidence indices are from Robert Shiller's web site.[7]

Table I reports the summary statistics for the main variables used in the empirical analysis. All variables are defined in Appendix Table A.I.

2.2 Trading Measures

We characterize the retail and institutional habitats using stock-level trading measures. Specifically, using the retail and institutional trading data, we compute each stock's retail trading proportion (RTP) and institutional trading proportion (ITP) to measure the trading intensity of retail and institutional investors, respectively. RTP is defined as the ratio of the total month-t buy- and sell-initiated small trades (trade size below \$5,000) dollar volume and the total stock trading dollar volume in the same month.[8] We obtain the RTP measure for each stock at the end of each month and ITP is defined in an analogous manner using quarterly changes in institutional portfolio holdings (i.e., institutional trades).

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[6] The data library is available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.
[7] The sentiment data are available at http://pages.stern.nyu.edu/~jwurgler/, while the confidence indices are available at http://icf.som.yale.edu/Confidence.Index/.
[8] See Han and Kumar (2011) for additional details about the RTP measure.

We measure the level of correlation in the trading activities of retail and institutional investors by estimating the partial correlation of stock-level buy-sell-imbalance (BSI) with the portfolio BSI of stocks within a certain category p, controlling for correlation with the market. To compute the portfolio BSI, we first measure period-t BSI for each stock i using

$$BSI_{it} = \frac{VB_{it} - VS_{it}}{VB_{it} + VS_{it}}, \tag{1}$$

where VB_{it} and VS_{it} are the period-t dollar buy and sell trading volumes of stock i, respectively. The period-t portfolio BSI measure BSI_{pt} is the equal-weighted average of the period-t buy-sell imbalance of all stocks that belong to portfolio p.

The partial correlation is defined as the correlation between the residuals ε_{it} and η_{pt} from the following two regressions:

$$BSI_{it} = \gamma_{10} + \gamma_{11} RMRF_t + \varepsilon_{it} \tag{2}$$

$$BSI_{pt} = \gamma_{20} + \gamma_{21} RMRF_t + \eta_{pt}. \tag{3}$$

Here, BSI_{it} is the period-t buy-sell imbalance of stock i, BSI_{pt} is the equal-weighted buy-sell imbalance of the low-price stock portfolio in period t, and $RMRF_t$ is the period-t market return in excess of the risk-free rate. We use partial correlation measures to isolate the correlation in retail investor demand that is not driven by common correlation with the market.[9] We compute annual estimates of this partial correlation using monthly observations of retail BSI and refer to this measure as retail trading correlation (RTC). In

[9] We control for the market factor because retail investors might act as liquidity provides when market returns are low (e.g., Barber and Odean (2000), Kaniel et al. (2008)). Because the relation between retail investor BSI and the market factor can also be explained by non-behavioral reasons (such as institutional demand for immediacy, as in Kaniel et al. (2008)), we focus specifically on the component of BSI that is unexplained by the market.

the case of institutional trading, we compute annual estimates of trading correlation for overlapping three-year periods using quarterly BSI observations and refer to this measure as institutional trading correlation (ITC).

We use different stock categories (p) in our tests. In our stock split tests, we follow Green and Hwang (2009) and associate p with portfolios of high and low-priced stocks defined relative to the pre-split stock price. In our cross-sectional tests, we focus on the BSI of retail investors, whose trading activity as proxied by small-sized trades (trade size $\leq$ \$5,000) in the TAQ/ISSM data. Thus, VB_{it} (VS_{it}) is the dollar volume of small trades in month t, which were signed as buyer-initiated (seller-initiated) using the Lee and Ready (1991) algorithm. The portfolio BSI of the low-price portfolio is then the equal-weighted average BSI of low-priced stocks, defined as stocks priced below the 30^{th} percentile of NYSE stocks. When stock i is itself a low-price stock, we exclude it from the low-price portfolio when estimating correlation with the low-price portfolio BSI.

3. Main Empirical Results

In this section, we use our trading measures to investigate the impact of retail trading on return comovements within price-based investor habitats. Specifically, we examine whether return comovement changes are explained by changes in retail trading proportion (RTP) and, in particular, changes in retail trading correlations (RTC). We first focus on stock splits and then use cross-sectional tests to demonstrate that the results are likely to generalize to other related settings.

3.1 Comovements and Trading Patterns Around Stock Splits

In our main test, we use stock splits as an exogenous change in the price category to identify the causal impact of retail trading on return comovements. We follow the procedure in Green and Hwang (2009) to compute the comovement changes around stock splits. For each splitting stock, we define a high price and low-price category relative to the pre-split stock price as in Green and Hwang (2009). The low-price category contains stocks with a share price between 1/4 and 3/4 of the splitting stock's share price on the day prior to the split. The high price category is comprised of stocks with share price between 3/4 and 5/4 of the stock's pre-split price. For each stock that experiences a stock split, we then estimate

$$R_{it} - R_{ft} = \alpha_i + \beta_{LowPrice,i}\left(R_{it}^{LowPrice} - R_{ft}\right) + \beta_{HighPrice,i}\left(R_{it}^{HighPrice} - R_{ft}\right) + \varepsilon_{it}, \quad (4)$$

where R_{it} is the return of the stock that undergoes a price split, R_{ft} is the the risk-free rate, and $R_{it}^{LowPrice}$ and $R_{it}^{HighPrice}$ are the returns of the low- and high-price portfolios. We estimate the betas using daily returns for the year prior to and the year after the split, excluding the one-month window around the split. We require at least 20 observations in each period. These beta measures are commonly referred to as measures of comovement in the literature.

Table II, Panel A shows the results from the Green and Hwang (2009) test for our sample period. We report the low-price beta ($\beta_{LowPrice}$) and the high price beta ($\beta_{HighPrice}$) estimates, both before and after the stock split. Similar to Green and Hwang (2009), we find that stocks comove more with the low-price category after the split. This beta difference is highly significant and shows a change in comovements that is not related to firm fundamentals. We also find that the difference in the comovement differential between the low- and high-price categories increases following stock splits. This evidence indicates that there is an increase in comovement for low-priced stocks that cannot be explained by a common factor that would simultaneously affect comovements within low-price and high-price stock categories. In contrast, we do not find a significant change in comovements in the high-price category.[10]

In Panel B of Table II, we report the mean retail trading correlations (RTC) with respect to low-price and high-price stock categories for the period before the split, the period after the split, and the difference in estimates between the two periods. The results show that the RTC among low-priced stocks increases following a split, while the RTC among high-priced stocks decreases. This finding indicates that the buy-sell imbalance for a low-priced stock is more correlated with the buy-sell imbalances of other low-priced stocks after the split. Further, Panel C shows that the retail trading proportion (RTP) increases significantly after the split. Thus, the concentration of retail investors in a stock increases when it experiences a price split. Overall, the observed patterns in RTP and RTC supports our central conjecture and are consistent with habitat-based theories of return comovements.

3.2 Determinants of Comovement Changes Around Stock Splits

To test whether correlated retail trading generates price-based return comovements, we directly relate the change in comovements around stock splits to changes in RTP and RTC using cross-sectional regressions. Specifically, we follow Green and Hwang (2009)

[10] This finding is similar to Green and Hwang (2009) who do not find a significant difference in high price betas when they restrict their sample to 1971-1990, which is part of our sample period. When we restrict the sample period to 1990-2000, consistent with Green and Hwang (2009), we find a decrease of the high price comovements after stock splits.

and regress the cumulative comovement change, defined as

$$(\beta_{LowPrice,i,post} - \beta_{LowPrice,i,pre}) - (\beta_{HighPrice,i,post} - \beta_{HighPrice,i,pre}) \,, \qquad (5)$$

on cumulative changes in RTC and RTP, which are defined analogously, and several control variables.

The results in Table III show that the cumulative comovement change is higher if the cumulative change in RTC is higher. This evidence is consistent with the view that correlated retail trading within price categories induces excess comovements in stock returns. Since stock splits are unlikely to alter firm fundamentals, these changes cannot be jointly induced by simultaneous changes in firm fundamentals. These changes are also unlikely to reflect common time trends since we use difference measures.

