

Overnight Returns and Firm-Specific Investor Sentiment

David Aboody, Omri Even-Tov, Reuven Lehavy,
and Brett Trueman*

Abstract

We examine the suitability of using overnight returns to measure firm-specific investor sentiment by analyzing whether they possess characteristics expected of a sentiment measure. We document short-term overnight-return persistence, consistent with existing evidence of short-term persistence in the share demand of sentiment-influenced investors. We find that short-term persistence is stronger for harder-to-value firms, consistent with existing evidence that sentiment plays a larger role for such firms. We show that stocks with high (low) overnight returns underperform (outperform) over the longer term, consistent with prior evidence of temporary sentiment-driven mispricing. Overall, our evidence supports using overnight returns to measure firm-specific sentiment.

I. Introduction

The effect of market-wide investor sentiment on the cross-sectional and time-series properties of stock returns is a topic of substantial research interest.¹ Among the proxies that have been used to measure market-wide sentiment are New York Stock Exchange (NYSE) share turnover, the closed-end mutual fund discount, the degree of underpricing in initial public offerings, and the aggregate level of corporate investment. There is also a significant body of work studying how investor sentiment affects decision making at the firm level and the price response

*Aboody, daboody@anderson.ucla.edu, UCLA Anderson Graduate School of Management; Even-Tov, omri_eventov@haas.berkeley.edu, University of California Berkeley Haas School of Business; Lehavy, rlehavy@umich.edu, University of Michigan Ross School of Business; and Trueman (corresponding author), brett.trueman@anderson.ucla.edu, UCLA Anderson Graduate School of Management. We thank an anonymous referee, Brad Barber, Hendrik Bessembinder (the editor), Eddie Riedl, Siew Hong Teoh, and seminar participants at Boston University; the University of California, Berkeley; Notre Dame; and the joint UCLA/University of California, Irvine/USC accounting conference for their helpful comments. All remaining errors are our own.

¹Studies include those by Arif and Lee (2014), Baker and Wurgler (2006), Brown and Cliff (2004), (2005), Brown, Christensen, Elliott, and Mergenthaler (2012), Gao and Suss (2015), Huang, Jiang, Tu, and Zhou (2015), Lee, Shleifer, and Thaler (1991), Lemmon and Portniaguina (2006), Ljungqvist, Nanda, and Singh (2006), Neal and Wheatley (1998), Qui and Welch (2004), Ritter (1991), Stambaugh, Yu, and Yuan (2012), and Yu and Yuan (2011).

to firm-level disclosures.² These studies also utilize proxies of market-wide sentiment that, although varying over time, are invariant in the cross section. This makes them not well suited to address firm-level issues. Although it would be preferable to use a firm-specific measure of investor sentiment, such a measure has not generally been available.

The recent work of Berkman, Koch, Tuttle, and Zhang (2012) suggests that a stock's overnight (close-to-open) return can serve as a measure of firm-level sentiment. Its potential suitability is based on the premise that retail investors are the ones most likely to be affected by sentiment (see, e.g., Barber, Odean, and Zhu (2009), Berkman et al. (2012), and Lee et al. (1991)) and the evidence of Berkman et al. (2012) suggesting that individuals tend to place orders outside of normal working hours, to be executed at the start of the next trading day. Specifically, Berkman et al. (2012) find that attention-generating events (high absolute returns or strong net buying by retail investors) on one day lead to higher demand by individual investors, concentrated near the open of the next trading day.³ This creates temporary price pressure at the open, resulting in elevated overnight returns that are reversed during the trading day.⁴ Consistent with this return pattern being driven by retail investor demand, Berkman et al. (2012) show that the one-day reversal is more pronounced for firms that are harder to value and more costly to arbitrage.

In this article we examine the suitability of using overnight returns as a measure of firm-specific investor sentiment. We do so by analyzing whether these returns exhibit characteristics that would be expected of a sentiment measure. We conduct three sets of analyses. In the first we test for short-run persistence in overnight returns. The basis for expecting this from a measure of sentiment is the evidence of Barber et al. (2009) that the order imbalances of retail investors, who are the investors most likely to exhibit sentiment, persist for periods extending over several weeks. In the second analysis we test whether overnight-return persistence is greater for harder-to-value firms. Finding this would be consistent with the prior empirical evidence that market-wide sentiment has a greater impact on the prices of firms that are harder to value (see Baker and Wurgler (2006), Berkman, Dimitrov, Jain, Koch, and Tice (2009), Hribar and McNinnis (2012), Mian and Sankaraguruswamy (2012), and Seybert and Yang (2012)). Relatedly, we also test whether short-term persistence is greater the lower the institutional presence in a firm's shares. We expect this relation to hold given that retail investors are more likely to be affected by sentiment than are institutional investors. In the third analysis we examine whether stocks with high overnight returns underperform those with low overnight returns over the long term. One reason to expect this is the evidence given by Hvidkjaer (2008) and Barber et al. (2009) of long-run underperformance of stocks with strong short-term retail investor demand relative

²Among the articles examining firm-level issues using market-wide sentiment measures are those by Bergman and Roychowdhury (2008), Livnat and Petrovits (2013), Walther and Willis (2013), Hribar and McNinnis (2012), and Mian and Sankaraguruswamy (2012).

³The use of high absolute returns and strong retail buying to gauge the level of attention is motivated by the analysis of Barber and Odean (2008).

⁴Branch and Ma (2012) and Cliff, Cooper, and Gulen (2008) also find evidence of return reversals during the trading day.

to those with weak short-term retail investor demand. Another is the finding of Baker and Wurgler (2006) that when market-wide sentiment is high, stocks that are more attractive to optimists and less attractive to arbitrageurs (such as small stocks and stocks with high volatility) generate lower returns over the next 12 months.

Our sample period spans July 1992 through Dec. 2013. We begin in 1992 because this is the first year for which open prices, which we use to compute overnight returns, are available in the Center for Research in Security Prices (CRSP) database. To test for short-term persistence in overnight returns, we rank all stocks in each week w of our sample period in increasing order according to the stock's overnight return that week and partition the sample into deciles. We then calculate the average overnight return in week $w + 1$ for the portfolio of stocks in each decile. Consistent with short-term persistence, we find that the stocks in the top overnight-return decile in week w have a significantly higher average overnight return in week $w + 1$ than do those in the lowest decile. The difference in the average overnight return for week $w + 1$ is an economically large 1.76 percentage points. Although decreasing in magnitude, this return difference remains reliably greater than 0 for weeks $w + 2$ through $w + 4$. Moreover, the average overnight return in each of these 4 weeks is strictly increasing as we move from the lowest to the highest decile of week w overnight returns.

To ensure that our results cannot be explained by differences in the characteristics of the stocks in the different overnight-return deciles, we partition our week w firms, first according to the characteristic of interest (beta, firm size, book-to-market ratio, or momentum) and then into deciles according to week w overnight return. Across the 10 partitions by market beta, the difference between the week $w + 1$ average overnight returns for week w 's top and bottom deciles ranges from 1.29 to 1.9 percentage points. Over the various size partitions, the difference between the week $w + 1$ average overnight returns for week w 's top and bottom deciles ranges from 0.98 to 2.5 percentage points. When partitioning first according to the book-to-market ratio, week $w + 1$ average overnight-return differences range from 1.34 to 1.8 percentage points. When partitioning initially by momentum, the week $w + 1$ overnight-return differences vary from 1.27 to 1.87 percentage points. All return differences are significantly greater than 0. These results indicate that differences in the characteristics of the stocks across the various overnight-return deciles are not driving our short-term continuation results.

