Relative Sentiment and Stock Returns

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The sentiment of retail investors relative to that of institutional investors was measured by comparing their respective portfolio allocations to equity versus cash and fixed-income securities. The results suggest that fluctuations in retail sentiment are a primary driver of equity valuations for reasons unrelated to fundamentals.

Sentiment in an investment context may refer to fluctuations in risk tolerance or to overly optimistic or pessimistic cash flow forecasts.

In either case, sentiment should have an impact on asset pricing that is distinct from the impact of fundamentals (changes in the investment opportunity set, “rational” cash flow forecasts, interest rates, etc.). When sentiment rises, investors seek to increase their investment allocations to risky assets, thereby bidding up valuations and, in the process, lowering the expected future return (given fundamentals) on those assets. Erosion in sentiment has the opposite effect, which leads to an increase in the expected return associated with any given set of fundamentals.

Several recent papers have explored the asset-pricing implications of sentiment by proposing proxy variables and then relating those proxies to equity returns. Rather than using proxies, this study focused on the essential meaning of sentiment: a time-varying propensity, unrelated to fundamentals, to invest in risky assets. Thus, we assessed sentiment directly by using observed allocations to (i.e., portfolio proportions held in) risky assets. Of course, this approach immediately presents a conundrum: All assets have to be held by someone, so changes over time in the aggregate allocation to risky assets can occur only if the aggregate value of the entire supply of risky assets changes relative to the aggregate value of other asset classes. But the comparative size of each asset class can change only as a result of either net security issuance or differences in returns. Fluctuations in sentiment may, in fact, be among the drivers of differential returns on risky assets versus other assets, but because so many other factors also affect returns and aggregate supply, the aggregate allocations to risky assets cannot be equated with sentiment.

It is easier to justify equating comparative allocations to risky securities with relative sentiment in groups of investors. By “comparative allocations,” we mean the difference in allocations to risky assets between two sets of investors. The comparative approach largely avoids the confounding influence of fundamentals, to the extent that fundamentals affect the two groups similarly. For example, the effect of changing asset supply cancels out in a cross-group comparison. Moreover, “rational” cash flow forecasts should be similar among investor groups because information asymmetries are probably not material at a macro level; forecasts for the broad market are based largely on public information, which is the same for all investor groups. Finally, to the extent that discount rates are the result of systematic macro factors (interest rates, investment opportunities, etc.), differences among groups cancel out. By elimination, comparative allocations reflect primarily the sentiment of one group of investors relative to the sentiment of another.

Thus, although it is difficult to attribute a shift in aggregate allocations to sentiment (as opposed to fundamentals), a link between sentiment and comparative allocations is plausible. One question, however, is whether relative sentiment has the same implications for asset pricing as aggregate sentiment. A more important question is whether comparative allocations to risky assets can be used to identify an impact of sentiment on asset pricing. Our analysis demonstrates that the answer is yes.

To see why, suppose that one group of investors experiences an upward surge in sentiment with no concurrent change in fundamentals. To achieve its desired increase in exposure to risky assets, the optimistic group must induce an offsetting shift in the desired allocation of other investors (unless those other investors just coincidentally...
experience a concurrent wave of pessimism). The optimists accomplish this shift in other investors’ desired allocation by bidding for the equity of the other investors; in the process, the optimists force up equity prices to the point at which the other investors no longer consider the expected return on their equity position sufficiently attractive to continue holding that position. In this framework, the sector with relatively stable sentiment (“other investors”) acts as a sort of market maker, accommodating (at a cost) the fluctuating demands of investors with changing sentiment.

The interplay between the variable-sentiment and stable-sentiment sectors provides two empirical implications. First, the allocations to equity of the more variable sector will move in tandem with concurrent market returns (as they bid up prices while increasing their equity allocations), whereas allocations to equity of the stable sector will move inversely with concurrent returns (as they sell off equity in response to higher prices and lower expected future returns). The association between market returns and comparative asset allocations thus provides a means to test which sector’s sentiment shifts are the driving force behind asset reallocations. Second, increases in the comparative equity allocation of the sector identified as the more variable should predict lower future equity returns.

Thus, to identify relative sentiment in our study, we used comparative allocations to risky assets. The key requirement underlying this approach is that sentiment shifts in one identifiable category of investors be consistently more volatile than those of the complementary set of investors. For example, if the sentiment of all investors fluctuates in tandem, then relative sentiment is stable and cannot be used to detect a sentiment influence on asset pricing. Similarly, if the volatility of sentiment for the two groups is similar, then relative sentiment will have no identifiable asset-pricing implications. For example, suppose we observe that the comparative allocation to risky assets by investors in Group A has fallen. Given equal volatility in sentiment, this decline would reflect a downward shift in the sentiment of Group A half of the time but it would reflect increased sentiment among other investors half of the time. In the first scenario, selling pressure from Group A would push asset prices down and expected returns up. In the second scenario, buying pressure from other investors would push asset prices up and expected returns down. On average, neither concurrent nor expected future market returns would be correlated with comparative allocations.

Hence, our comparative approach can be used to evaluate the asset-pricing implications of sentiment if and only if the volatility of sentiment of one group of investors exceeds that of the other group of investors. Many studies posit that, indeed, retail investors as a group have substantially more volatile sentiment than institutional investors have. Our study examined whether this hypothesis is consistent with observed pricing patterns. In particular, we investigated two predictions: (1) that the comparative equity allocation of retail investors (i.e., the level of relative sentiment) is negatively associated with subsequent market returns and (2) that changes in the comparative equity allocations of retail investors are positively associated with concurrent market returns.