The estimates from specification (2) provide additional support for our key conjecture, which posits that correlated trading generates comovements in returns. We find that the comovement change is stronger when there is more retail trading after stock splits. The pre-split level of RTP is also significantly related to comovement changes, which suggests that our results are stronger for smaller stocks with higher concentration of retail investors and higher arbitrage costs. These conclusions are unchanged if we follow Green and Hwang (2009) and include the Baker and Wurgler (2006) sentiment index, the NYSE size decile based on the price at the end of the prior year, and the pre-split price as additional controls.

Overall, the results in Tables 2 and 3 indicate that comovement changes around stock splits are induced by the correlated trading activities of retail investors. This evidence supports our key conjecture.

3.3 Cross-Sectional Tests: Sorting Results

We next investigate if these patterns are also evident more generally in the cross-section of stocks. The results from our stock splits tests show that retail trading induced comovement changes are particularly relevant for low-priced stocks. Motivated by this evidence, we focus on explaining return comovements among low-priced stocks. Specifically, for each stock i, we compute a measure of excess comovements by estimating the following time series regression:

$$R_{it} - R_{ft} = \beta_0 + \beta_1 LowPrcIdx_{it} + \beta_2 RMRF_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 UMD_t + \varepsilon_{it}. \tag{6}$$

To measure the return comovement relative to an index of low-priced stocks, we define a low-price index ($LowPrcIdx$), which is the equal-weighted portfolio return of stocks priced below the 30^{th} percentile of NYSE stock prices at the end of the prior year (excluding stock i). β_1 from this regression is the comovement measure for stock i relative to the return index of low-priced stocks. We estimate the beta annually using daily data.

Table IV, Panel A presents average values of β_1 (obtained using equation (6)) for RTP and RTC sorted portfolios. We use the entire universe of CRSP stocks for this analysis. If comovements are induced by correlated retail trading, then the average β_1 should be higher when retail trading is a large fraction of total trading in the stock (i.e., RTP is high) and when retail trades are more correlated (i.e., RTC is high).

The results reported in Table IV, Panel A are consistent with this conjecture. In particular, the return comovements increase monotonically with RTP and RTC and the difference in average low-price comovement across high and low RTP and RTC quintiles is highly statistically significant. These sorting results indicate that low-price comovements are stronger when retail investors trade more actively and their trades are more strongly correlated.

The last two rows in Panel A report the β_1 estimates for the institutional trading proportion (ITP) and institutional trading correlation (ITC) measures as defined in Section 2.2. These measures are the institutional analogues to the retail trading measures. These sorting results point to the important difference between the impact of institutional trading and retail trading on return comovements. Low-price comovements are not monotonic in ITC and the difference in average comovements between the high and the low quintiles is only weakly significant.

More strikingly, comovements decrease in ITP, which indicates that comovements are weaker when institutions are active in trading a stock. This finding suggests that informed trading by institutions and lower limits to arbitrage in stocks where institutions trade substantially reduce the degree of low-price comovements.

3.4 Cross-Sectional Tests: Pooled Regression Results

In the next set of tests, we examine whether the sorting results from the previous section hold in a multivariate setting. Specifically, we estimate pooled cross-sectional regressions to identify the main determinants of excess return comovements.

The dependent variable in our regression is the comovement measure relative to an index of low-priced stocks (β_1) obtained using equation (6). β_1 measures the comovement between stock i and the return index of low-priced stocks that cannot be explained by the standard risk factors. The main explanatory variables are RTP and RTC. The RTP measure is an indicator of the strength of retail trading in a stock and RTC measures the extent to which those trades are correlated with retail trading in low-priced stocks. We also define an interaction between RTC and RTP to test whether the effect of trading correlation on comovement is larger when the magnitude of retail trading is high.

In addition to these key independent variables, we consider the lagged values of several firm and regional variables to account for the effects of firm and regional characteristics on return comovements. For example, smaller firms might exhibit stronger return correlations because they are more susceptible to sentiment shifts. Similarly, the returns of firms located near an industry cluster could be more strongly correlated due to local information spillovers. The pooled regressions also include year and industry fixed effects defined using the 48 Fama and French (1997) industries. The standard errors are clustered by firm in all specifications.

The regression estimates are reported in Panel B of Table IV. Consistent with the evidence from the sorting tests, we find that low-price comovement is stronger among stocks with high levels of retail trading. The RTP coefficient estimate of 0.153 (t-statistic $= 20.25$) in specification (1) indicates that a one standard deviation change in RTP would be associated with an $0.153 \times 1.769 = 0.271$ increase in the low-price return comovement. Relative to the mean low-price index comovement estimate of 0.587, this represents an economically significant 46.17% increase.

We also find that the low-price index comovement is stronger when retail trades are more strongly correlated. The RTC coefficient estimate of 0.194 (t-statistic $= 9.88$) implies that a one standard deviation change in RTC would correspond to a $0.194 \times 0.401 = 0.078$ shift in the low-price return comovement. Relative to the mean low-price index comovement estimate, this represents a 13.25% shift.

If excess comovements are induced by correlated retail trading, then we expect the strongest effects when both RTP and RTC are high. The results from specification (4) strongly confirm this intuition. The coefficient on the RTP × RTC interaction term is positive and highly significant. Further, neither the RTC nor the RTP baseline effect is significantly affected by the inclusion of the interaction effect.

Overall, the pooled regression results suggest that the effect of correlated retail trading on return comovements generalizes to the broad cross-section of stocks.

3.5 Robustness Checks

In this section, we conduct additional tests designed to examine the robustness of our cross-sectional results in Table IV. The results from these tests are summarized in Table V where for brevity we only report the estimates of the main explanatory variables.

Although any comovements induced by fundamentals should be captured by the standard risk factors, in the first set of robustness tests, we directly control for cash flow correlations in our comovement regressions. We measure the cash flow beta of each stock using a three-year rolling window and include it as an additional explanatory variable in our comovement regressions.[11] We find that the coefficient estimate of cash flow betas in the low-price comovement regression are statistically insignificant (estimate = 0.001, t-statistic = 0.54). Other coefficient estimates, including the main RTC variable, remain qualitatively similar to the baseline estimates reported in Table IV.

In the second set of tests, we examine whether shifts in discount rates, as captured by local macro-economic conditions, influence return comovements. To capture changes in local discount rate, motivated by Korniotis and Kumar (2010), we use the state-level income growth rate, the relative unemployment rate in the state, and the state-level housing

[11] The cash flow beta measures are obtained in the same manner as the returns beta measures. We just replace the return-based variables in the time-series specifications of the form shown in equation (4) by cash flow variables. We define quarterly cash flows as earnings minus accruals, scaled by total assets

collateral ratio proposed in Lustig and van Nieuwerburgh (2005).[12] Again, we find that the comovement regression estimates are very similar to the baseline estimates reported in Table IV.

In the third set of tests, we consider alternative comovement measures. The first measure is defined as the change in the adjusted R^2 measure when the low-price index is added to the four-factor model. This comovement measure is defined in Appendix Table A.I. As a second alternative, we use partial correlations to measure comovements. Specifically, we first regress both the return of stock i and the return of the portfolio of low-priced stocks on the standard four factors, and then use the correlation between the residuals from these regressions as a measure of comovement. The estimation results presented in sets (3) and (4) indicate that our results are robust to the choice of the return comovement measure.

In the next set of tests, we estimate the comovement regressions for two sub-periods to ensure that our results are not time-period specific. We find that our results are robust to the choice of the sample period.

In the next three tests, we examine whether our results reflect lack of liquidity or commonality in liquidity induced by NYSE specialists (e.g., Chordia et al., 2000; Coughenour and Saad, 2004). Specifically, we directly control for liquidity using the Amihud (2002) illiquidity measure, exclude stocks that are priced below $5, which are likely to have lower liquidity, and exclude NYSE stocks that are likely to be influenced by shocks to market-makers' capital and inventory.[13] In all three instances, the retail trading measures and the interaction terms have estimates similar to the baseline results.