We next examine whether the difference between the week $w + 1$ average overnight returns for week w 's top and bottom deciles is greater for harder-to-value firms and for those with a lower presence of institutional investors. We use a number of different proxies to measure the extent to which a firm's shares are difficult to value: stock return volatility, firm size, firm age, profitability, and earnings-to-price ratio (as a measure of the firm's expected growth rate).⁵ Firms that are more volatile, smaller, younger, less profitable, and expected to be growing rapidly are likely to be harder to value. We divide our sample into

⁵One or more of these proxies are also used by Baker and Wurgler (2006), Hribar and McNinnis (2012), Mian and Sankaraguruswamy (2012), and Seybert and Yang (2012) to measure the level of difficulty in valuing a firm.

quartiles each year according to each hard-to-value measure and repeat our weekly overnight analysis for each quartile. For each measure, the difference between the week $w + 1$ average overnight returns for the top and bottom deciles of week w average overnight return is significantly greater for the most-difficult-to-value quartile than for the least-difficult-to-value quartile. The difference between these quartile differences ranges from 0.69 percentage points (for the sort on firm age) to 1.6 percentage points (for the sort on firm size). As expected from a measure of investor sentiment, overnight-return persistence is stronger for harder-to-value firms.

We test for the effect of institutional holdings on persistence by partitioning our sample of firms into quartiles according to the percentage of shares owned by institutions and repeating our overnight-return calculations for each partition. As expected, the difference between the week $w + 1$ average overnight returns for week w 's top and bottom deciles increases as institutional presence decreases. For the firms with the lowest percentage of institutional shareholders, the return difference is 2.36 percentage points, whereas for the firms with the greatest institutional presence, the return difference is just 1.07 percentage points. The difference between these two is reliably positive.

Next, we examine whether, over the longer-run, stocks with high short-term overnight returns underperform those with low short-term overnight returns. For this analysis we use monthly returns, ranking stocks each year according to their average daily overnight return during the month of December. Partitioning the sample into deciles, we then form a portfolio long in the stocks of decile 1 (those with the lowest December overnight returns) and short in the stocks of decile 10 (those with the highest December overnight returns) and hold that portfolio for 12 months. Over the year, the average abnormal return on the portfolio is a significant 7.4 percentage points. This suggests that firms with the highest short-term overnight returns are overpriced relative to those with the lowest short-term overnight returns, consistent with the notion that overnight returns are reflective of firm-specific investor sentiment.

To gain insight into how these portfolio returns vary across subsets of stocks, we repeat this analysis for those stocks that are hardest to value (those with the highest return volatility, the smallest, the youngest, the least profitable, and those with the highest expected growth rate) and for those that are easiest to value. For each of the hardest-to-value subsamples, we find the average abnormal return on a portfolio long in the stocks of decile 1 and short in the stocks of decile 10 to be significantly positive. Over the year, the average abnormal return ranges from 4.4 percentage points (for the smallest firms) to 9.7 percentage points (for the firms with the highest expected growth rate). Only for one of the easiest-to-value subsamples, the most profitable firms, do we find the average abnormal portfolio return over the year (5.3 percentage points) to be significantly different from 0. The stronger long-term return reversal results for the hardest-to-value firms are consistent with our previously documented finding that sentiment plays a bigger role for such firms.

As mentioned previously, the value of having a measure of firm-specific investor sentiment is that it allows for the study of sentiment's effect on decisions and prices at the individual firm level. In the last part of the article, we use

overnight returns to provide insights into the relation between investor sentiment and the price reaction to earnings announcements. Two recent studies (Livnat and Petrovits (2013), Mian and Sankaraguruswamy (2012)) have investigated this relation using the Baker and Wurgler (2006) measure of market-level sentiment and obtained mixed results. Using overnight returns as a measure of sentiment, we find that investors respond less positively to reported earnings when investors are optimistic than when they are pessimistic. This is consistent with the notion that objective evidence (reported earnings) serves to correct, at least partially, the effect of sentiment on preannouncement stock prices.

In Section II we provide a description of our sample. This is followed in Section III by an analysis of the short-run persistence in overnight returns. In Section IV we examine whether our short-run results are magnified for harder-to-value firms and for firms with a lower presence of institutional investors. An analysis of longer-term returns appears in Section V. In Section VI we use overnight returns to investigate the effect of sentiment on the price response to earnings announcements. Section VII provides a summary and conclusions.

II. Sample, Variable Definitions, and Descriptive Statistics

Our sample period begins in July 1992 (the first month for which CRSP provides opening stock prices) and ends in Dec. 2013. For each year of our sample period, we include in our analysis all stocks in the CRSP database with end-of-prior-year prices greater than \$5 per share and market capitalizations of more than \$10 million. The overnight return on the shares of firm i for day d , CTO_{id} , is calculated as follows:

$$(1) \quad CTO_{id} = \frac{O_{id} - C_{id-1}}{C_{id-1}},$$

where O_{id} is the opening price for the shares of firm i on day d , and C_{id-1} is the closing price for the shares on day $d - 1$. All opening and closing prices are taken from CRSP and are adjusted for stock splits, stock dividends, and cash dividends. The average daily overnight return on the stock of firm i during week w is defined as the average of the overnight returns beginning on Wednesday of week $w - 1$ and ending on Tuesday of week w (beginning the week on Wednesday is consistent with Lehmann (1990) and Barber et al. (2009)). We treat the return for an overnight period as missing if either the prior day's closing price or the current day's opening price is not available in CRSP. The overnight return for week w , CTO_{iw} , is the average daily return for that week, multiplied by 5. The *total* return for week w (as opposed to the overnight return) is the compounded daily (close-to-close) return over the period beginning on Wednesday of week $w - 1$ and ending on Tuesday of week w .

Following Lehmann (1990) and Barber et al. (2009), most of our analyses focus on weekly overnight returns. For these analyses, we rank all stocks for each week w in ascending order according to their overnight return that week and then partition the stocks into deciles. Descriptive statistics for the stocks in each overnight-return decile over our sample period are reported in Table 1. In addition to reporting the average weekly overnight return and the average weekly total

TABLE 1
Descriptive Statistics

Table 1 provides sample descriptive statistics for our variables by decile ranking of the average weekly overnight return. The overnight return on the shares of firm i for day d is given by $CTO_{id} = (O_{id} - C_{id-1}) / C_{id-1}$, where O_{id} is the opening price for the shares of firm i on day d , and C_{id-1} is the closing price for the shares on day $d - 1$. All opening and closing prices are taken from the Center for Research in Security Prices (CRSP) and are adjusted for stock splits, stock dividends, and cash dividends. The average daily overnight return on the stock of firm i during week w is the average of the overnight returns beginning on Wednesday of week $w - 1$ and ending on Tuesday of week w . The overnight return for firm i during week w is the average daily return for that week, multiplied by 5. The weekly total return for week w is the compounded daily return over the period beginning on Wednesday of week $w - 1$ and ending on Tuesday of week w . We rank all stocks each week in ascending order according to their overnight returns that week and then partition the stocks into deciles. For a given decile, the average weekly overnight return for week w is the average of the overnight returns of the stocks in that decile. The average weekly total return for week w is the average of the weekly total returns of the stocks in the decile. Return volatility for a given week w is computed as the standard deviation of monthly stock returns over months $t - 12$ through $t - 2$, where t is the month in which week w falls. Size is the end of the prior-fiscal-quarter market value of equity. Age is the number of years since the firm first appeared on CRSP, calculated as of the end of the prior calendar quarter. Profitability is the firm's net income before extraordinary items for the prior fiscal quarter divided by its book value of equity at the beginning of that quarter. Earnings-to-price is the firm's net income per share before extraordinary items for the previous fiscal quarter divided by the price per share as of the end of that quarter. Book-to-market is the book value of equity at the end of the previous fiscal quarter divided by the market value of equity at the end of the previous fiscal quarter. Momentum is calculated as the cumulative return over months $t - 12$ to $t - 2$. Percentage of institutional shareholdings is the percentage of outstanding shares held by institutions as of the end of the previous fiscal quarter. Our sample period extends from June 1992 to Dec. 2013.