We tested these predictions by using the asset allocations of the retail and institutional sectors constructed from the U.S. Federal Reserve Board’s Flow of Funds Accounts.

**Sentiment and Returns**

Several recent papers have asked whether investor sentiment affects asset pricing. Broadly speaking, these studies can be categorized into one of two groups:

- studies that relate various sentiment proxies to returns at an individual-stock level and
- studies that relate proxies for aggregate sentiment to broad market returns or the returns to a market sector thought to be prone to sentiment influences.

The first category includes studies of trading by retail investors (Barber, Odean, and Zhu 2009; Hvidkjaer 2008), market reactions to media reports (Tetlock 2007), and fund flows prorated either to factor-mimicking portfolios (Teo and Woo 2004) or to individual stocks via data on portfolio holdings (Frazzini and Lamont 2008). As in most studies of sentiment, the focus in these studies is twofold: documenting a positive concurrent correlation between sentiment and returns and documenting a subsequent price reversal. The price reversal provides an important basis for the argument that sentiment, rather than a change in fundamentals, explains the concurrent association with returns. Another study along these lines is Ali, Hwang, and Trombley (2003), which shows that the book-to-market effect is strongest in stocks that are difficult to arbitrage, which is consistent with the effect arising from mispricing rather than missing risk factors.

The return frequency of individual-stock studies is generally high, with price impacts measured over holding periods of about two weeks, making many of these studies more relevant to...
microstructure concerns than to asset pricing. The evidence in Teo and Woo (2004) and Frazzini and Lamont (2008), however, pertains to a much longer horizon, which is consistent with asset-pricing implications. In particular, these two studies show that when mutual fund flows are directed toward a certain investment style or sector of stocks, that style or sector tends to outperform in the near term but underperform in the long run (approximately three years).

Our study is closely related to the second category of sentiment study—namely, examining long-run returns to the market or broad market sectors. Most of the studies in this category focus on sectors rather than the market as a whole. The typical procedure is to relate the long-run returns of the target sector (e.g., difficult-to-arbitrage stocks, small-capitalization stocks, or non-dividend-paying stocks) to a proxy for aggregate sentiment. Many sentiment proxies have been used, including consumer and investor sentiment surveys (Lemmon and Portniaguina 2006; Brown and Cliff 2005); aggregate mutual fund flows (Ben-Raphael, Kandel, and Wohl 2008); trading volume (Baker and Stein 2004); the “dividend premium” (i.e., the difference in the average market-to-book ratio for dividend payers versus non-payers; Baker and Wurgler 2004); the closed-end fund discount (Lee, Shleifer, and Thaler 1991); IPO first-day returns, issuance volume, and trading volume (Loughran and Ritter 1995; Lowry 2003; Derrien 2005; Cornelli, Goldreich, and Ljungqvist 2006); and equity issues as a fraction of total capital issuance (Baker and Wurgler 2000).

Our study differs from these long-horizon studies in two important respects. First, we examined investment holdings directly instead of using sentiment proxies. On this dimension, the studies closest to ours are those that used surveys of consumer and investor sentiment, which are also direct in nature. Our approach differs, however, in that we focused on investment actions rather than self-reported subjective assessments of sentiment. Second, our study was necessarily one of relative, as opposed to absolute, sentiment. Certain other studies focused on one investor group—for example, retail trades, IPO investors, or mutual fund flows. None of these studies explicitly computed a relative sentiment measure, however, and thus directly compared retail investors’ actions with the actions of institutional investors.

We emphasize that none of the proxies used in prior studies equate with the relative sentiment of retail versus institutional investors. For example, although flows into equity-oriented mutual funds may be driven partly by retail optimism, they may also be driven by economywide shifts in expected cash flows, interest rates, or the supply of equity versus debt investments. Thus, concurrent institutional flows into equities may be even larger than fund flows. We are not saying that existing studies are uninformative; our argument is simply that by using a measure with a different rationale (and, as it turns out, a low correlation with other indicators of absolute sentiment), our approach sheds independent light on the role of sentiment in security pricing.

**Data**

Our primary data source was the Federal Reserve’s quarterly Z.1 statistical release. This source provides quarterly holdings data for various categories of cash and cash equivalents, equities, and fixed-income securities. We combined these data to measure the allocations of retail and institutional accounts. The filings themselves go back to 1945, but certain categories of institutional holdings do not go back that far, so our primary data are for the fourth quarter (Q4) of 1968 through Q4 of 2008.

We partitioned the universe of invested wealth into two categories: (1) that allocated by “pure” institutional investors, such as defined benefit pension funds, endowments, and trusts, and (2) that allocated by retail investors. Our classification of investor classes into retail versus institutional sectors was guided by who had control over broad asset allocations. For example, we counted mutual funds as retail investors because, although mutual funds are, of course, “institutions,” most of them operate within a single asset class (e.g., cash/bonds/stocks) and, crucially, the retail investor directs the allocation among these classes. More than 85 percent of mutual fund assets are held in individual rather than institutional accounts (ICI 2008). Therefore, asset allocations in mutual funds reflect the decisions of retail investors. We defined institutional categories as those in which the beneficial investor generally has no say over asset allocation. Therefore, we classified defined benefit (DB) pension plans as part of the institutional sector but defined contribution (DC) plans as part of the retail sector.