[12] The relative state unemployment rate is the ratio of the current unemployment rate to the moving average of past unemployment rates, where the moving average is a proxy for the expected level of unemployment or the natural rate of unemployment. The state-level housing collateral ratio measure captures investors' borrowing constraints and their ability to engage in risk sharing. It is defined as the log ratio of state-level housing equity to state labor income.

[13] Our results are almost identical when we control for liquidity using the bid-ask spread.

In the last set of tests, we examine whether our results are robust to variations in the definitions of the retail trading correlation measure. Specifically, we use 24 monthly observations instead of 12 to define the RTC measure. We find that our results are again essentially unchanged.

Overall, the results from these additional tests indicate that our baseline results reported in Table IV are robust. In particular, our evidence of trading based comovements do not reflect comovements induced by cash flow correlations, changes in discount rates, liquidity levels, or commonality in liquidity. The results are also not influenced by the estimation time periods or the specific choice of trading correlation or comovement measures.

4. Additional Supporting Evidence

Our results so far indicate that price-based return comovements are induced by correlated retail trading. The evidence provides strong support to our main conjecture. In this section, we provide three sets of additional tests to provide further support to our conjecture. First, we investigate the impact of institutional investors on return comovements and highlight the significant differences between the effects of institutional and retail trading on comovements. Second, we show that our trading correlation approach can also be used in other economic settings where prior research has suggested that comovements cannot be fully explained by firm fundamentals. In these tests, we focus on comovements among stocks that are geographically close. Third, using an alternative perspective, we provide additional evidence for the impact of correlated retail trading on return comovements. In particular, we show that our results are stronger when aggregate uncertainty is higher. These are the periods during which behavioral biases of retail investors are known to be stronger.

4.1 Institutional Trading and Return Comovements

We first study the impact of institutional trading on low-price return comovements. Institutional trading could attenuate excess comovements because their information-based trading would reduce the impact of correlated retail trading on return comovements. But institutions may also further amplify the comovement patterns, perhaps because institutions are subject to the same types of biases as retail traders. Our direct trading based approach allows us to shed light on these related questions.

We start by analyzing the patterns in ITP and ITC around stock splits. The results reported in Table VI, Panel A show that institutional trading correlations do not change significantly around stock splits. The mean estimates also suggest that increased institutional trading correlations cannot explain the observed shift in price-based comovements around stock splits. The evidence in Panel B shows that there is a significant drop in the institutional trading proportion following a split. To the extent that institutional trading proxies for sophisticated information-based trading, this evidence indicates that retail trading is likely to have a stronger impact on comovements after a split event.

Panel C of Table VI presents results when we re-estimate the pooled cross-sectional regression from Table IV using institutional trading measures. The dependent variable in these regressions is still the measure of price-based return comovement (β_1 from equation (6)) and we continue to employ all previously used control variables. The estimates in specification (1) show that unlike RTP, which was strongly positively related to comovements, the coefficient of ITP is negative and highly significant. Thus, return comovements are attenuated when the level of institutional trading in a stock is high. This evidence is consistent with the view that institutional trading is largely based on information and that institutions make pricing more efficient.

The pooled regression results also show that correlated trading among institutions (ITC) does not have a meaningful impact on return comovements. The ITC coefficient estimate is insignificant across all specifications. Given that the standard deviation of ITC is 0.377 and the low-price beta has a mean of 0.071, the economic magnitude of a one standard deviation shift indicated by the point estimates is very small.

Our finding of a significant institutional trading-comovement relation using ITP but not using ITC is reassuring for our retail trading results as they show that our empirical approach does not somehow mechanically generate a relation between trading and comovement. As can be seen from the last two specifications in Panel C, our baseline results on retail trading are not affected by including the institutional trading measures.

These results allow us to shed light on the debate in the literature on the impact of institutional trading on return comovements. While Kumar and Lee (2006) stress the potential of institutions to attenuate comovements, Green and Hwang (2009) conjecture that institutions might themselves exacerbate comovements. Our results indicate that overall institutions tend to attenuate, rather than amplify comovements, potentially because institutional investors are relatively more sophisticated.

4.2 Comovements Among Local Stocks

In this section, we examine comovement among local stocks as an alternative setting to price-based comovements. This is an interesting setting for our purposes because previous research (e.g., Pirinsky and Wang, 2006) has shown that local stocks comove together more than what can be explained by comovement in firm fundamentals and those comovement patterns change when firms move their headquarters. Finding evidence of a trading-comovement relation for the set of local stocks can be valuable because it would demonstrate that our baseline results can generalize and does not reflect anything specific to low-priced stocks.[14]

We start by analyzing RTC changes around headquarter relocations. For each stock that changed headquarters location, we estimate the partial correlations of the stock's retail BSI with the equal-weighted portfolio BSI of old and new local portfolios. The local portfolio is defined using firms in the same Metropolitan Statistical Area (MSA). We estimate the partial correlations using monthly data for a period of 24 months before and 24 months after the relocation, requiring at least 20 monthly observations to be included in the sample.

Table VII, Panel A reports changes in estimates of retail trading correlation (RTC) with respect to the local portfolios corresponding to the firms' headquarters locations before and after the move. Specifically, we report the mean RTC with respect to old and new local stocks for the period before the relocation, the period after the relocation, and the difference in the estimates between the two periods. We find that the change in RTC with respect to stocks in the firm's old location decreases significantly from 0.107 before the move to 0.063 after the move (t-statistic of the difference $= -2.19$). In contrast, RTC with respect to stocks in the firm's new location increases from 0.049 before the move to 0.078 after the move, although this increase is not statistically significant (t-statistic $= 1.03$).

As with price-based comovements, we also investigate the impact of correlated trading on return comovement in the cross section of stocks. Our measure of excess comovements is again the β_1 estimate from equation (6). However, we use an index of average stock returns of stocks headquartered in the same MSA instead of the low-price return index.

[14] Potential drawbacks of the local stock setting are that (i) we have to rely on a proxy from a smaller brokerage dataset to identify local trades because the TAQ/ISSM data does not allow us to identify the location of investors and (ii) the number of headquarter moves is small, which limits the statistical power of our tests involving headquarter relocations.

In Table VII, Panel B, we report the average values of the local comovement measure for RTP, RTC, ITP, and ITC sorted portfolios. We find that local comovement is positively related to RTP and increases monotonically with RTC. The difference in average excess comovements between high and low quintiles is significant in both cases. Hence, in yet another setting, we find that return comovements are positively related to the trading activities of retail investors.

In contrast, similar to the low-price comovement results, we find that local comovements are weaker when the level of institutional trading is high. In addition, correlated trading among local institutions is negatively correlated with excess comovements. This evidence suggests again that the level of institutional trading is likely to be a proxy for informed trading.

To further assess the effects of local retail trading on local return comovements, we examine the variation in local comovement as the extent of local participation rates and trading vary. We have to use this indirect approach because we cannot observe investor location directly in the TAQ/ISSM dataset. First, we consider a local stock market participation proxy that is constructed using county-level Census data. Specifically, motivated by the evidence in Campbell (2006), we assume that local stock market participation rates would be higher in urban regions with low concentration of minorities and younger, more educated, and high income individuals.[15] As an alternative measure of the importance of local trading, for each stock, we also obtain its average distance to all retail stockholders in the retail brokerage dataset. We assume that this distance measure would serve as a good proxy for the distance between the location of the firm and all its retail stockholders.

[15] See Appendix Table A.I for additional details about the local participation proxy.

The results in Panel B of Table VII show that while the relation between retail shareholder distance and comovements in this univariate test is not strong, local comovement increases as the local retail participation rates increase. This evidence is consistent with the conjecture that excess comovements are induced at least partly by the behavior of local investors.