Decile of Weekly Overnight Return	Average Weekly Overnight Return	Average Weekly Total Return	Average Return Volatility	Average Size	Average Age	Average Profitability	Average Earnings- to-Price	Average Book-to- Market	Average Momentum	Average Percentage Institutional Shareholdings
1 (Lowest)	-8.16%	-2.60%	0.1253	160.4	11.0212	2.755	1.743	1.846	0.2122	27.08%
2	-2.83%	-1.03%	0.1126	238.2	12.2889	4.247	2.004	1.36	0.1975	31.97%
3	-1.53%	-0.54%	0.102	268.8	13.9788	2.857	2.102	1.092	0.1833	34.03%
4	-0.78%	-0.20%	0.0955	303.4	15.3118	1.459	2.132	0.9627	0.1828	35.36%
5	-0.22%	0.07%	0.092	350.2	15.7805	1.379	2.143	0.907	0.1797	35.65%
6	0.27%	0.34%	0.0929	373.4	15.6152	0.029	2.156	0.8949	0.1865	35.76%
7	0.85%	0.65%	0.0962	332.9	14.9096	0.085	2.167	0.9271	0.1966	35.31%
8	1.62%	1.06%	0.1044	288.2	13.586	1.462	2.211	1.079	0.2153	34.06%
9	2.95%	1.74%	0.1183	254.3	11.7977	0.034	2.157	1.267	0.2574	32.09%
10 (Highest)	8.13%	4.12%	0.14	190.5	9.8996	2.858	2.006	1.701	0.3033	28.22%

return, this table presents statistics on the five proxies we use to measure the extent to which a stock is difficult to value: return volatility, firm size, age, profitability, and earnings-to-price ratio (as a measure of the firm's expected growth rate). Return volatility is defined as the standard deviation of the stock's monthly stock returns over months $t - 12$ through $t - 2$, where t is the month in which week w falls. Firm size is defined as the market value of the firm as of the end of the prior fiscal quarter. Firm age is the number of years since the firm first appeared on CRSP, calculated as of the end of the prior calendar quarter. Profitability is defined as the prior fiscal quarter's net income before extraordinary items divided by the book value of equity at the beginning of that quarter. The earnings-to-price ratio is equal to the firm's prior fiscal quarter net income per share before extraordinary items divided by the price per share as of the end of that quarter. We exclude firm-quarters with negative reported income when calculating each decile's average earnings-to-price ratio.⁶ The table also provides statistics on average book-to-market ratio, price momentum, and percentage of institutional shareholdings for each overnight-return decile. A firm's book-to-market ratio is defined as the firm's book value of equity divided by its market value of equity, measured at the end of the prior fiscal quarter. Momentum is equal to the firm's cumulative stock return over months $t - 12$ to $t - 2$. Percentage of institutional shareholdings is equal to

⁶If included, these firms would be misclassified as high-growth firms because of their low (negative) earnings-to-price ratios.

the number of the firm's outstanding shares held by institutions divided by the number of outstanding shares, calculated as of the end of the prior fiscal quarter.

As shown in Table 1, the average weekly overnight return ranges from -8.16% in the lowest decile to 8.13% in the highest decile. The average weekly total return is monotonically increasing with the overnight-return decile, ranging from -2.6% to 4.12% . For 8 of the 10 deciles, the average weekly overnight return has the same sign as the average weekly total return and is the larger of the two in magnitude. This implies an intraday return reversal, as has been documented by Berkman et al. (2012). In decile 5, the two returns are of opposite signs, again indicative of an intraday reversal in returns. Only in decile 6 is there no evidence of a return reversal; however, in this case, both the average overnight return and the average total return are very small in magnitude.

The average standard deviation of returns, book-to-market ratio, and price momentum exhibit a U-shaped pattern, achieving their maxima in the top and bottom overnight-return deciles. Average firm size, age, earnings-to-price ratio, and institutional holdings display an inverse U-shape. There is no pronounced pattern across the overnight-return deciles for average profitability. The stocks with the most positive and most negative overnight returns share the characteristics of being young and small, with high book-to-market and low earnings-to-price ratios, strong prior returns, high prior return variability, and relatively low institutional presence.

III. Weekly Overnight-Return Results

We begin our analysis by examining the short-run persistence in overnight returns. For each decile of stocks constructed according to the week w overnight return, we calculate the subsequent average overnight returns for weeks $w + 1$ through $w + 4$. Panel A of Table 2 presents these returns, averaged over all the weeks of our sample period. As seen in the table, the average week $w + 1$ overnight return is monotonically increasing in the week w overnight-return decile. For the lowest week w decile, the average week $w + 1$ overnight return is -90 basis points (bps). The corresponding return for the highest week w decile is 86 bps. The difference, 1.76 percentage points, is significantly greater than 0.⁷ The differences for weeks $w + 2$, $w + 3$, and $w + 4$ are 1.48 , 1.33 , and 1.21 percentage points, respectively, and are also significantly positive. (All of these t -statistics are calculated using the mean and standard deviation of the weekly overnight-return differences between deciles 10 and 1, over the more than 1,000 weeks in our sample period.) These positive differences are evidence of the short-term persistence of overnight returns, a characteristic to be expected from a measure of sentiment.

It is possible that these results could be due, at least in part, to differences in bid-ask spreads across firms. If stocks tend to close at the bid price and open at the ask price (or vice versa), then a sort on overnight returns will also be a sort on the magnitude of the bid-ask spread. If spreads are persistent in the short term, then that could cause persistence in weekly overnight returns. To address this possibility, we recalculate overnight returns using the daily quotation data

⁷Significance is attained at a p -value of 5% or less (2-tailed).

TABLE 2
Short-Run Persistence of Weekly Overnight Returns and Subsequent Weeks' Total Returns

Panel A of Table 2 reports the average weekly overnight return for weeks $w + 1$ through $w + 4$ for each decile of stocks constructed according to the rank of week w overnight return. We rank all stocks in each week w of our sample period in increasing order according to the week's overnight return and partition the sample into deciles. We then calculate the average overnight return over each of the next 4 weeks for the portfolio of stocks in each decile. Panel B reports the average weekly total return over each of the next 4 weeks for the portfolio of stocks in each decile. See Table 1 for a description of the calculation of weekly overnight and weekly total returns.

Panel A. Short-Run Persistence of Overnight Returns

Decile of Weekly Overnight Return	No. of Obs.	Average Weekly Overnight Return			
		Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	624,958	-0.90%	-0.82%	-0.76%	-0.71%
2	625,487	-0.27%	-0.21%	-0.20%	-0.17%
3	625,625	-0.13%	-0.09%	-0.08%	-0.06%
4	626,404	-0.04%	-0.01%	0.00%	0.00%
5	626,688	0.02%	0.03%	0.04%	0.05%
6	624,297	0.09%	0.08%	0.09%	0.08%
7	624,816	0.18%	0.16%	0.17%	0.14%
8	625,453	0.29%	0.26%	0.24%	0.21%
9	625,604	0.46%	0.40%	0.37%	0.34%
10 (Highest)	625,023	0.86%	0.67%	0.57%	0.49%
(10) - (1)		1.76%	1.48%	1.33%	1.21%
<i>t</i> -statistic		46.0	42.9	38.1	35.9

Panel B. Subsequent Weeks' Close-to-Close Returns

Decile of Weekly Overnight Return	No. of Obs.	Average Weekly Total Return			
		Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	624,958	0.35%	0.37%	0.34%	0.36%
2	625,487	0.29%	0.33%	0.32%	0.33%
3	625,625	0.28%	0.32%	0.30%	0.33%
4	626,404	0.28%	0.30%	0.30%	0.32%
5	626,688	0.30%	0.31%	0.30%	0.32%
6	624,297	0.31%	0.31%	0.32%	0.31%
7	624,816	0.35%	0.33%	0.34%	0.30%
8	625,453	0.41%	0.36%	0.38%	0.32%
9	625,604	0.47%	0.40%	0.40%	0.35%
10 (Highest)	625,023	0.61%	0.48%	0.50%	0.42%
(10) - (1)		0.26%	0.11%	0.15%	0.06%
<i>t</i> -statistic		4.1	1.9	3.0	0.8

of Berkman et al. (2012).⁸ In their paper, Berkman et al. (2012) compute overnight returns using the midpoint of the last valid bid and ask quotes before the market close and the midpoint of the first valid bid and ask quotes after the market open. Untabulated results are very similar to those reported in Panel A of Table 2. From this we conclude that the positive short-term correlation in weekly overnight returns that we find are not driven by cross-sectional variations in the magnitude of the bid-ask spread.