The partition we made is a true partition, in the sense that we counted only dollars recorded in the Flow of Funds statistics. Thus, “all stock” as we use it here means “all stock holdings recorded in the Flow of Funds Accounts.” Our investable universe is, therefore, delimited by those assets reported in the Flow of Funds, and our asset allocation is based on a three-asset-class taxonomy (cash, bonds, or stocks). Appendix A summarizes the line items included in each sector.
Table 1 summarizes basic characteristics of the data. Panel A provides the composition of retail portfolios and institutional portfolios. Not surprisingly, retail investors devote a far larger share of their portfolios to cash equivalents, presumably a reflection of their demand for precautionary holdings. As a result, retail investors place smaller fractions of their portfolios in equity and long-term fixed-income assets than do institutional investors. Panel B indicates what fraction of each asset class is owned by the retail sector and the institutional sector. Here, the retail side tends to dominate all three asset classes. This domination merely reflects the larger size of the household sector (which includes mutual funds as well as DC pension plans) in relation to the institutional sector, particularly in the early years of the sample.

Panel C presents summary statistics for an index of relative retail sentiment. The index is constructed as follows:

\[
\text{Index of relative retail sentiment} = \frac{\text{Fraction of retail investable wealth held in equity}}{\text{Fraction of total investable wealth held in equity}}
\]

A sentiment index of 1.0 would indicate that the retail sector maintained an asset allocation matching that of the broad market. In practice, retail investors, on average, have allocated a lower fraction of their total portfolios to equity than have institutional investors, probably because of their liquidity needs and resulting demand for money market securities. Thus, the value of the sentiment index averages 0.985 in our sample and ranges from 0.927 to 1.028.

Figure 1 provides a plot of the index of relative sentiment over time. Notice that the ratio trended down during the bear markets of the 1970s, trended up during the dot-com era of the 1990s, and turned back down again in the dot-com meltdown. This casual observation suggests that retail allocations to equity are more highly associated than are institutional allocations with contemporaneous stock market performance.

A rising index indicates that the retail sector is becoming comparatively more optimistic than institutional investors about the prospects for equity markets. This interpretation is purely relative, however, because the retail allocation to equity is normalized by aggregate market weights. Indeed, because we partitioned investors into two classes, an increase in relative retail optimism necessarily implies an increase in relative institutional pessimism: Retail investors can acquire a disproportionately large (or small) share of equities only to the extent that institutional investors make opposite adjustments to their allocations. Thus, our relative measure does not vary in tandem with broad measures of aggregate sentiment for purely mechanical reasons. In fact, over the period starting in 1978, when the University of Michigan Consumer Sentiment Index became available, our measure has a correlation of only 0.185 with that measure. Similarly, the correlation of our index with the Baker–Wurgler (2006) composite index of investor sentiment is 0.080. Both results suggest that our measure of relative sentiment captures a phenomenon different from absolute sentiment.\(^7\)

<table>
<thead>
<tr>
<th>Table 1. Summary Statistics, 1968:Q4–2008:Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Retail Sector</strong></td>
</tr>
<tr>
<td><strong>Institutional Sector</strong></td>
</tr>
<tr>
<td><strong>Asset Class</strong></td>
</tr>
<tr>
<td>A. Fraction of portfolio in each asset class</td>
</tr>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>Fixed income</td>
</tr>
<tr>
<td>Equity</td>
</tr>
<tr>
<td>B. Fraction of asset class owned</td>
</tr>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>Fixed income</td>
</tr>
<tr>
<td>Equity</td>
</tr>
<tr>
<td>C. Index of relative retail sentiment</td>
</tr>
<tr>
<td>Min. = 0.927</td>
</tr>
</tbody>
</table>

Notes: Data are taken from the Federal Reserve’s quarterly Z.1 statistical release and aggregated as described in Appendix A. The “Index of relative retail sentiment” is defined as the fraction of retail wealth held in equity divided by the fraction of total wealth held in equity.
Evidence on Relative Sentiment and Asset Returns

Although retail sentiment is commonly assumed to be more variable than institutional sentiment, it need not be so. In principle, institutions could undergo volatile shifts in sentiment that push valuations up (or down) as they force offsetting equity reallocations on retail investors. In that case, institutional rather than retail reallocations would drive asset prices and be positively associated with concurrent returns. Thus, before testing whether relative sentiment is associated with future returns, we began with an assessment of which sector seems to be on the active side of sentiment shifts.

Sentiment and Contemporaneous Returns.

If the commonly held view that the retail sector is more prone to fluctuations in sentiment obtains, then we should see equity valuations rise (fall) in tandem with increases (decreases) in our index of relative retail sentiment. Conversely, if variation in institutional sentiment is the driving force behind comparative changes in portfolio allocations, then the sentiment index should be inversely correlated with contemporaneous equity market returns. Thus, our first set of tests was to examine the relationship between market returns (as measured by the CRSP indices) and concurrent changes in the relative sentiment index.

Table 2 presents regression results relating market returns to the change in relative retail sentiment in the concurrent quarter.

Panel A of Table 2, which shows the relationship between changes in the sentiment index and market returns as measured by the CRSP value-weighted index, indicates that changes in relative retail sentiment are strongly and positively correlated with concurrent market returns. The slope coefficient for the full sample period is 9.70, with a t-statistic of 9.42. The sample standard deviation of changes in sentiment from one quarter to the next is 0.0055, so this coefficient implies that a one-standard-deviation increase in the sentiment index is associated with a contemporaneous increase in market valuations of 0.0055 × 9.70 = 0.053, or 5.3 percent. Moreover, the $R^2$ for the regression is a very impressive 36 percent. One might reasonably wonder whether the dot-com boom and bust of 1998–2002 drove these results. When we ended the sample period in 1997:Q4, however, we found that the relationship in this pre-bubble period, as Panel A shows, is essentially unchanged.
Panel B provides the results of similar analysis but with the CRSP equal-weighted index, instead of the value-weighted index, as the market proxy. The equal-weighted index gives higher point estimates of the sensitivity of market returns to changes in sentiment than in Panel A, but because that index is noisier than the value-weighted index, the \( t \)-statistics are actually lower. Nevertheless, the results in Panel B are fully consistent with those in Panel A.