In Panel C of Table VII, we examine these relations in a multivariate setting. The dependent variable in these regressions is the comovement measure used in Panel B. The independent variables are RTP, RTC, and the distance to shareholders. In addition, we include the full set of control variables used previously in Table IV, Panel B. Our results indicate that similar to the low-price comovements setting, local return comovements are influenced by the overall level of retail trading. The RTP variable has a positive and significant coefficient estimate.

Similarly, RTC has a positive and significant coefficient estimate. In specification (3), the local index RTC estimate of 0.051 (t-statistic $= 5.11$) implies that a one standard deviation change in RTC would correspond to a $0.051 \times 0.377 = 0.019$ shift in the local return comovement. Relative to the mean local return index comovement of 0.149, this represents a significant 12.75% increase. We also find that the distance to retail investors has a negative but insignificant coefficient estimate. The point estimate indicates that the local return comovement is stronger when a stock is held more by local retail investors.

To further assess the effects of local investors on local return comovements, we estimate the local return comovement regression for low, medium, and high local participation subsamples separately. These results are reported in Columns (4) to (6) of Table VII, Panel B. Consistent with our conjecture that local investors influence local return comovements, we find that our results are concentrated in the high local retail participation sub-sample.

In particular, local index RTC has a coefficient estimate of 0.007 (t-statistic = 0.47) for the low local participation sub-sample and 0.089 (t-statistic = 4.60) for the high local participation sub-sample. Finding that our results are stronger when local retail participation rate is high provides further support for our conjecture that local comovements are induced by local retail trading.

Collectively, our results from the local return comovements setting show that retail trading also induces return comovements among local stocks. Hence, while the stock split setting is particularly suited for our analysis, there is nothing special about stock splits. Our evidence generalizes reasonably well to other related settings.

4.3 Uncertainty, Trading Correlations, and Return Comovements

In our last set of tests, we examine the impact of aggregate market-level uncertainty and sentiment on return comovements and trading correlations. We conjecture that market-level uncertainty would amplify investors' behavioral biases, generate stronger trading correlations, and induce stronger return comovement patterns. This conjecture is motivated by previous research (e.g., Daniel et al., 1998, 2001; Hirshleifer, 2001), which posits that investors' behavioral biases would be stronger when they operate in informationally sparse environments.

Kumar (2009) provides empirical support for this conjecture and also demonstrates that greater market-level uncertainty induces stronger behavioral biases among retail investors. In particular, retail investors exhibit greater overconfidence, stronger disposition effect, and gravitate toward familiar domestic and local stocks during periods of greater market-wide uncertainty. Additionally, Barber et al. (2009b) show that behavioral biases induce correlated buying and selling patterns among retail investors.

Because uncertainty amplifies the behavioral biases of retail investors and their trading correlations, we conjecture that through its effect on behavioral biases, higher uncertainty levels would generate stronger comovement patterns in stock returns. Further, we expect to find a similar amplification role for investor sentiment because an increase in aggregate sentiment is typically driven by an increase in investor optimism and bullishness. Trading behavior of retail investors is likely to be more correlated during these high sentiment periods and could lead to stronger return comovements.

To test these conjectures, we estimate the low-price and local return comovement regressions from Table IV, Panel B, and Table VII, Panel C, separately for low, medium, and high sentiment and uncertainty sub-periods. Following Kumar (2009) and Lemmon and Portnaiguina (2006), we use the Chicago Board of Options Exchange volatility index (VIX) as a proxy for aggregate market-level uncertainty and the Michigan consumer sentiment index as a proxy for the level of the aggregate market sentiment. We also consider the Baker and Wurgler (2006) sentiment index and the Shiller retail confidence index.[16] For brevity, we only report the RTC coefficient estimates in Figure 1.

Panel A presents the results for the low-price setting. Across all four sentiment and uncertainty proxies we find that the RTC coefficient is highest when sentiment and uncertainty levels are high. Across all specifications we also observe that the statistical significance is higher during high uncertainty periods. The t-statistics are 3.07 for the Michigan Sentiment index, 3.91 for the VIX, 4.97 when we consider the Shiller retail confidence index, and 5.73 for the Baker and Wurgler (2006) sentiment index.[17] These results indicate

[16] The sentiment and uncertainty measures are positively correlated but the correlations are not very strong. For example, the correlations between the VIX and Michigan sentiment, Baker-Wurgler sentiment, retail confidence, and institutional confidence measures are 0.169, 0.346, 0.348, and 0.103, respectively.

[17] The respective t-statistics for the other specifications and variables are available from the authors upon request.

that correlated trading is more strongly related to comovements when behavioral biases of retail investors are more pronounced.

We repeat this analysis for the local stock setting in Panel B and find very similar patterns. In particular, we again find that our results are strongest when uncertainty and sentiment are highest.[18] The similarities in our results across multiple settings suggest that the trading-comovement relation is robust and our findings are unlikely to be spuriously generated.

Taken together, the results from our uncertainty tests suggest that behavioral biases are an important underlying driver of correlated retail trading that generates excess comovements in stock returns.

5. Summary and Conclusion

This paper provides evidence consistent with the view that correlated retail trading generates comovements in stock returns. Using a variety of trading-based measures, we show *directly* that retail investors generate excess comovements in stock returns. Specifically, we find that around stock splits retail trading correlations decrease with stocks in the pre-split price range and increase with the post-split price range. Further, retail trading correlation shifts influence return comovement changes around stock splits.

While the focus of our investigation is on stock splits and price-based comovements, we show in several other settings that correlated retail trading generates return comovements. For example, in a large cross-section of stocks we show that excess return comovements among low-priced stocks are amplified when retail trades are more correlated. We also find similar patterns among local stocks and when firms change their corporate headquarters.

[18] There is an exception. The top tercile of the Shiller index is larger than the bottom tercile but smaller than the middle tercile.

Last, we demonstrate that retail-trading induced comovement patterns are stronger when uncertainty is high and behavioral biases of retail investors are amplified.

In contrast to the impact of retail investors, active trading by institutional investors attenuates return comovements. This evidence is consistent with the view that relatively more sophisticated investors engage in information-based trading that reduces the impact of correlated retail trading on return comovements. Overall, the comovement patterns we document fit well with the habitat-based view of return comovements developed in Barberis et al. (2005).

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Table I. Summary Statistics. This table reports summary statistics for all variables used in the empirical analysis. All variables are defined in Appendix Table A.I. The retail trading proportion (RTP) and the retail trading correlation (RTC) measures are available for the 1983 to 2000 period, while the distance to retail measure is computed using data for the 1991 to 1996 period. The sample period is from 1980 to 2005 for all other variables.