For comparison purposes, we also compute the average close-to-close return for weeks $w + 1$ through $w + 4$ in each week w overnight-return decile (Panel B of Table 2). In contrast to what was found for the overnight returns, there is not a monotonic relation between the weeks $w + 1$ through $w + 4$ close-to-close returns and the decile of week w overnight return. Moreover, although the differences in close-to-close returns between the highest and lowest deciles of week w overnight return are positive, they are much lower than the corresponding differences in

⁸We thank Paul Koch and his coauthors in Berkman et al. (2012) for generously providing us with their data on bid and ask quotes.

overnight returns. They range from 0.06 to 0.26 percentage points and are significant just for weeks $w + 1$ and $w + 3$.

Our analysis to this point has been based on raw returns. Calculating abnormal returns using conventional methods is difficult in our setting because these calculations are based on daily close-to-close returns, whereas we are focused on overnight returns. Using raw returns admits the possibility, though, that our results could be due, at least in part, to cross-decile differences in firm characteristics. To examine whether this is the case, we partition our sample of stocks in each week w into deciles, separately according to the four firm characteristics most commonly used in measuring abnormal returns: beta, firm size, book-to-market ratio, and return momentum. Then, within each firm-characteristic decile, we partition stocks according to their week w overnight return. Table 3 presents the average overnight return for the top and bottom of these overnight-return deciles during each of the subsequent 4 weeks, as well as the difference between these two returns.

Panel A of Table 3 reports the results when first partitioning by beta. Although the average overnight-return differences for weeks $w + 1$ through $w + 4$ do vary across the beta partitions, all are significantly positive, indicating that our prior results are not driven by differences in beta across week w return deciles. Results by size partition are reported in Panel B. Of note, the average overnight-return differences for weeks $w + 1$ through $w + 4$ are all larger in the lowest size decile than they are for the sample as a whole (refer to Table 2). In contrast, the average overnight-return differences for weeks $w + 1$ through $w + 4$ are all smaller in the highest size decile than for the whole sample. Firm size clearly affects the magnitude of the return difference. Nevertheless, controlling for size, all return differences (for all size deciles and all weeks) remain significantly greater than 0. Panel C reports the results by book-to-market partition. Here the average overnight-return differences over weeks $w + 1$ through $w + 4$ are much more similar between the top and bottom book-to-market deciles and are similar to the return differences reported for the entire sample. The book-to-market ratio apparently has little impact on the magnitude of the average overnight-return differences. As with beta and firm size, controlling for the book-to-market ratio, all overnight return differences remain reliably positive. Panel D reports the results by price momentum partition. Here, too, the average overnight-return differences do not vary much between the top and bottom momentum deciles. Controlling for price momentum, all overnight-return differences remain significantly greater than 0. None of the factors commonly employed in abnormal return calculations (beta, size, book-to-market ratio, and momentum) can explain our short-term overnight-return continuation results.⁹

IV. Short-Term Overnight-Return Persistence, Hard-to-Value Firms, and Institutional Shareholdings

Baker and Wurgler (2006), Hribar and McNinnis (2012), Mian and Sankaraguruswamy (2012), and Seybert and Yang (2012) all conjecture that sentiment

⁹In untabulated results, we find that the persistence in overnight returns remains reliably positive when we control for all four factors simultaneously through a multivariate regression.

will have a greater effect on the returns of firms that are harder to objectively value. The empirical evidence they present is consistent with their conjecture. If overnight returns are reflective of firm-specific investor sentiment, then we should find that short-term overnight-return persistence is stronger for firms that are harder to value.

We use five different measures to proxy for the extent to which a firm is difficult to value: stock return volatility, firm size, firm age, profitability, and earnings-to-price ratio, with more volatile, smaller, younger, and less profitable firms and

TABLE 3
Short-Run Persistence of Weekly Overnight Returns, by Firm Characteristic Decile

Table 3 reports the average overnight return for weeks $w + 1$ through $w + 4$ for the highest and lowest deciles of week w overnight return, as well as the difference between the two, by decile of beta (Panel A), firm size (Panel B), book-to-market ratio (Panel C), and momentum (Panel D). Stocks are first ranked each week in ascending order according to the firm characteristic of interest and then partitioned into deciles. Within each firm-characteristic decile, stocks are then ranked in ascending order according to their weekly overnight return and partitioned into deciles. See Table 1 for a description of the calculation of weekly overnight returns and for the definitions of all other variables.

Panel A. Short-Run Persistence of Overnight Returns, by Beta

Beta Decile	Decile of Weekly Overnight Return	No. of Obs.	Beta	Average Weekly Overnight Return			
				Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	1	56,765	-0.22	-1.95%	-1.98%	-1.78%	-1.82%
	10	56,883	-0.21	-0.05%	-0.02%	-0.16%	-0.22%
	(10) - (1)			1.90%	1.96%	1.62%	1.59%
	<i>t</i> -statistic			24.7	24.2	20.7	20.1
2	1	56,823	0.16	-1.46%	-1.38%	-1.31%	-1.26%
	10	56,945	0.16	0.20%	0.10%	0.08%	-0.01%
	(10) - (1)			1.67%	1.48%	1.39%	1.25%
	<i>t</i> -statistic			31.0	26.1	25.1	23.1
3	1	56,838	0.34	-1.19%	-1.07%	-0.98%	-1.00%
	10	56,951	0.34	0.41%	0.30%	0.17%	0.18%
	(10) - (1)			1.60%	1.37%	1.16%	1.18%
	<i>t</i> -statistic			31.2	26.9	22.9	23.9
4	1	56,819	0.49	-0.95%	-0.82%	-0.76%	-0.80%
	10	56,943	0.49	0.51%	0.34%	0.29%	0.29%
	(10) - (1)			1.47%	1.16%	1.05%	1.09%
	<i>t</i> -statistic			31.9	26.0	22.7	24.1
5	1	56,813	0.63	-0.83%	-0.71%	-0.63%	-0.58%
	10	56,933	0.63	0.62%	0.48%	0.38%	0.37%
	(10) - (1)			1.45%	1.18%	1.01%	0.94%
	<i>t</i> -statistic			33.2	26.2	24.4	22.4
6	1	56,851	0.76	-0.68%	-0.54%	-0.47%	-0.47%
	10	56,962	0.76	0.61%	0.49%	0.38%	0.31%
	(10) - (1)			1.29%	1.03%	0.85%	0.78%
	<i>t</i> -statistic			31.4	26.8	21.5	19.4
7	1	56,830	0.89	-0.67%	-0.52%	-0.45%	-0.40%
	10	56,954	0.89	0.73%	0.56%	0.50%	0.42%
	(10) - (1)			1.40%	1.08%	0.94%	0.82%
	<i>t</i> -statistic			32.0	23.6	21.3	19.4
8	1	56,826	1.07	-0.49%	-0.37%	-0.31%	-0.29%
	10	56,942	1.07	0.91%	0.70%	0.65%	0.59%
	(10) - (1)			1.40%	1.07%	0.96%	0.88%
	<i>t</i> -statistic			29.1	24.8	23.0	21.5
9	1	56,834	1.32	-0.45%	-0.35%	-0.31%	-0.28%
	10	56,955	1.32	1.05%	0.84%	0.74%	0.71%
	(10) - (1)			1.50%	1.19%	1.06%	0.99%
	<i>t</i> -statistic			29.5	26.7	22.4	21.9
10 (Highest)	1	56,774	1.90	-0.03%	0.10%	0.12%	0.15%
	10	56,899	1.94	1.36%	1.15%	1.07%	0.99%
	(10) - (1)			1.39%	1.05%	0.95%	0.83%
	<i>t</i> -statistic			24.7	21.2	19.7	17.2

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TABLE 3 (continued)
Short-Run Persistence of Weekly Overnight Returns, by Firm Characteristic Decile