The fact that increases in relative retail sentiment occur concurrently with equity price increases suggests that retail investors implement a desired increase (decrease) in equity allocations relative to institutions by bidding up (forcing down) prices. In other words, the pattern is consistent with the view that retail investors tend to be the initiators of portfolio shifts. In contrast, relative institutional reallocations appear to be in response to contemporaneous price movements (and changes in expected future returns). This finding is precisely the pattern predicted by the relative sentiment hypothesis.

**Sentiment and Expected Returns.** The primary hypothesis examined in our study is that fluctuations in relative retail sentiment push equity price levels independently of fundamentals and, as a result, periods of high relative retail sentiment presage lower future returns to equity. In this section, we present evidence consistent with this hypothesis.

We started by dividing retail sentiment into three regions: an optimistic region for which relative retail sentiment (as defined by Equation 1) is above its 75th percentile value, a pessimistic region for which it is below its 25th percentile value, and a neutral region equal to the interquartile range. Table 3 documents that subsequent equity returns are predictably higher (lower) when preceded by low (high) relative retail sentiment, which is consistent with the joint hypothesis that sentiment has a material impact on equity valuations and that retail investors experience more sentiment volatility than do institutional investors.

To determine quartile breakpoints for relative sentiment, we used the realized distribution over the entire sample period. Thus, although our evidence hints at the efficacy of a (low-frequency) trading rule based on relative retail sentiment, we urge caution in this regard. We used the benefit of hindsight to recognize when sentiment was extreme compared with the full unconditional distribution.

### Table 3. Relative Sentiment as a Predictor of Market Returns

<table>
<thead>
<tr>
<th>Sample Period</th>
<th>Average Market Return</th>
<th>No. of Quarters</th>
<th>Quarters with ( r_M &gt; r_f )</th>
<th>( \text{prob}(r_M &gt; r_f) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentiment &lt; 25th percentile</td>
<td>0.256</td>
<td>40</td>
<td>29</td>
<td>0.725</td>
</tr>
<tr>
<td>Sentiment within interquartile range</td>
<td>0.045</td>
<td>81</td>
<td>47</td>
<td>0.580</td>
</tr>
<tr>
<td>Sentiment &gt; 75th percentile</td>
<td>0.045</td>
<td>40</td>
<td>18</td>
<td>0.450</td>
</tr>
<tr>
<td>Unconditional (full sample) values</td>
<td>0.097</td>
<td>161</td>
<td>94</td>
<td>0.584</td>
</tr>
<tr>
<td>Sentiment &lt; 25th percentile</td>
<td>0.253</td>
<td>29</td>
<td>20</td>
<td>0.690</td>
</tr>
<tr>
<td>Sentiment within interquartile range</td>
<td>0.116</td>
<td>59</td>
<td>37</td>
<td>0.627</td>
</tr>
<tr>
<td>Sentiment &gt; 75th percentile</td>
<td>0.032</td>
<td>29</td>
<td>12</td>
<td>0.414</td>
</tr>
<tr>
<td>Unconditional (full sample) values</td>
<td>0.129</td>
<td>117</td>
<td>69</td>
<td>0.590</td>
</tr>
<tr>
<td>Sentiment &lt; 25th percentile</td>
<td>0.276</td>
<td>40</td>
<td>25</td>
<td>0.625</td>
</tr>
<tr>
<td>Sentiment within interquartile range</td>
<td>0.101</td>
<td>81</td>
<td>44</td>
<td>0.543</td>
</tr>
<tr>
<td>Sentiment &gt; 75th percentile</td>
<td>0.027</td>
<td>40</td>
<td>19</td>
<td>0.475</td>
</tr>
<tr>
<td>Unconditional (full sample) values</td>
<td>0.126</td>
<td>161</td>
<td>88</td>
<td>0.547</td>
</tr>
<tr>
<td>Sentiment &lt; 25th percentile</td>
<td>0.248</td>
<td>29</td>
<td>16</td>
<td>0.552</td>
</tr>
<tr>
<td>Sentiment within interquartile range</td>
<td>0.174</td>
<td>59</td>
<td>37</td>
<td>0.627</td>
</tr>
<tr>
<td>Sentiment &gt; 75th percentile</td>
<td>–0.007</td>
<td>29</td>
<td>13</td>
<td>0.448</td>
</tr>
<tr>
<td>Unconditional (full sample) values</td>
<td>0.147</td>
<td>117</td>
<td>69</td>
<td>0.590</td>
</tr>
</tbody>
</table>

*Notes: Ranks were determined across all quarters indicated in the panel heading. Returns are measured as decimals (i.e., a 1 percent return = 0.01) and annualized (i.e., multiplied by 4); \( r_f \) denotes the three-month U.S. Treasury yield concurrent with the market return, \( r_M \).*
Traders at the beginning of our sample (1969) would not have had this luxury. Hence, we view these results more as economists would than traders would: Armed with the unconditional distribution of relative retail sentiment, we can see that sentiment tracks future returns as predicted.

Although hindsight of any form precludes real-time implementation of a strategy, the crucial point in interpreting these results is that there is no direct bias with respect to average returns. By construction, the empirical distribution of relative sentiment is not related to market prices (because retail allocations have been normalized by aggregate market values).