Variables	Mean	Std. Dev.	25th Pctile.	50th Pctile.	75th Pctile.	N
Stock Split Variables						
Cumulative Beta Change	0.021	2.929	−1.649	0.078	1.691	1,138
Cumulative RTC Change	0.104	0.623	−0.311	0.103	0.527	1,138
Pre-Split RTP	0.246	0.260	0.084	0.153	0.313	1,138
RTP Change	0.163	0.307	0.006	0.087	0.242	1,138
Sentiment	0.127	0.369	−0.200	0.180	0.570	1,138
Size Decile	7.025	2.101	6.000	7.000	9.000	1,138
Pre-Split Price	44.84	14.03	35.00	44.13	53.88	1,138
Return Comovement Measures						
Low-Price Index Beta	0.587	1.508	−0.261	0.309	1.180	78,389
Local Index Beta	0.149	0.634	−0.121	0.058	0.333	78,323
Low-Price Index ΔAdj. R^2	0.312	1.001	−0.291	−0.062	0.503	78,389
Local Index ΔAdj. R^2	0.285	1.887	−0.311	−0.137	0.316	78,334
Trading Correlation Measures						
Low-Price Index RTC	0.145	0.401	−0.136	0.177	0.448	41,040
Local Index RTC	0.100	0.377	−0.163	0.115	0.379	41,011
Low-Price Indec ITC	0.099	0.377	−0.153	0.119	0.370	65,517
Local Index ITC	0.076	0.374	−0.179	0.093	0.346	65,481
Clientele Characteristics						
ln(1+RTP)	−0.100	1.769	−1.374	−0.132	1.169	41,515
ln(1+ITP)	0.244	0.209	0.059	0.210	0.383	78,389
EW Distance to Retail	1.019	0.519	0.713	1.000	1.283	54,903
Stock Characteristics						
Share Price	16.392	21.750	3.750	10.250	23.100	78,389
Dividend Yield	0.018	0.213	0	0	0.014	78,389
Past 12-Month Return	0.188	0.945	−0.256	0.046	0.384	78,389
Turnover	0.100	0.139	0.030	0.059	0.117	76,718
ln(Firm Age)	4.763	0.937	4.043	4.796	5.455	78,389
ln(Firm Size)	18.396	2.189	16.798	18.270	19.914	78,331
Market-to-Book	2.824	3.825	0.986	1.648	3.007	78,329
Leverage	0.223	0.190	0.044	0.200	0.353	78,148
3-Year R&D Expenditure	0.044	0.081	0	0	0.053	72,025
3-Year Advertising Expenditure	0.014	0.031	0	0	0.012	72,025
3-Year ROA	−0.017	0.172	−0.029	0.032	0.069	72,025
Regional Characteristics						
ln(Number of Firms in MSA)	4.285	1.280	3.367	4.615	5.142	78,389
Social Capital Index	1.344	0.589	0.920	1.310	1.750	67,929
Urban Dummy	0.953	0.072	0.943	0.978	0.995	78,389
Industry Cluster Dummy	0.707	0.455	0	1	1	78,315
Stock Market Participation Index	0.502	0.126	0.411	0.505	0.611	78,389

Table II. Trading Correlation and Comovement Changes Around Stock Splits. This table reports changes in return comovements, retail trading correlations, and proportion of trading by retail investors following 2-for-1 stock splits. Panel A reports changes in return comovement with low-price and high-price stock portfolios defined relative to the stock's pre-split share price. The low-price portfolio contains stocks with a share price between 1/4 and 3/4 of the splitting stocks share price on the day prior to the split. The high price portfolio is comprised of stocks with share price between 3/4 and 5/4 of the stock's pre-split price. For each split stock, we estimate

$$R_{it} - R_{ft} = \alpha_i + \beta_{LowPrice,i}\left(R_{it}^{LowPrice} - R_{ft}\right) + \beta_{HighPrice,i}\left(R_{it}^{HighPrice} - R_{ft}\right) + \varepsilon_{it},$$

where R_{it} is the return of the split stock, R_{ft} is the the risk-free rate, and $R_{it}^{LowPrice}$ and $R_{it}^{HighPrice}$ are the returns of the low- and high-price portfolios. We estimate the betas using daily returns for the year prior to and the year after the split, excluding the one-month window around the split and requiring at least 20 observations in each period. We report the mean values of $\beta_{LowPrice}$ and $\beta_{HighPrice}$ for the period before the split, the period after the split, and the difference in estimates between the two periods. Panel B reports changes in estimates of retail trading correlation (RTC) with respect to the low- and high-price portfolios around stock splits. For each stock that experiences a split, we estimate the partial correlations of the stock's retail buy-sell imbalance (BSI) with the equal-weighted portfolio BSI of low- and high-price portfolios as defined above. We estimate the partial correlations using monthly data for a period of 24 months before and 24 months after the split, requiring at least 20 observations in each period to be included in the sample. We report the mean RTC with respect to low-price and high-price stocks for the period before the split, the period after the split, and the difference in estimates between the two periods. In Panel C, we report mean retail trading proportion (RTP) for the period before the split, the period after the split, and the difference in estimates between the two periods, where RTP is the mean proportion of trading volume comprised by small trades over the 12 months before or after the split. In all panels, *t*-statistics are reported in parentheses below the estimates, with standard errors clustered by month. The sample period is from 1983 to 2000.

Panel A: Change in Return Comovement Around Stock Splits

	Price index return beta			
Price index	Before Split	After Split	Difference	N
Low Price	0.779	0.973	0.194	2,600
	(22.28)	(19.22)	(3.63)	
High Price	0.468	0.522	0.054	2,600
	(15.44)	(13.59)	(1.35)	
Low−High	0.311	0.451	0.140	2,600
	(5.04)	(5.30)	(1.54)	

Continued

Table II. Continued

Panel B: Change in Retail Trading Correlation Around Stock Splits

	Price index return beta			
Price index	Before Split	After Split	Difference	N
Low Price	0.049 (6.67)	0.115 (11.57)	0.061 (4.54)	1,138
High Price	0.055 (7.22)	0.011 (1.17)	−0.043 (−3.64)	1,138
Low−High	−0.005 (−0.40)	0.105 (6.74)	0.104 (4.88)	1,138

Panel C: Change in Retail Trading Proportion Around Stock Splits

	Before split	After split	Difference	N
Retail Trading Proportion	0.265 (24.87)	0.471 (20.55)	0.206 (11.00)	2,394

Table III. Comovement Changes Around Stock Splits: Cross-Sectional Regression Estimates. This table reports estimates from cross-sectional regressions of changes in return comovements around 2-for-1 stock splits on the change in retail trading correlations, the mean retail trading proportion (RTP) over the 12 months prior to the split, the change in RTP from the pre-spit period to the post-split period, the Baker and Wurgler (2006) measure of sentiment, the stock's NYSE size decile, and the pre-split share price. The dependent variable is the cumulative change in return comovement $\Delta\beta_{LowPrice} - \Delta\beta_{HighPrice}$, where $\Delta\beta_{LowPrice}$ and $\Delta\beta_{HighPrice}$ are the change in estimated low-price and high price betas from the regression

$$R_{it} - R_{ft} = \alpha_i + \beta_{LowPrice,i}\left(R_{it}^{LowPrice} - R_{ft}\right) + \beta_{HighPrice,i}\left(R_{it}^{HighPrice} - R_{ft}\right) + \varepsilon_{it},$$

estimated over the year prior to and the year after the split, excluding the one-month window around the split and requiring at least 20 observations in each period. The low-price portfolio is defined as stocks with a share price between 1/4 and 3/4 of the split stock's price on the day before the split, while the high price portfolio is defined as stocks whose price is between 3/4 and 5/4 of the splitting stocks pre-split price. Similarly, we measure the cumulative change in RTC as $\Delta \mathrm{RTC}_{LowPrice} - \Delta \mathrm{RTC}_{HighPrice}$, where $\mathrm{RTC}_{LowPrice}$ and $\mathrm{RTC}_{HighPrice}$ are the partial correlations of the stock's retail buy-sell imbalance (BSI) with the equal-weighted portfolio BSI of low- and high-price portfolios as defined above. We estimate the partial correlations using monthly data for a period of 24 months before and 24 months after the split, requiring at least 20 observations in each period to be included in the sample. t-statistics are reported in parentheses below the estimates, where standard errors are clustered by month. The sample period is from 1983 to 2000.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
RTC Change	0.446	0.419	0.414	0.401	0.405	0.397
	(2.99)	(2.82)	(2.78)	(2.73)	(2.78)	(2.71)
Pre-Split RTP		1.260	1.259	1.837	1.772	1.926
		(3.30)	(3.30)	(4.14)	(4.21)	(4.38)
RTP Change		1.374	1.365	1.735	1.468	1.707
		(3.58)	(3.55)	(4.45)	(3.87)	(4.37)
Sentiment			0.103			0.040
			(0.47)			(0.18)
Size Decile				0.174		0.146
				(3.30)		(2.05)
Pre-Split Price					0.020	0.007
					(2.71)	(0.70)
Adjusted R^2	0.027	0.037	0.037	0.048	0.044	0.047
N	1,138	1,138	1,138	1,138	1,138	1,138

Table IV. Determinants of Price-Based Comovement: Sorting Results and Pooled Regression Estimates. Panel A reports the mean estimate of excess comovements with respect to a habitat-specific return index sorted in to quintiles by RTP, RTC, ITP and ITC. Excess comovements are measured with respect to the low-price index, which is defined for each stock as the β_1 coefficient from equation (6). The differences between the high and low portfolios are also reported. Panel B reports coefficient estimates from pooled OLS regressions of price-based comovement measures on retail trading proportion (RTP), retail trading correlation (RTC) and other controls. The dependent variable is the annual estimate of a stock's comovement with low-priced (below 30^{th} NYSE percentile) stocks, controlling for the market, SMB, HML and UMD factors. All variables have been defined in Appendix Table A.I. The data are annual, with the sample period running from 1983 to 2000 for retail measures and from 1980 to 2005 for institutional measures. The regressions include year and industry effects using the 48 Fama and French (1997) industry definitions, and the standard errors are clustered by firm. The t-statistics for the coefficient estimates are reported in the parentheses below the estimates.