Panel B. Short-Run Persistence of Overnight Returns, by Firm Size

Size Decile	Decile of Average Weekly Overnight Return	No. of Obs.	Size	Average Weekly Overnight Return			
				Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	1	61,261	40	-2.38%	-2.19%	-1.99%	-1.98%
	10	61,369	42	0.12%	-0.07%	-0.20%	-0.22%
	(10) - (1)			2.50%	2.12%	1.79%	1.76%
	t -statistic			32.4	29.7	23.6	24.0
2	1	61,317	132	-1.13%	-0.98%	-0.88%	-0.88%
	10	61,431	134	0.82%	0.62%	0.49%	0.46%
	(10) - (1)			1.95%	1.60%	1.38%	1.34%
	t -statistic			39.6	33.2	28.9	28.3
3	1	61,324	277	-0.58%	-0.40%	-0.36%	-0.39%
	10	61,456	278	0.98%	0.76%	0.67%	0.65%
	(10) - (1)			1.56%	1.16%	1.03%	1.04%
	t -statistic			34.9	28.0	24.0	24.6
4	1	61,319	546	-0.37%	-0.21%	-0.16%	-0.11%
	10	61,428	545	0.94%	0.75%	0.68%	0.62%
	(10) - (1)			1.31%	0.96%	0.84%	0.74%
	t -statistic			32.5	26.7	24.0	20.7
5	1	61,301	1,120	-0.20%	-0.08%	-0.08%	-0.05%
	10	61,433	1,122	0.87%	0.70%	0.67%	0.62%
	(10) - (1)			1.06%	0.78%	0.75%	0.67%
	t -statistic			27.1	22.3	20.6	19.4
6	1	61,343	3,608	-0.19%	-0.12%	-0.11%	-0.07%
	10	61,458	3,523	0.78%	0.65%	0.66%	0.58%
	(10) - (1)			0.98%	0.77%	0.77%	0.65%
	t -statistic			21.7	18.6	18.2	15.6
7	1	61,335	16,444	-0.99%	-1.02%	-0.94%	-0.90%
	10	61,446	16,395	0.62%	0.59%	0.43%	0.34%
	(10) - (1)			1.61%	1.61%	1.37%	1.24%
	t -statistic			20.2	20.0	18.0	15.6
8	1	61,316	61,105	-1.09%	-1.06%	-1.03%	-0.99%
	10	61,436	61,876	0.69%	0.61%	0.55%	0.42%
	(10) - (1)			1.79%	1.67%	1.58%	1.41%
	t -statistic			25.6	25.6	24.3	20.8
9	1	61,325	193,778	-0.44%	-0.36%	-0.34%	-0.29%
	10	61,450	197,107	1.28%	1.13%	1.05%	0.95%
	(10) - (1)			1.72%	1.49%	1.39%	1.24%
	t -statistic			29.7	28.0	25.7	23.5
10 (Highest)	1	61,273	2,166,469	-0.24%	-0.13%	-0.08%	-0.05%
	10	61,385	2,073,203	1.08%	0.98%	0.90%	0.88%
	(10) - (1)			1.32%	1.11%	0.98%	0.93%
	t -statistic			23.5	22.2	19.2	18.3

Panel C. Short-Run Persistence of Overnight Returns, by Book-to-Market Ratio

Book-to- Market Decile	Decile of Average Weekly Overnight Return	No. of Obs.	Book-to- Market Ratio	Average Weekly Overnight Return			
				Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	1	41,703	0.09	-0.43%	-0.32%	-0.25%	-0.14%
	10	41,803	0.09	1.37%	1.18%	1.06%	0.99%
	(10) - (1)			1.80%	1.50%	1.31%	1.13%
	t -statistic			29.4	27.1	22.0	21.0
2	1	41,762	0.22	-0.36%	-0.23%	-0.19%	-0.18%
	10	41,850	0.22	1.13%	0.88%	0.82%	0.80%
	(10) - (1)			1.49%	1.10%	1.01%	0.98%
	t -statistic			26.9	21.9	19.6	19.0
3	1	41,773	0.31	-0.54%	-0.39%	-0.30%	-0.30%
	10	41,858	0.31	0.95%	0.76%	0.67%	0.69%
	(10) - (1)			1.49%	1.15%	0.97%	1.00%
	t -statistic			28.3	22.3	19.9	19.3

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TABLE 3 (continued)
Short-Run Persistence of Weekly Overnight Returns, by Firm Characteristic Decile

Panel C. Short-Run Persistence of Overnight Returns, by Book-to-Market Ratio (continued)

Book-to-Market Decile	Decile of Average Weekly Overnight Return	No. of Obs.	Book-to-Market Ratio	Average Weekly Overnight Return			
				Week w + 1	Week w + 2	Week w + 3	Week w + 4
4	1	41,757	0.40	−0.63%	−0.49%	−0.43%	−0.43%
	10	41,849	0.40	0.84%	0.61%	0.56%	0.45%
	(10) − (1)			1.47%	1.10%	0.99%	0.89%
	t-statistic			28.9	22.9	20.6	18.5
5	1	41,749	0.49	−0.73%	−0.56%	−0.58%	−0.52%
	10	41,844	0.49	0.63%	0.43%	0.42%	0.38%
	(10) − (1)			1.37%	1.00%	1.00%	0.90%
	t-statistic			27.0	19.9	19.9	17.7
6	1	41,781	0.59	−0.83%	−0.70%	−0.67%	−0.61%
	10	41,866	0.59	0.50%	0.34%	0.23%	0.25%
	(10) − (1)			1.34%	1.04%	0.91%	0.86%
	t-statistic			26.1	19.7	18.3	17.2
7	1	41,763	0.70	−0.95%	−0.87%	−0.78%	−0.77%
	10	41,855	0.70	0.41%	0.27%	0.20%	0.15%
	(10) − (1)			1.36%	1.14%	0.98%	0.93%
	t-statistic			25.1	21.1	18.7	17.3
8	1	41,767	0.84	−1.23%	−1.17%	−1.10%	−1.05%
	10	41,852	0.84	0.25%	0.16%	0.12%	0.02%
	(10) − (1)			1.48%	1.33%	1.22%	1.07%
	t-statistic			24.6	22.6	20.7	18.1
9	1	41,769	1.04	−1.38%	−1.33%	−1.18%	−1.19%
	10	41,852	1.04	0.15%	0.09%	−0.05%	−0.07%
	(10) − (1)			1.53%	1.41%	1.14%	1.11%
	t-statistic			23.6	22.8	18.0	18.0
(10) Highest	1	41,716	7.80	−1.50%	−1.33%	−1.28%	−1.22%
	10	41,816	8.36	0.17%	0.03%	−0.04%	−0.13%
	(10) − (1)			1.67%	1.36%	1.23%	1.09%
	t-statistic			23.3	19.4	17.0	15.3

Panel D. Short-Run Persistence of Overnight Returns, by Price Momentum

Price Momentum Decile	Decile of Average Weekly Overnight Return	No. of Obs.	Price Momentum	Average Weekly Overnight Return			
				Week w + 1	Week w + 2	Week w + 3	Week w + 4
(1) Lowest	1	55,659	−40.1%	−1.01%	−0.92%	−0.82%	−0.76%
	10	55,779	−41.7%	0.85%	0.66%	0.49%	0.38%
	(10) − (1)			1.86%	1.58%	1.31%	1.14%
	t-statistic			25.0	23.5	19.7	16.5
2	1	55,720	−17.6%	−1.28%	−1.24%	−1.17%	−1.12%
	10	55,838	−17.7%	0.32%	0.21%	0.13%	0.09%
	(10) − (1)			1.60%	1.46%	1.31%	1.22%
	t-statistic			27.9	25.4	22.3	20.6
3	1	55,728	−7.0%	−1.18%	−1.10%	−1.04%	−0.99%
	10	55,852	−6.9%	0.21%	0.11%	0.09%	0.01%
	(10) − (1)			1.39%	1.22%	1.14%	1.00%
	t-statistic			26.3	23.7	21.8	18.4
4	1	55,726	0.7%	−1.09%	−1.01%	−0.91%	−0.90%
	10	55,833	0.7%	0.22%	0.15%	0.08%	0.07%
	(10) − (1)			1.31%	1.16%	0.98%	0.97%
	t-statistic			26.5	24.9	20.1	20.4
5	1	55,703	7.3%	−0.97%	−0.95%	−0.86%	−0.83%
	10	55,828	7.3%	0.31%	0.20%	0.13%	0.07%
	(10) − (1)			1.29%	1.15%	0.99%	0.89%
	t-statistic			26.0	25.2	22.9	19.2
6	1	55,743	14.1%	−0.91%	−0.81%	−0.80%	−0.82%
	10	55,859	14.1%	0.36%	0.26%	0.21%	0.17%
	(10) − (1)			1.27%	1.07%	1.00%	0.99%
	t-statistic			26.1	22.4	21.7	21.7