Moreover, one might argue that even in 1969, investors would have known that retail sentiment was high. Although we do not have sufficiently detailed data from prior years to calculate precisely the institutional allocations as a benchmark to evaluate retail allocations, we can calculate the percentage of equity in retail portfolios in earlier periods. Retail equity allocation increased by a factor of about 20 percent from the 1950s to its 1969 value, suggesting that the initial value of our index was indeed “high”—and could at the time have been recognized as such.

Table 3 documents that comparatively high retail allocations to equity, our proxy for relative retail sentiment, are associated with lower future market returns. The average (annualized) return on the CRSP value-weighted market index for the full sample period was 9.7 percent (last row of Panel A), but the average return conditional on relative retail pessimism in the prior quarter was 25.6 percent; return conditional on prior-quarter relative retail optimism was only 4.5 percent. Similarly, the market outperformed U.S. three-month T-bills in 58.4 percent of all quarters in the entire sample (last column), but it outperformed T-bills in 72.5 percent of all quarters identified as pessimistic by relative retail sentiment and outperformed in only 45 percent of the quarters identified as optimistic. Again, consistent with the hypothesis that fluctuations in retail sentiment drive stock prices, the evidence suggests that relative retail sentiment may be a useful contrarian indicator of future stock returns.

Panel B presents similar statistics but for a period ending before the dot-com bubble and meltdown. Although average returns in this sample period differ somewhat from those of the full sample, the inverse relationship between returns and sentiment is as strong as it is in Panel A.

Panels C and D provide results of a similar analysis with the CRSP equal-weighted index substituted for the value-weighted index. Similar to the results in Table 2, use of the equal-weighted index results in slightly higher point estimates for the impact of sentiment on returns, with larger spreads between average returns in high-sentiment periods and returns in low-sentiment periods. Because returns on the equal-weighted index are noisier, however, sentiment is a bit less reliable in predicting the probability of market outperformance.9

Table 4 provides the results of our regression analysis to measure the response of future market returns to sentiment. For the regressions reported in Panel A, we regressed the return on the CRSP value-weighted index in each quarter on the level of the sentiment index at the start of that quarter. All returns are quarterly returns, not annualized. So, the coefficient on retail sentiment in Panel A, –0.727, indicates that an increase in the sentiment index of 1 percentage point (e.g., from 1.00 to 1.01) reduced the expected market return in the coming quarter by 0.727 percent, or 72.7 bps. The coefficient is statistically significant at conventional levels. This result held for the pre-bubble sample.

The evidence in Panel A is based on the level of the index at the end of each quarter. In reality, Flow of Funds data are released several months after the end of the quarter, so the sentiment index would be available to market participants only with a lag. As discussed previously, a profitable trading rule was not necessarily the aim of our study, but whether the reporting lag affects inferences is obviously of interest. Therefore, we reestimated these regressions but used the value of the sentiment index at the start of the previous quarter. As it turns out, because the index is a relatively slow moving series (equivalently, return implications are at a long horizon), the lag is inconsequential. Panel B of Table 4 demonstrates that market predictions (and statistical significance) are nearly identical for either the index or the lagged index.

Panels C and D report regression results for the CRSP equal-weighted index. Consistent with earlier results, the slope coefficients are generally slightly higher when this index was used but the additional noise in this index reduces t-statistics.

One interpretation of the results in Tables 3 and 4 is that retail investors periodically drive market valuations away from fundamentals, resulting in an overinvested (underinvested) position as prices subsequently decline (rise) back to fundamental values. Another interpretation is that the retail sector experiences substantial fluctuations in risk tolerance and thus willingly chooses a higher (lower) allocation to risky assets in conjunction with low (high) expected returns. Our study does not resolve these different interpretations; we take “sentiment” to refer to either. Our key points are that sentiment—however interpreted—drives
asset allocation preferences and that these shifting preferences affect equity valuations independently of fundamentals.

**Valuation of the Sentiment Indicator**

Our results suggest that the relative sentiment index has predictive value for market performance. Can it be used for market timing? In its pure form, market timing entails shifting funds between a market index portfolio and a risk-free asset, such as T-bills or some money market equivalent. Merton (1981) defined a perfect market timer as one who is fully invested in the market when the market outperforms T-bills and is fully invested in T-bills when the market underperforms. He noted that perfect market timing is tantamount to holding a call option on the market index with strike price equal to the current index value grossed up by the risk-free rate while simultaneously investing in T-bills. When the market underperforms T-bills and the call option expires worthless, this position provides the T-bill return. When the market outperforms T-bills, the call expires in the money and the position provides the market return.

Of course, perfect market timing is an unattainable ideal, but as Merton (1981) described market timing, it provides a useful framework for assessing the predictive accuracy of market-timing signals. Call $P_{Bear}$ the probability that a bear market, in which the market return is less than the risk-free rate ($r_M < r_f$), is preceded by a prediction of a bear market, and call $P_{Bull}$ the probability that a bull market ($r_M > r_f$) is preceded by a prediction of a bull market. Market-timing ability is defined as $(P_{Bear} + P_{Bull} - 1)$. For example, a timer who always predicts good market performance will correctly “predict” all bull markets but no bear markets; for such a timer, $P_{Bear} = 0$ and $P_{Bull} = 1$, resulting in an ability assessment of zero. A coin flipper would be equally likely to predict bull or bear markets in any period and thus would score $P_{Bear} = P_{Bull} = 1/2$, again resulting in an ability assessment of zero. A perfect market timer would score +1. Merton showed that if the value of a perfect timing signal (i.e., the aforementioned call option on the market index) is denoted $C$, the value of an imperfect timing signal is $(P_{Bear} + P_{Bull} - 1)C$.