Panel A: Univariate Sorts

	Quintiles					
	Low	Q2	Q3	Q4	High	High−Low
RTP	−0.094	0.020	0.260	0.696	1.320	1.413
						(22.68)
RTC	0.215	0.356	0.506	0.542	0.609	0.395
						(5.68)
ITP	1.455	0.955	0.460	0.129	0.004	−1.442
						(−24.70)
ITC	0.558	0.464	0.463	0.521	0.641	0.083
						(1.85)

Continued

Table IV. Continued

Panel B: Pooled Regression Estimates

Variable	(1)	(2)	(3)	(4)
Clientele and Correlated Trading Measures				
ln(1 + RTP)	0.153		0.166	0.149
	(20.25)		(20.87)	(17.31)
Low-Price Index RTC		0.194	0.117	0.159
		(9.88)	(5.76)	(6.44)
RTP × RTC				0.098
				(6.88)
Stock and Firm Characteristics				
Share Price	0.002	−0.002	0.001	0.001
	(2.42)	(−3.26)	(0.77)	(0.69)
Monthly Turnover	0.085	0.132	0.108	0.120
	(1.26)	(1.79)	(1.51)	(1.67)
ln(Firm Age)	−0.064	−0.056	−0.060	−0.060
	(−5.85)	(−5.23)	(−5.62)	(−5.60)
ln(Firm Size)	−0.114	−0.036	−0.150	−0.170
	(−1.22)	(−0.38)	(−1.62)	(−1.84)
Market-To-Book	−0.026	−0.018	−0.031	−0.030
	(−2.28)	(−1.58)	(−2.78)	(−2.68)
Leverage	−0.126	−0.207	−0.117	−0.119
	(−13.05)	(−22.37)	(−12.16)	(−12.46)
3-Year R&D Expenditure	−0.004	0.003	−0.002	−0.002
	(−1.09)	(0.89)	(−0.69)	(−0.60)
3-Year Advert. Expenditure	0.143	0.148	0.133	0.133
	(2.42)	(2.47)	(2.26)	(2.27)
3-Year ROA	0.179	−0.007	0.189	0.172
	(0.80)	(−0.03)	(0.85)	(0.78)
Dividend Yield	0.694	0.655	0.510	0.513
	(2.28)	(2.12)	(1.70)	(1.71)
Past 12-Month Return	−1.670	−1.752	−1.605	−1.582
	(−14.94)	(−15.19)	(−14.60)	(−14.42)
Regional Characteristics				
ln(Number of Firms in MSA)	−0.004	−0.004	−0.006	−0.005
	(−0.43)	(−0.42)	(−0.61)	(−0.56)
Social Capital Index	−0.005	−0.001	−0.005	−0.005
	(−0.29)	(−0.06)	(−0.32)	(−0.30)
Urban Dummy	0.331	0.318	0.326	0.325
	(2.43)	(2.30)	(2.41)	(2.41)
Industry Cluster Dummy	0.038	0.033	0.036	0.033
	(1.87)	(1.56)	(1.76)	(1.63)
Adjusted R^2	0.180	0.172	0.186	0.188
N	31,977	31,567	31,451	31,451

Table V. Comovement Regressions: Robustness Test Results. This table reports the estimates from low-price return comovement regressions from a variety of robustness tests. We either add other explanatory variables in the comovement regression specifications or estimate them for sub-samples. The caption of Table 4 provides details about the comovement regressions.

Robustness Test	ln(1+RTP)	RTC	RTP×RTC	N	Adj. R^2
Baseline	0.149	0.159	0.098	31,451	0.188
	(17.31)	(6.44)	(6.88)		
(1) Include Cash Flow Betas	0.152	0.158	0.101	22,423	0.183
	(15.10)	(5.09)	(5.64)		
(2) Include Local Macro Variables	0.149	0.158	0.098	31,451	0.188
	(17.32)	(6.42)	(6.89)		
(3) Use ΔAdj. R^2	0.043	0.095	0.058	31,451	0.084
	(7.88)	(6.58)	(6.82)		
(4) Use $\rho_{r_i,LowPrcIdx\|X}$	0.008	0.016	0.005	31,451	0.175
	(17.21)	(14.00)	(7.42)		
(5) 1983-1991 Subperiod	0.153	0.171	0.066	11,697	0.169
	(9.89)	(4.32)	(2.97)		
(6) 1992-2000 Subperiod	0.144	0.127	0.119	19,754	0.200
	(13.52)	(3.96)	(6.85)		
(7) Include Amihud Liquidity Measure	0.150	0.161	0.101	31,451	0.192
	(17.08)	(6.54)	(7.24)		
(8) Exclude Stocks Priced Below $5	0.125	0.158	0.084	23,887	0.137
	(17.39)	(7.95)	(7.58)		
(9) Exclude NYSE Firms	0.144	0.109	0.123	20,096	0.169
	(13.05)	(3.70)	(6.27)		
(10) RTC Using Past 24 Months	0.140	0.126	0.156	19,743	0.169
	(13.12)	(3.47)	(6.27)		

Table VI. Comovement Estimates Using Institutional Trading Measures. This table reports changes in institutional trading measures around stock splits, as well as coefficient estimates from pooled OLS regressions of price-based comovement measures on institutional trading proportion (ITP), institutional trading correlation (ITC) and other controls. Panel A reports changes in estimates of ITC with respect to the low- and high-price portfolios around stock splits. For each split stock, we estimate the partial correlations of the stock's institutional buy-sell imbalance (BSI) with the equal-weighted portfolio BSI of low- and high-price portfolios as defined above. We estimate the partial correlations using quarterly data for a period of 20 quarters before and 20 quarters after the split. We report the mean RTC with respect to low-price and high-price stocks for the period before the split, the period after the split, and the difference in estimates between the two periods. In Panel B, we report mean ITP for the period before the split, the period after the split, and the difference in estimates between the two periods, where ITP is the mean proportion of trading volume comprised by institutions' quarterly net position changes over the four quarters before or after the split. Panel C reports coefficient estimates from pooled OLS regressions. The dependent variable is the annual estimate of a stock's comovement with low-priced (below 30^{th} NYSE percentile) stocks, controlling for the market, SMB, HML and UMD factors. All variables have been defined in Appendix Table A.I. The data are annual, with the sample period running from 1983 to 2000 for retail measures and from 1980 to 2005 for institutional measures. The regressions include year and industry effects using the 48 Fama and French (1997) industry definitions, and the standard errors are clustered by firm. The t-statistics for the coefficient estimates are reported in the parentheses below the estimates.