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TABLE 3 (continued)
Short-Run Persistence of Weekly Overnight Returns, by Firm Characteristic Decile

Panel D. Short-Run Persistence of Overnight Returns, by Price Momentum (continued)

Price Momentum Decile	Decile of Average Weekly Overnight Return	No. of Obs.	Price Momentum	Average Weekly Overnight Return			
				Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
7	1	55,735	22.1%	−0.93%	−0.80%	−0.78%	−0.72%
	10	55,849	22.1%	0.43%	0.30%	0.24%	0.18%
	(10) − (1)			1.35%	1.09%	1.02%	0.90%
	<i>t</i> -statistic			29.6	22.9	21.3	19.2
8	1	55,719	33.4%	−0.84%	−0.71%	−0.74%	−0.69%
	10	55,836	33.5%	0.54%	0.39%	0.34%	0.28%
	(10) − (1)			1.38%	1.10%	1.08%	0.97%
	<i>t</i> -statistic			26.9	23.0	22.6	19.7
9	1	55,730	53.2%	−0.82%	−0.70%	−0.64%	−0.62%
	10	55,854	53.5%	0.72%	0.55%	0.48%	0.51%
	(10) − (1)			1.54%	1.25%	1.11%	1.13%
	<i>t</i> -statistic			28.4	24.1	21.9	21.3
(10) Highest	1	55,674	150.3%	−0.63%	−0.42%	−0.45%	−0.33%
	10	55,794	165.6%	1.24%	0.99%	0.92%	0.88%
	(10) − (1)			1.87%	1.40%	1.37%	1.21%
	<i>t</i> -statistic			31.7	23.5	23.2	21.2

firms that are expected to grow more quickly (low earnings-to-price ratio) being harder to value. For each week w , we rank stocks in ascending order according to the measure of interest and partition the stocks into quartiles. We then rank the stocks in each quartile in ascending order according to the week w overnight return and then partition them into deciles. We compute the average overnight returns during each of weeks $w + 1$ through $w + 4$ for the highest and lowest of these deciles as well as the difference between these average overnight returns.

Table 4 presents the results for each of our five measures. For parsimony, the results are reported just for week $w + 1$. (The overnight-return results for weeks $w + 2$ through $w + 4$ are qualitatively very similar.) With just one exception, the difference between the average overnight returns of the highest and lowest return deciles increases monotonically as firms become harder to value. The average overnight-return difference for the highest return-volatility quartile is 1.99 percentage points, but it is only 1.04 percentage points for the lowest quartile of volatility. The difference between these two, 0.95 percentage points, is reliably greater than 0. The average overnight-return differences for the smallest and largest firm-size quartiles are 2.32 and 0.72 percentage points, respectively, with the difference of 1.6 percentage points being significantly greater than 0. For the youngest and oldest firm-age quartiles, the average overnight-return differences are 1.94 percentage points and 1.25 percentage points, respectively. The difference of 0.69 percentage points is significantly positive. For the least- and most-profitable-firm quartiles, the average overnight-return differences are 2.13 and 1.30 percentage points, respectively, with the difference of 0.83 percentage points being reliably positive. The average overnight-return differences for the lowest and highest earnings-to-price quartiles are 1.93 and 0.82 percentage points, respectively. The difference between these two, 1.12 percentage points, is significantly greater than 0. That short-term overnight-return persistence is

TABLE 4
Short-Run Persistence of Overnight Returns for Each Quartile of Hard-to-Value Proxy

Table 4 reports the average weekly overnight return for week $w + 1$ for the top and bottom decile of stocks constructed according to week w average daily overnight return, by quartile of our proxies for hard-to-value firms: return volatility, firm size, firm age, profitability, and earnings-to-price ratio. Stocks are first ranked each week in ascending order according to the proxy of interest and then partitioned into quartiles. Within each proxy quartile, stocks are then ranked in ascending order according to their weekly overnight return and partitioned into deciles. See Table 1 for a description of the calculation of weekly overnight returns and for definitions of the proxies.

Quartile of Hard-to- Value Measure	Decile of Weekly Overnight Return	Average Week $w + 1$ Overnight Return				
		Return Volatility	Size	Age	Profitability	Earnings-to- Price
1 (Lowest)	1	-0.90%	-1.95%	-0.53%	-1.23%	-1.69%
	10	0.13%	0.37%	1.41%	0.90%	0.24%
	(10) - (1)	1.04%	2.32%	1.94%	2.13%	1.93%
	t -statistic	35.0	41.1	32.7	39.2	33.9
2	1	-1.05%	-0.63%	-0.96%	-1.14%	-0.69%
	10	0.15%	0.99%	0.69%	0.28%	0.69%
	(10) - (1)	1.20%	2.05%	1.66%	1.42%	1.38%
	t -statistic	35.0	40.2	37.8	34.0	36.5
3	1	-1.14%	-0.25%	-1.21%	-0.67%	-0.36%
	10	0.44%	0.88%	0.41%	0.47%	0.75%
	(10) - (1)	1.57%	1.13%	1.62%	1.13%	1.10%
	t -statistic	37.0	31.3	41.7	32.5	32.5
4 (Highest)	1	-0.81%	0.00%	-0.99%	-0.38%	-0.16%
	10	1.18%	0.71%	0.26%	0.92%	0.65%
	(10) - (1)	1.99%	0.72%	1.25%	1.30%	0.82%
	t -statistic	37.3	18.5	36.7	35.0	26.9
(4) - (1)		0.95%	-1.60%	-0.69%	-0.83%	-1.12%
t -statistic		17.6	-26.9	-13.5	-16.5	-19.7

stronger for firms that are harder to value is additional evidence that overnight returns are reflective of firm-specific investor sentiment.

If overnight returns serve as a measure of investor sentiment, then their persistence over the short term should also be stronger the lower the institutional presence in a firm's shares. This is based on the premise that retail investors are the ones more likely to be affected by sentiment. To analyze the impact of institutional holdings on persistence, we rank firms in each week w in ascending order according to the percentage of institutional ownership at the end of the prior quarter and then partition our sample into quartiles. For each quartile, we repeat our overnight-return calculations. Table 5 presents, by quartile, the average overnight returns for weeks $w + 1$ through $w + 4$ for the top and bottom deciles of week w overnight return as well as the difference between these two returns. As shown in Table 5, the return difference for each week decreases with the level of institutional ownership. For week $w + 1$, for example, the difference in returns is 2.36 percentage points for the lowest institutional-ownership quartile and 1.07 percentage points for the highest quartile. The difference between these two, 1.28 percentage points, is significantly positive. The corresponding differences for weeks $w + 2$ through $w + 4$ are also significant, ranging from 1.07 to 1.26 percentage points.¹⁰

¹⁰These differences remain significant after controlling for firm size (untabulated results).

TABLE 5
Short-Run Persistence of Overnight Returns and the Level of Institutional Ownership

Table 5 reports the average weekly overnight return for weeks $w + 1$ through $w + 4$ for the top and bottom deciles of stocks constructed according to week w average daily overnight return, by institutional ownership. Stocks are first ranked each week in ascending order according to the percentage of outstanding shares held by institutions as of the end of the prior fiscal quarter and partitioned into quartiles. Within each quartile, stocks are then ranked in ascending order according to their weekly overnight return and partitioned into deciles. See Table 1 for a description of the calculation of weekly overnight returns and for the definition of percentage institutional ownership.