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**Table 4. Regression Estimates of Retail Sentiment as a Predictor of Market Returns**

<table>
<thead>
<tr>
<th>Sample Period</th>
<th>Intercept</th>
<th>Slope</th>
<th>$R^2$</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. CRSP value-weighted index; explanatory variable = level of relative retail sentiment at beginning of quarter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample, 1968:Q4–2008:Q4</td>
<td>0.740</td>
<td>−0.727</td>
<td>0.033</td>
<td>161</td>
</tr>
<tr>
<td>Pre-bubble sample, 1968:Q4–1997:Q4</td>
<td>0.720</td>
<td>−0.741</td>
<td>0.041</td>
<td>117</td>
</tr>
<tr>
<td><strong>B. CRSP value-weighted index; explanatory variable = level of relative retail sentiment at beginning of previous quarter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample, 1968:Q4–2008:Q4</td>
<td>0.695</td>
<td>−0.681</td>
<td>0.031</td>
<td>160</td>
</tr>
<tr>
<td>Pre-bubble sample, 1968:Q4–1997:Q4</td>
<td>0.693</td>
<td>−0.672</td>
<td>0.036</td>
<td>116</td>
</tr>
<tr>
<td><strong>C. CRSP equal-weighted index; explanatory variable = level of relative retail sentiment at beginning of quarter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample, 1968:Q4–2008:Q4</td>
<td>0.809</td>
<td>−0.790</td>
<td>0.020</td>
<td>161</td>
</tr>
<tr>
<td>Pre-bubble sample, 1968:Q4–1997:Q4</td>
<td>0.715</td>
<td>−0.689</td>
<td>0.018</td>
<td>117</td>
</tr>
<tr>
<td><strong>D. CRSP equal-weighted index; explanatory variable = level of relative retail sentiment at beginning of previous quarter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample, 1968:Q4–2008:Q4</td>
<td>0.776</td>
<td>−0.756</td>
<td>0.018</td>
<td>160</td>
</tr>
<tr>
<td>Pre-bubble sample, 1968:Q4–1997:Q4</td>
<td>0.733</td>
<td>−0.707</td>
<td>0.018</td>
<td>116</td>
</tr>
</tbody>
</table>

**Notes:** The dependent variable in all regressions is the total return on the CRSP index in each quarter (not annualized). Returns are measured as decimals (i.e., a 1 percent return = 0.01). Relative retail sentiment is calculated as in Equation 1.
Our signal of next period’s market performance is the current level of relative retail sentiment. Because a high level of relative retail sentiment predicts poor market performance, we take values above the sample median as a sell signal and values below the median as a buy signal.\(^{10}\)

**Table 5** provides the results of our tests of the sentiment index as a market-timing signal. Line 1 shows that in 67 of the 161 quarters in our sample, the market underperformed T-bills and that 55.2 percent of those underperforming quarters were preceded by above-median relative retail sentiment. Hence, \(P_{\text{Bear}} = 0.552\). In the remaining 94 quarters, the market outperformed T-bills, and relative retail sentiment was below median in 53.2 percent of those quarters. Hence, \(P_{\text{Bull}} = 0.532\). Thus, \(P_{\text{Bear}} + P_{\text{Bull}} - 1 = 0.084\). The last column of Table 5 shows that the \(p\)-value for this statistic is 0.147, considerably shy of the conventional 5 percent cutoff for statistical significance. The reader will see in a moment, however, that conditioning on the more extreme values of relative sentiment improves the reliability of the signal considerably.

The standard deviation of the market excess return over the full sample period was 8.90 percent per quarter. Using this value in the Black–Scholes option pricing equation, we found that the value of a perfect timing call option on market returns for a three-month horizon would be 3.55 percent of the value of the invested portfolio.\(^{11}\) Because our signal provides accuracy of \(P_{\text{Bear}} + P_{\text{Bull}} - 1 = 0.084\), its value is \(0.084 \times 3.55\) percent, or 0.30 percent (i.e., 30 bps per quarter, or 1.2 percent per year). This value may be considered similar to a portfolio alpha; that is, it can be interpreted as a return premium attributable to successful active analysis.

To improve the statistical reliability of the market-timing forecasts, we also examined the predictive value of signals based on the extreme values of relative sentiment. In the test reported in Line 2 of Table 5, we used relative retail sentiment below the 25th percentile value to forecast bull markets and above the 75th percentile to forecast bear markets. Sentiment within the interquartile range was interpreted as “no signal.” Because we excluded the interquartile range, only 80 observations were available for the Line 2 tests (compared with 161 observations for the Line 1 tests). Using only these stronger signals improved predictive accuracy to \(P_{\text{Bear}} + P_{\text{Bull}} - 1 = 0.284\), and this signal is significant at a level better than 1 percent, with a \(p\)-value of 0.007. When valuing this signal, we had to multiply its Black–Scholes value by 0.5, however, because in any period, the chance of obtaining a signal strong enough to act on is only 50 percent. Thus, the value of the signal in this case is \(0.5 \times 0.284 \times 3.55\) percent, or 0.50 percent (i.e., 50 bps per quarter).

The predictions for the tests reported in Lines 1 and 2 of Table 5 were based on the relative retail sentiment at the end of each quarter. We noted previously that because the Flow of Funds data come out a few months after the end of each quarter, they are available only with a lag of up to a quarter. Therefore, we redid our calculations using lagged relative retail sentiment. The results are reported in Lines 3 and 4 of Table 5. Here again, the lag is largely inconsequential: The value of the sentiment index as a market-timing signal is slightly lower when lagged values were used but is still economically significant and statistically significant when the relatively extreme sentiment values were used (see Line 4).