Panel A: Change in Institutional Trading Correlation Around Stock Splits

	Institutional Trading Correlation			
Price Index	Before Split	After Split	Difference	N
Low Price	0.061	0.048	−0.014	1,175
	(7.46)	(6.42)	(−1.32)	
High Price	0.049	0.065	0.019	1,175
	(7.02)	(8.71)	(1.66)	

Panel B: Change in Institutional Trading Proportion Around Stock Splits

	Before Split	After Split	Difference	N
Insti. Trading Proportion	0.361	0.343	−0.018	2,542
	(74.39)	(61.59)	(−3.83)	

Continued

Table VI. Continued

Panel C: Pooled Regression Estimates

Variable	(1)	(2)	(3)	(4)	(5)	(6)
ln(1 + ITP)	−0.854		−0.890	−0.894	−0.527	−0.530
	(−20.60)		(−21.62)	(−20.82)	(−9.17)	(−8.70)
Low-Price Index ITC		0.002	−0.007	−0.015	0.004	−0.018
		(0.10)	(−0.33)	(−0.37)	(0.14)	(−0.27)
ITP × ITC				0.034		0.089
				(0.34)		(0.59)
ln(1 + RTP)					0.153	0.136
					(19.05)	(15.89)
Low-Price Index RTC					0.106	0.154
					(5.20)	(5.98)
RTP × RTC						0.097
						(6.58)
Estimates of control variables have been suppressed						
Adjusted R^2	0.196	0.199	0.208	0.208	0.191	0.193
N	54,622	51,376	51,376	51,376	30,312	30,312

Table VII. Local Comovements: Sorting Results and Cross-Sectional Regression Estimates. This table reports changes in retail trading correlations around headquarter location changes and pooled OLS regressions of local comovement measures on measures of retail trading. Panel A reports changes in estimates of retail trading correlation (RTC) with respect to the local portfolios corresponding to the firms' locations before and after the move. For each stock that change headquarters location, we estimate the partial correlations of the stock's retail buy-sell imbalance (BSI) with the equal-weighted portfolio BSI of old and new local portfolios, defined as firms in the same Metropolitan Statistical Area (MSA) before and after the relocation. We estimate the partial correlations using monthly data for a period of 24 months before and 24 months after the relocation, requiring at least 20 monthly observations to be included in the sample. We report the mean RTC with respect to old and new local stocks for the period before the relocation, the period after the relocation, and the difference in estimates between the two periods. Panel B reports the mean estimate of excess comovements with respect to a habitat-specific return index sorted in to quintiles by RTP, RTC, ITP and ITC, as well as the average distance between the stock's headquarters and its retail shareholders and a measure of local stock market participation. Excess comovements are measured with respect to the local index, which is defined for each stock as the β_1 coefficient from equation (6). The differences between the high and low portfolios are also reported. Panel C reports coefficient estimates from pooled OLS regressions of local comovement measures on retail trading proportion (RTP), retail trading correlation (RTC), the average distance of the stock's headquarters to retail shareholders, and other controls. The dependent variable is the annual estimate of a stock's comovement with local (located in the same county) stocks, controlling for the market, SMB, HML and UMD factors. All variables have been defined in Appendix Table A.I. The data are annual, with the sample period running from 1983 to 2000 for retail measures and from 1980 to 2005 for institutional measures. The regressions include year and industry effects using the 48 Fama and French (1997) industry definitions, and the standard errors are clustered by firm. The t-statistics for the coefficient estimates are reported in the parentheses below the estimates.

Panel A: RTC Changes Around Headquarter Moves

	Retail Trading Correlation			
Local Index	Before Move	After Move	Difference	N
Old MSA	0.107	0.063	−0.051	109
	(8.18)	(3.85)	(−2.19)	
New MSA	0.049	0.078	0.036	68
	(2.48)	(3.33)	(1.03)	

Continued

Table VII. Continued

Panel B: Pooled Sample Sorting Results

	Quintiles					
	Low	Q2	Q3	Q4	High	High−Low
RTP	0.077	0.071	0.085	0.140	0.203	0.126 (5.03)
RTC	0.088	0.100	0.116	0.124	0.153	0.065 (3.05)
ITP	0.240	0.230	0.144	0.086	0.056	−0.184 (−7.32)
ITC	0.174	0.147	0.139	0.140	0.143	−0.031 (−2.32)
Participation Proxy	0.039	0.105	0.181	0.178	0.206	0.167 (9.03)
Distance to Retail Shareholders	0.124	0.118	0.134	0.135	0.129	0.005 (0.64)

Panel C: Pooled Regression Estimates

				Local Retail Part. Proxy		
Variable	(1)	(2)	(3)	Low (4)	Medium (5)	High (6)
Clientele and Trading Correlation Measures						
ln(1 + RTP)	0.015		0.015	0.016	0.010	0.022
	(3.68)		(3.45)	(2.62)	(1.34)	(2.95)
Low-Price Index RTC		0.056	0.051	0.007	0.034	0.089
		(5.56)	(5.11)	(0.47)	(2.14)	(4.60)
Distance to Retail Shareh.	−0.008	−0.009	−0.009	0.013	0.004	−0.024
	(−1.00)	(−1.06)	(−1.06)	(1.28)	(0.28)	(−1.48)
Stock and Firm Characteristics						
Share Price	−0.001	−0.001	−0.001	0.001	−0.002	−0.001
	(−2.17)	(−3.00)	(−2.48)	(2.33)	(−1.87)	(−2.02)
Monthly Turnover	−0.122	−0.125	−0.126	−0.063	−0.308	0.007
	(−1.83)	(−1.86)	(−1.88)	(−1.00)	(−1.63)	(0.15)
ln(Firm Age)	−0.001	0.000	−0.001	−0.005	0.000	0.003
	(−0.21)	(0.04)	(−0.10)	(−0.44)	(0.01)	(0.40)
ln(Firm Size)	0.541	0.546	0.535	0.207	0.359	0.715
	(8.74)	(8.98)	(8.65)	(2.39)	(4.24)	(6.53)
Market-To-Book	−0.017	−0.017	−0.018	−0.012	−0.016	−0.021
	(−2.72)	(−2.59)	(−2.72)	(−1.75)	(−1.25)	(−1.71)

Continued

Table VII. Continued

Leverage	0.001	−0.006	0.002	−0.010	0.010	−0.001
	(0.26)	(−1.49)	(0.33)	(−1.48)	(1.19)	(−0.11)
3-Year R&D Expenditure	−0.001	−0.001	−0.001	0.001	−0.005	0.003
	(−0.51)	(−0.42)	(−0.27)	(0.29)	(−1.72)	(0.91)
3-Year Advert. Expenditure	0.045	0.044	0.042	0.028	0.016	0.035
	(1.51)	(1.47)	(1.40)	(0.90)	(0.31)	(0.54)
3-Year ROA	0.216	0.203	0.187	−0.124	−0.192	0.504
	(2.00)	(1.84)	(1.72)	(−0.67)	(−1.18)	(2.58)
Dividend Yield	−0.210	−0.202	−0.237	0.285	−0.373	−0.512
	(−1.57)	(−1.48)	(−1.73)	(1.63)	(−1.40)	(−1.98)
Past 12-Month Return	−0.236	−0.237	−0.243	−0.202	−0.353	−0.206
	(−4.20)	(−4.09)	(−4.26)	(−2.47)	(−3.82)	(−1.99)
Regional Characteristics						
ln(Number of Firms in MSA)	0.024	0.024	0.024	0.014	0.020	0.022
	(6.98)	(6.97)	(6.89)	(2.92)	(3.22)	(2.26)
Social Capital Index	0.007	0.008	0.008	0.017	0.004	0.008
	(0.96)	(1.19)	(1.10)	(2.77)	(0.33)	(0.50)
Urban Dummy	0.241	0.226	0.230	0.059	0.203	0.522
	(5.88)	(5.48)	(5.59)	(1.51)	(2.92)	(4.14)
Industry Cluster Dummy	0.030	0.028	0.029	−0.012	0.006	0.039
	(3.08)	(2.85)	(2.96)	(−0.90)	(0.31)	(1.84)
Adjusted R^2	0.054	0.054	0.055	0.018	0.103	0.069
Number of Observations	27,124	26,757	26,675	8,706	8,909	9,060