Quartile of Institutional Ownership	Decile of Weekly Overnight Return	No. of Obs.	Percentage of Institutional Ownership	Average Weekly Overnight Return			
				Week $w + 1$	Week $w + 2$	Week $w + 3$	Week $w + 4$
1 (Lowest)	1	134,562	5.10%	-1.51%	-1.47%	-1.37%	-1.35%
	10	134,652	5.16%	0.85%	0.63%	0.47%	0.38%
	(10) - (1)			2.36%	2.10%	1.84%	1.73%
	t -statistic			39.5	36.9	32.5	31.2
2	1	134,604	21.75%	-0.95%	-0.81%	-0.77%	-0.70%
	10	134,712	21.82%	1.07%	0.81%	0.71%	0.63%
	(10) - (1)			2.02%	1.62%	1.49%	1.33%
	t -statistic			40.6	35.4	32.4	29.5
3	1	134,636	41.18%	-0.50%	-0.39%	-0.35%	-0.29%
	10	134,738	41.21%	0.87%	0.70%	0.64%	0.56%
	(10) - (1)			1.37%	1.09%	0.99%	0.85%
	t -statistic			33.4	30.0	26.7	24.3
4 (Highest)	1	134,574	63.60%	-0.38%	-0.27%	-0.23%	-0.20%
	10	134,679	63.34%	0.69%	0.57%	0.51%	0.46%
	(10) - (1)			1.07%	0.84%	0.74%	0.66%
	t -statistic			31.8	28.7	24.4	21.7
(4) - (1)				-1.28%	-1.26%	-1.10%	-1.07%
t -statistic				-23.9	-24.2	-22.0	-21.5

V. Longer-Term Returns

In this section we examine whether, over the long run, stocks with high short-term overnight returns underperform those with low short-term overnight returns. Finding evidence of this would be consistent with temporary mispricing and is a characteristic we would expect of a measure of sentiment. It would also be consistent with the finding of Hvidkjaer (2008) and Barber et al. (2009) that stocks with high (low) short-term retail investor demand underperform (outperform) over the long run and with the finding of Baker and Wurgler (2006) that when market-wide sentiment is high, stocks that are more attractive to speculators underperform over the following 12 months. For our long-term analysis we use monthly, rather than weekly, returns. For each December in our sample period (Dec. 1992 through Dec. 2012), we compute the average daily overnight return for all stocks that have at least 15 daily overnight returns available on CRSP for that month. We rank stocks in ascending order according to the month's average daily overnight return and partition our sample into deciles. We then form 3 equal-weighted portfolios: one that is long in the stocks in decile 1, one that is long in the stocks in decile 10, and one that is long in the decile 1 stocks and short in the decile 10 stocks. For each of these portfolios, we calculate the cumulative buy-and-hold *total* return for each of the following 12 months.

Each portfolio's average monthly abnormal return is given by the intercept, α , from the following monthly time-series regression:

(2) $R_t - R_{ft} = \alpha + \beta_1(R_{mt} - R_{ft}) + \beta_2SMB_t + \beta_3HML_t + \beta_4WML_t + \varepsilon_t,$

where R_t is the portfolio return during month t ; R_{ft} is the month t risk-free rate; R_{mt} is the month t return on the value-weighted market index; SMB_t is the month t return on a value-weighted portfolio of small-cap stocks minus the month t return on a value-weighted portfolio of large-cap stocks; HML_t is the month t return on a value-weighted portfolio of high book-to-market stocks minus the month t return on a value-weighted portfolio of low book-to-market stocks; and WML_t is the month t return on a value-weighted portfolio of stocks with high recent returns minus the month t return on a value-weighted portfolio of stocks with low recent returns.

As reported in Panel A of Table 6, we find that a portfolio long in the stocks of decile 1 and short in the stocks of decile 10 earns a positive and significant average monthly abnormal return of 0.62 percentage points or 7.4 percentage points, annualized. The stocks in the highest decile of overnight returns during a given month significantly underperform those in the lowest decile over the next 12 months, suggesting that firms with the highest short-term overnight returns are overpriced relative to those with the lowest short-term overnight returns. This result provides additional evidence that overnight returns are suitable as a measure of firm-specific investor sentiment.

We gain insight into how these long–short portfolio returns vary across subsets of stocks by repeating this analysis for the quartile of stocks that are most difficult to value (those in the top quartile of return volatility, the lowest quartile of size, the lowest quartile of age, the lowest quartile of profitability, and the highest quartile of expected growth) as well as for the quartile of stocks that are easiest to value. All characteristics are measured as of the end of each September to ensure that their values are known in December, at the time of portfolio formation. Panel B of Table 6 reports the regression results for the long–short portfolio formed for each of these 10 subsamples. For each subsample of hardest-to-value stocks, the average monthly abnormal return on a portfolio long in the stocks of decile 1 and short in the stocks of decile 10 is significantly positive. The average monthly abnormal return ranges from 0.37 percentage points, or 4.4 percentage points, annualized (for the smallest firms) to 0.81 percentage points, or 9.7 percentage points, annualized (for the firms that are expected to be growing most rapidly). The average monthly abnormal portfolio return is significantly different from 0 for only one of the easiest-to-value firm subsamples (the most profitable firms), where the average monthly abnormal return is 0.44 percentage points (5.3 percentage points, annualized). The strong long-term return reversal results for the hardest-to-value firms and the weak reversal results for the easiest-to-value firms are consistent with our previously documented finding that sentiment plays a bigger role for the hard-to-value firms.

VI. Firm-Specific Investor Sentiment and the Price Reaction to Earnings Announcements

In this section we use overnight returns to examine the relation between investor sentiment and the price reaction to earnings announcements. Two recent studies (Mian and Sankaraguruswamy (2012), Livnat and Petrovits (2013)) have investigated this relation using the Baker and Wurgler (2006) measure of

TABLE 6
Long-Run Return Reversals for Portfolios Formed on the Basis of Overnight Returns

For Panel A of Table 6, stocks are ranked each year according to their average daily overnight return during the month of December and partitioned into deciles. We form three equal-weighted portfolios: one long in the stocks of decile 1 (those with the lowest December average daily overnight returns), one long in the stocks of decile 10 (those with the highest December average daily overnight returns), and one long in the stocks of decile 1 and short in the stocks of decile 10. We hold those portfolios for 12 months, beginning with the month after portfolio formation. Panel A reports the results of estimating the following monthly regression:

$$R_t - R_{ft} = \alpha + \beta_1(R_{mt} - R_{ft}) + \beta_2SMB_t + \beta_3HML_t + \beta_4WML_t + \varepsilon_t,$$

where $R_t - R_{ft}$ is the excess of the portfolio return in month t over the risk-free rate that month, $R_{mt} - R_{ft}$ is the excess of the month t market return over the risk-free rate, SMB_t is the difference between the month t returns of a value-weighted portfolio of small stocks and one of large stocks, HML_t is the difference between the month t returns of a value-weighted portfolio of high book-to-market stocks and one of low book-to-market stocks, and WML_t is the difference between the month t returns of a value-weighted portfolio of high-price-momentum stocks and one of low-price-momentum stocks. For Panel B, stocks are first ranked in ascending order according to the value of the hard-to-value proxy of interest as of the end of the month of December of each year and then partitioned into quartiles. Within each proxy quartile, stocks are then ranked in ascending order according to their average daily overnight return during the month of December and partitioned into deciles. Panel B reports the results of estimating the previous regression for an equal-weighted portfolio that is long in the stocks of decile 1 and short in the stocks of decile 10 within the highest and lowest quartiles of the hard-to-value proxy. The hard-to-value proxies are return volatility, firm size, firm age, profitability, and earnings-to-price ratio. See Table 1 for a description of the calculation of average daily overnight returns and for the definitions of the proxies. Below each intercept and coefficient estimate is the corresponding t -statistic in parentheses.