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**Table 5. The Sentiment Index as a Market-Timing Signal**

<table>
<thead>
<tr>
<th>Prediction Criterion</th>
<th>No. of Quarters</th>
<th>Quarters Correctly Predicted</th>
<th>Timing Ability</th>
<th>(p)-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sentiment &gt; (&lt;) median 67 94</td>
<td>Bear 37 50</td>
<td>0.552</td>
<td>P_{\text{Bear}}</td>
<td>(p)-value 0.147</td>
</tr>
<tr>
<td>2. Sentiment &gt; 75th percentile (&lt; 25th percentile) 33 47</td>
<td>Bear 22 29</td>
<td>0.667</td>
<td>P_{\text{Bull}}</td>
<td>(p)-value 0.007</td>
</tr>
<tr>
<td>3. Lag sentiment &gt; (&lt;) median 66 94</td>
<td>Bear 36 50</td>
<td>0.545</td>
<td>P_{\text{Bull}}</td>
<td>(p)-value 0.169</td>
</tr>
<tr>
<td>4. Lag sentiment &gt; 75th percentile (&lt; 25th percentile) 36 45</td>
<td>Bear 22 26</td>
<td>0.611</td>
<td>Timing Ability</td>
<td>(p)-value 0.046</td>
</tr>
</tbody>
</table>

Notes: A bull market quarter is when the market return (CRSP value-weighted index, denoted \(r_{M}\)) exceeds the concurrent three-month U.S. Treasury yield (denoted \(r_{f}\)); otherwise, the quarter is denoted a bear market. The frequency \(P_{\text{Bear}}(P_{\text{Bull}})\) refers to the fraction of bear (bull) quarters that the indicated criterion correctly predicted. Timing ability is defined as \(P_{\text{Bear}} + P_{\text{Bull}} - 1\). The \(p\)-value equals the probability of a false positive concerning the hypothesis that the indicated criterion has value as a timing signal; \(p\)-value is derived from the normal approximation to the hypergeometric distribution. See Merton and Henriksson (1981, p. 520, Equation 10).
The 2008 Financial Crisis and the Sentiment Index

Our empirical results are based on index values available through year-end 2008 and, therefore, stock market returns through the end of 2009:Q1. The financial crisis of 2008 provided an opportunity to test the model on out-of-sample data. We could extend the index values for another two quarters, through 2009:Q2, and use stock returns through 2009:Q3. We observed that, consistent with the hypothesis that the retail sector has more volatile sentiment, equity allocations of retail investors compared with those of institutional investors fell throughout 2008. Stock market returns in 2009:Q1 (the first quarter after our sample period ended) were dismal, and relative retail equity allocation continued to fall: Over that quarter, the sentiment index declined by 0.0090. Conversely, equity returns in 2009:Q2 were spectacular (the Wilshire 5000 Index return in that quarter was 16.8 percent), and equity allocations of retail investors rose more rapidly than those of institutional investors: The index increased in that quarter by 0.012.

The predictive value of the index also seemed to hold up in the crisis. At the end of 2009:Q1, the index had fallen to 0.9705, almost precisely at the 25th percentile of its distribution, signifying that retail sentiment was considerably more bearish than institutional sentiment. Our results suggest that such sentiment would portend higher expected market returns in the following quarter, and in fact, the market was up 16.8 percent in the second quarter. By the end of 2009:Q2, the index of retail sentiment had recovered to a value just below its median value—that is, an essentially neutral stance on market returns. In summary, the predictive value of the index appeared to be even greater when the sample period was extended to include the two additional quarters available in 2009.

Conclusion

We have shown that fluctuations in relative retail sentiment are positively associated with contemporaneous stock market returns and negatively associated with future stock market returns. This pattern is consistent with the hypothesis that retail sentiment is more variable than institutional sentiment and retail investors move prices as they update their asset allocations to reflect their shifting sentiment. Although we followed convention in labeling shifts in retail demand for equities independent of fundamentals as “sentiment driven,” our results are fully consistent with a rational interpretation of retail-side behavior. Shifts in retail risk tolerance lead to precisely the same pattern as shifts in the optimism of cash flow forecasts (relative to fundamentals). Increases in risk tolerance will induce contemporaneous increases in both prices and retail equity allocations as the retail sector bids up shares from the institutional side and will be followed by lower future expected returns. Increases in risk aversion will work similarly, with the retail sector forcing prices lower as it sells shares to the institutional side. If one were to substitute “caution” for “pessimism” in this discussion, our argument would be effectively unchanged. Thus, “sentiment” should be interpreted broadly—and not necessarily pejoratively—as also encompassing variation in risk tolerance.

To interpret our evidence in a “smart money/dumb money” framework, one would have to conclude that institutional investors are “smarter” than retail investors (better at collecting and processing information about future prospects). Our study provides no conclusions about whether this interpretation is superior to the alternative—that retail investors experience relatively volatile fluctuations in their tolerance for risk. Our results are, nevertheless, consistent with a smart money/dumb money view of the world in which all investors use the same risk-adjusted discount rate but one group (institutions) is better at forecasting future prospects. The key distinction between this view and a rational interpretation (that the difference in behavior comes from time-varying risk tolerance) lies with investors’ expectations. In the smart money/dumb money interpretation, if retail investors knew the conditional expected returns that we have documented, they would alter their behavior. In the rational interpretation, they would not. Unfortunately, these two interpretations are not readily distinguishable by empirical analysis.

We thank Mark Kritzman, Ronnie Sadka, Phil Strahan, and seminar participants at the University of California, Davis, University of California, Irvine, and Boston College Center for Asset Management. We also thank Kristle Kilijanczyk for excellent research assistance.