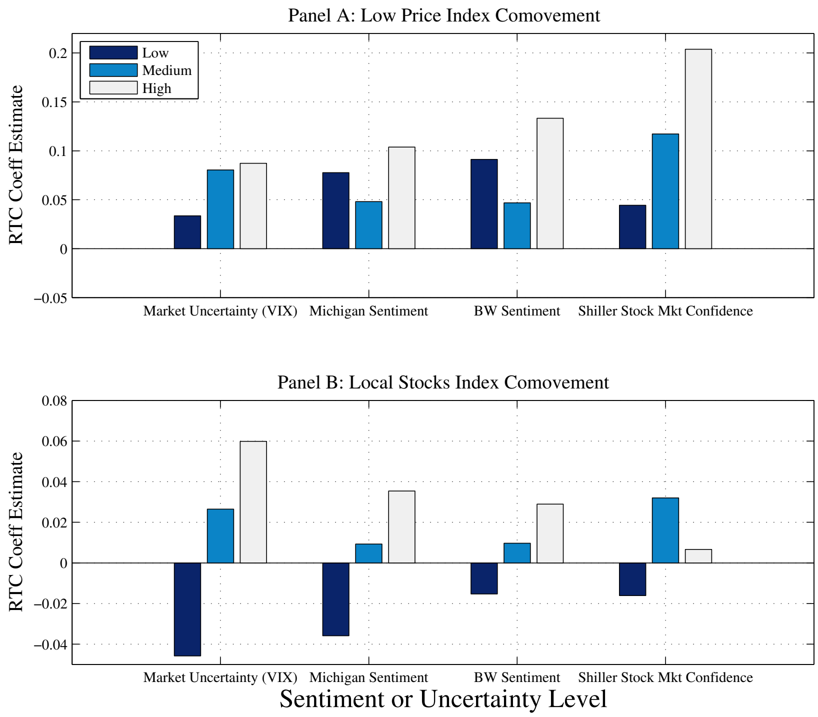

Fig. 1. Comovement Regressions: Uncertainty- and Sentiment-Based Sub-Period Estimates. This figure shows the RTC coefficient estimates from low-price (Panel A) and local (Panel B) comovement regressions, which are estimated separately for low, medium, and high sentiment/uncertainty sub-periods. The captions of Tables 4 and 7 provide details about the comovement regressions.

Appendix

Table A.I. Brief Definitions and Sources of Main Variables. This table briefly defines the main variables used in the empirical analysis. The data sources are: (i) ARDA: Association of Religion Data Archives, (ii) Brokerage: Large U.S. discount brokerage, (iii) Census: U.S. Census County Files, (iv) Compustat (iv) CRSP: Center for Research on Security Prices, (v) Estimated: Estimated by the authors, (vi) Putnam: Robert Putnam's web site, www.bowlingalone.com (vii) ISSM/TAQ: Institute for the Study of Security Markets (ISSM) and the Trade and Quote (TAQ) databases, (viii) 13(f): 13(f) institutional portfolio holdings data from Thomson Reuters. Table 1 reports the summary statistics for all these variables.

Panel A: Return Comovement and Trading Correlation Measures

Return Comovement Measures (Betas)
All return comovement measures are estimated as β_1 from the regression

$$r_{it} - r_f = \beta_0 + \beta_1 CharIdx_{it} + \beta_2 MKTRF_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 UMD_t + \varepsilon_{it}$$

where $CharIdx_{it}$ is the day-t return of an equal-weighted portfolio of stocks in a certain category, excluding stock i. The betas are estimated annually using daily data. The compositions of the category portfolios used for each comovement measure are described below.

Retail Trading Correlation Measures (RTC)
All RTC measures are estimated as the partial correlation of BSI_{it} with $CharIdx_t$, controlling for $MKTRF_t$, where BSI_{it} is the buy-sell imbalance of small trades in stock i during month t and $CharIdx_t$ is the equal-weighted mean BSI of stocks in a certain category, excluding stock i. The BSI beta is estimated annually using monthly data. The compositions of the category portfolios used for each trading correlation measure are described below.

Institutional Trading Correlation Measures (ITC)
All ITC measures are estimated as the BSI_{it} with $CharIdx_t$, controlling for $MKTRF_t$, where BSI_{it} is the buy-sell imbalance of institutional trades inferred from quarterly 13(f) statements in quarter t and $CharIdx_t$ is the equal-weighted mean BSI of stocks in a certain category, excluding stock i. The BSI beta is estimated over a three year window using quarterly data. The compositions of the category portfolios used for each trading correlation measure are described below.

Stock Category Definitions

Low Price:	Stocks priced below the 30^{th} NYSE percentile of price at the end of the prior year.
Local:	Stocks in the same MSA.

Continued

Table A.I. Continued

Panel B: Other Measures

Variable Name	Description	Source
Alternative Return Comovement Measures		
Low Price $\Delta AdjR^2$	Adj. R^2 from the regression $r_{it} - r_f = \beta_0 + \beta_1 LowPrcIdx_{it} + \beta_2 MKTRF_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 UMD_t + \varepsilon_{it}$, minus the Adj. R^2 from the regression $r_{it} - r_f = \beta_0 + \beta_1 MKTRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_{it}$, estimated annually using daily data.	Estimated
Local Stocks $\Delta AdjR^2$	Adj. R^2 from the regression $r_{it} - r_f = \beta_0 + \beta_1 LocalIdx_{it} + \beta_2 MKTRF_t + \beta_3 SMB_t + \beta_4 HML_t + \beta_5 UMD_t + \varepsilon_{it}$, minus the Adj. R^2 from the regression $r_{it} - r_f = \beta_0 + \beta_1 MKTRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_{it}$, estimated annually using daily data.	Estimated
Clientele Characteristics		
ln(1+RTP)	Natural log of one plus the ratio of dollar volume of small trades to total dollar volume.	ISSM/TAQ
ln(1+ITP)	ITP is defined as the sum of absolute dollar value of quarterly share changes by institutions, scaled by total dollar volume over the quarter.	13(f)
EW Distance to Retail	Equal weighted distance between retail shareholders in the brokerage database and firm headquarters location, in thousands of miles.	Brokerage
Stock Characteristics		
Stock price	Price of the stock at a certain point in time.	CRSP
Monthly Turnover	Average monthly share turnover (share volume/shares outstanding) over the prior year.	CRSP
ln(Firm Age)	Natural log of the number of months since the stock appeared on CRSP.	CRSP
ln(Firm Size)	Natural log of Price × Shares outstanding (in millions).	CRSP
Market-To-Book (M/B)	Ratio of market value of equity to book value of equity.	Compustat
Leverage	Total debt in current liabilities plus total long-term debt, divided by total assets.	Compustat
3-Year R&D Expenditure	3-year average of R&D expenses.	Compustat
3-Year Advert. Expenditure	3-year average of advertising expenses	Compustat
3-Year ROA	3-year average of ROA.	Compustat
Dividend Yield	Total dividends paid in the prior year divided by price at the end of the prior year.	CRSP
Past 12-Month Return	12-month stock return over the prior year.	CRSP

Continued

Table A.I. Continued

Regional Characteristics		
ln(Num Firms in MSA)	Natural log of the number of firms located within the MSA.	Compustat
Social Capital Index	Social capital index in the MSA nearest to the firm headquarters location (based on Robert Putnam's Bowling Alone book).	Putnam
Urban Dummy	Ratio of population in living in urban areas in the county where firm headquarters is located.	Census
Industry Cluster Dummy	MSA level measure, equals 1 if 10% or more of the market capitalization of firms located in the MSA are from a single industry, and 10% or more of that industry's market capitalization is located in that MSA.	CRSP, Compustat
Local Market Participation Index	Stocks are assigned to vigintiles by per capita income, education, urbanicity, median age, and minority population in the county where the firm is headquartered (age and minority enter negatively so that 20 indicates the lowest levels of age and minority population). The income, education, urban, age, and minority vigintile assignments are added for each stock to produce a score ranging from 5 to 100, which is then scaled to range from 0 to 1 using $(Score - 5)/(100 - 5)$.	Estimated, Census