This article qualifies for 1 CE credit.
Appendix A. Classification of Retail and Institutional Asset Allocations

I. Retail Allocations (Households, Not-for-Profit Organizations, and DC Pension Plans)

Cash
• checkable deposits and currency
• total time and savings deposits
• money market mutual fund share holdings
• private foreign deposits

Bonds
• total U.S. Treasury securities, excluding U.S. savings bonds
• total U.S. government securities
• U.S. government agency securities
• municipal securities and loans
• corporate and foreign bonds
• total mortgages
• mutual funds invested in:
  • Treasury securities
  • U.S. government agency securities
  • corporate and foreign bonds

Equity
• corporate directly held equities
• mutual funds invested in corporate equities

II. Institutional Allocations

Cash
• state and local government employee retirement funds’ holdings of:
  • federal funds transactions and loans made under repurchase agreements
  • checkable deposits and currency (total time and savings deposits)
  • money market mutual fund share holdings
• federal government retirement funds
• property/casualty insurance companies’ holdings of:
  • federal funds transactions and loans made under security repurchase (repo) agreements
  • checkable deposits and currency
• DB pension plan holdings of:
  • federal funds transactions and loans made under security repo agreements
  • checkable deposits and currency
  • total time and savings deposits
  • money market mutual fund share holdings

Bonds
• state and local government employee retirement funds’ holdings of:
  • corporate and foreign bonds
  • Treasury securities
  • U.S. government agency securities
  • municipal securities and loans
  • total mortgages
• federal government retirement funds:
  • total Treasury securities, excluding U.S. savings bonds
  • corporate and foreign bonds
  • U.S. government agency securities
• property/casualty insurance companies:
  • total Treasury securities, excluding U.S. savings bonds
  • corporate and foreign bonds
  • U.S. government agency securities
  • municipal securities and loans
  • commercial mortgages
• DB pension plans:
  • total Treasury securities, excluding U.S. savings bonds
  • corporate and foreign bonds
  • U.S. government agency securities
  • total mortgages
  • commercial paper

Equity
• state and local government employee retirement funds’ holdings of domestic and foreign corporate equities (market values)
• federal government retirement funds’ investments in corporate equities
• property/casualty insurance companies’ investments in corporate equities
• DB pension plan holdings of equity
Notes

1. We do not take a stand on the largely philosophical debate as to whether these changes are the result of excessively optimistic (or pessimistic) cash flow forecasts or time-varying risk tolerance. The asset-pricing implications—the focus of this article—of the two sides are indistinguishable.

2. An alternative, considered in Baker and Wurgler (2000, 2004) and considered to be the “window of opportunity” view of IPO waves (Loughran and Ritter 1995), is that issuers can be induced to issue new securities. We emphasize that such a change in the investment opportunity set need not be the source accommodating the shift in desired risky-asset allocations of a subset of investors.

3. Consider the following quote from Barber, Odean, and Zhu: “Investor sentiment is generally attributed to individual, retail investors (e.g., Lee, Shleifer, and Thaler 1991)” (2009, p. 154).

4. The data are available at www.federalreserve.gov/releases/z1/Current/data.htm.

5. The Flow of Funds data are not broken into asset allocations for DB and DC plans separately until 1985. Prior to 1985, therefore, we allocate private pension assets in each asset class to DB and DC plans according to the total asset holdings of each type of plan.

6. One caveat to this assertion is that the Flow of Funds data on assets held by life insurance companies are not separated into those controlled by the company versus those held in variable annuities that are, presumably, controlled by the retail client. Therefore, we excluded life insurance assets from our sample universe.

7. Consumer sentiment and investor sentiment are not the same thing. Evidence in Lemmon and Portniaguina (2006) and Fisher and Statman (2003) shows, however, that they are highly correlated.

8. A natural concern is bias in this estimated relationship. In particular, Stambaugh (1999) analyzed settings in which a predictive variable for market returns is itself a function of asset price levels (e.g., a dividend-to-price ratio). Because asset price shocks partially determine the explanatory variable, a reverse-causality effect induces a positive bias in the hypothesized relationship. This critique, however, is not applicable to our analysis. In particular, although predictions based on retail (or institutional) allocations to equity would indeed be subject to Stambaugh’s reverse-causality bias, relative sentiment is not because it is a ratio of two variables that are proportionally affected by asset prices. The ratio, therefore, is unaffected.

9. As a robustness check, we also investigated several control variables as proxies for overall economic conditions. When we added the current level of interest rates (the one-year Treasury rate) to the regression, the t-statistic on relative sentiment was –2.2 and the coefficient on the interest rate was statistically insignificant. Adding both the term spread (the 10-year Treasury rate minus the 1-year rate) and the credit spread (the Baa rate minus the 10-year Treasury rate) had a similar effect: negligible change in the coefficient on relative sentiment (t-statistic = –2.3) and insignificant interest rate regressors.

10. This procedure contains hindsight bias because one could not have known the sample median until the end of the sample period. We address this bias later by ignoring some of the middle-range observations.

11. In the Black–Scholes equation, we used an expiration date of \( T = 1/4 \), stock price = $1, and \( \sigma = 0.0890 \). The strike price was set at $1 \( \exp(\sigma T) \), which made the option value independent of the interest rate.

12. Such a view is intuitive because institutions have substantial resources and a central focus on the task. Moreover, evidence in several papers has shown that institutions seem to add value in their stock picks; see, for example, Baker, Litov, Wachter, and Wurgler (forthcoming) and the references therein.

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