Panel A. Regression Results for Full Sample

Variable	Decile 1	Decile 10	Decile 1 – Decile 10
Intercept	0.0040 (2.98)	–0.0023 (–1.56)	0.0062 (3.54)
$R_m - R_f$	0.7786 (24.15)	1.1262 (32.42)	–0.3476 (–8.19)
SMB	0.6505 (15.54)	0.9483 (21.03)	–0.2978 (–5.40)
HML	0.0630 (1.44)	–0.3985 (–8.47)	0.4615 (8.03)
WML	–0.1716 (–6.47)	0.0585 (2.05)	–0.2301 (–6.59)

Panel B. Regression Results for Top and Bottom Quartiles of Hard-to-Value Proxies

Variable	Decile 1 – Decile 10									
	Return-Volatility Quartile		Size Quartile		Age Quartile		Profitability Quartile		Earnings-to-Price Quartile	
	Low	High	Small	Big	Young	Old	Low	High	Low	High
Intercept	–0.00137 (–1.42)	0.0060 (2.47)	0.0037 (1.97)	0.0042 (1.73)	0.0060 (2.16)	0.0022 (1.62)	0.0053 (2.32)	0.0044 (2.35)	0.0081 (2.60)	0.0020 (0.87)
$R_m - R_f$	–0.05495 (–2.35)	–0.30324 (–5.19)	–0.10594 (–2.31)	–0.34790 (–5.88)	–0.6090 (–9.00)	–0.1454 (–4.35)	–0.3255 (–5.93)	–0.2925 (–6.52)	–0.1863 (–2.49)	–0.2873 (–5.09)
SMB	0.0514 (1.70)	–0.1843 (–2.43)	–0.2561 (–4.30)	–0.4575 (–5.96)	–0.3791 (–4.32)	–0.1766 (–4.06)	–0.3940 (–5.53)	–0.1509 (–2.59)	–0.4072 (–4.20)	–0.0041 (–0.06)
HML	0.0444 (1.40)	0.5584 (7.05)	0.1685 (2.71)	0.6675 (8.33)	0.5163 (5.64)	0.1715 (3.78)	0.6192 (8.33)	0.4186 (6.89)	0.1349 (1.33)	0.3346 (4.38)
WML	–0.2232 (–1.16)	–0.22165 (–4.61)	–0.14379 (–3.81)	–0.38595 (–7.94)	–0.2776 (–4.99)	–0.1481 (–5.38)	–0.1080 (–2.39)	–0.2016 (–5.47)	–0.3518 (–5.73)	–0.2918 (–6.28)

market-level sentiment. They obtain mixed results. Mian and Sankaraguruswamy (2012) find that over the 3-day window surrounding a firm’s earnings announcement, the sensitivity of price to good (bad) earnings news is greater the more positive (negative) is market sentiment. Livnat and Petrovits (2013) obtain the opposite result. They find that the average price reaction to extremely good news is significantly greater when market sentiment is low than when it is high, whereas the reaction to extremely bad news is significantly greater when market sentiment

is high than when it is low. But when they use analysts' forecasts as the benchmark for expected earnings, these differences become insignificant.

We revisit this issue using overnight returns as a proxy for firm-specific investor sentiment. In the context of earnings expectations, we define optimistic (pessimistic) investors as those having an expectation of earnings that is greater (less) than the analyst consensus forecast. Denote by AF the analyst consensus forecast and by αAF investors' expectation of the period's earnings, where $\alpha > 1$ if investors are optimistic and $\alpha < 1$ if investors are pessimistic. In order to derive the specification for our empirical analysis, we use a simple multiples model to map earnings expectations and realized earnings into stock prices. Specifically, we assume that the pre-earnings announcement stock price, P_{pre} , is a multiple, γ , of investors' earnings expectation ($P_{pre} = \gamma \alpha AF$) and that the price of the firm after the earnings are released, P_{ann} , is equal to γE , where E is the realized earnings for the period. The stock return at the time of the earnings announcement is then given by

$$(3) \quad \frac{P_{ann} - P_{pre}}{P_{pre}} = \frac{\gamma(E - \alpha AF)}{P_{pre}},$$

where the numerator on the right-hand side of equation (3) is the earnings surprise from investors' perspective. From equation (3) we predict that the stock return at the time of the earnings announcement will be negatively related to investor sentiment, α , just prior to the announcement.

To test this conjecture, we calculate for each firm i and calendar quarter q the average daily overnight return over trading days -20 through -2 prior to the firm's earnings announcement that quarter (where day 0 denotes the day of the earnings announcement). Within each calendar quarter q , we then rank the firms in ascending order according to this average daily overnight return and partition the firms into deciles. For each quarter, we retain the observations in the two lowest and two highest deciles and estimate the following regression:

$$(4) \quad R_{iq} = \alpha + \beta_1 E_{iq} + \beta_2 AF_{iq} + \beta_3 SENT_{iq} AF_{iq} + \varepsilon_{iq},$$

where R_{iq} = the cumulative market-adjusted return for firm i (computed using the CRSP value-weighted market index) in the 3 days surrounding the calendar quarter q earnings announcement (trading days -1 , 0 , and 1); E_{iq} = earnings before extraordinary items for firm i announced in calendar quarter q , as reported in the Institutional Brokers' Estimate System (IBES) database, standardized by the per-share price of firm i at the close of trading 2 days prior to that announcement; AF_{iq} = the consensus analyst forecast of the earnings of firm i that are announced in calendar quarter q , as of 2 days prior to the announcement, standardized by the per-share price of firm i at the close of trading 2 days prior to the earnings release; and $SENT_{iq} = 1$ (0) if the average daily overnight return over trading days -20 through -2 prior to the quarter q earnings announcement of firm i puts that firm within the top (bottom) two deciles. Our conjecture is that β_3 will be negative.

Results of our analysis appear in Table 7. As expected, β_1 is significantly positive, and β_2 is significantly negative. The reaction to an earnings announcement is increasing in reported earnings and decreasing in the prior consensus analyst forecast. Consistent with our conjecture and with overnight returns reflecting investor

TABLE 7
Investor Sentiment and the Price Reaction to Earnings Announcements

Table 7 reports the results of estimating the following regression:

$$R_{iq} = \alpha + \beta_1 E_{iq} + \beta_2 AF_{iq} + \beta_3 SENT_{iq} AF_{iq} + \varepsilon_{iq},$$

where R_{iq} is the cumulative market-adjusted return for firm i (computed using the Center for Research in Security Prices (CRSP) value-weighted market index) in the 3 days surrounding the firm's calendar quarter q earnings announcement; E_{iq} is earnings before extraordinary items for firm i announced in calendar quarter q , standardized by the per-share price of firm i at the close of trading 2 days prior to that announcement; AF_{iq} is the consensus analyst forecast of the earnings of firm i announced in calendar quarter q , computed immediately prior to the earnings announcement and standardized by the per-share price of firm i at the close of trading 2 days prior; and $SENT_{iq}$ is a dummy variable equal to 1 (0) if the average daily overnight return for firm i calculated over trading days -20 through -2 prior to its quarter q earnings announcement (where day 0 is the day of the earnings announcement) is within the top (bottom) two deciles for quarter q . Only those observations that fall within these top or bottom two deciles for quarter q are included in the regression estimate.

Variable	Coefficient	t-Statistic
Intercept	0.0023	3.50
E	0.3249	7.51
AF	-0.1861	-3.64
$SENT \times AF$	-0.0821	-2.93

sentiment, β_3 is significantly negative. Investors respond less positively to reported earnings when they are optimistic than when they are pessimistic. When investors are optimistic, the firm's preannouncement price is higher than what would be justified based on the consensus analyst forecast of earnings. Consequently, the share price responds less positively to reported earnings than would be expected given the actual earnings surprise. Conversely, when investors are pessimistic, the preannouncement price is lower than what is appropriate given the consensus earnings forecast. The return at the time of the earnings announcement is then more positive than justified based on the actual earnings surprise. This finding suggests that objective evidence (in the form of reported earnings) serves to correct, at least partially, the effect of sentiment on stock prices.

VII. Summary and Conclusions

We examine the suitability of using overnight returns as a measure of firm-specific investor sentiment. The choice of this measure is based on the premise that retail investors are the ones most likely to be affected by sentiment and evidence given by Berkman et al. (2012) that individuals tend to place orders when the market is closed. We find that overnight returns exhibit characteristics that would be expected of a firm-specific sentiment measure. First, we show that weekly overnight returns persist in the short run, consistent with existing evidence of short-term persistence in investor sentiment. Second, we find that short-term persistence is higher for firms that are more difficult to value. This is consistent with sentiment playing a larger role in the pricing of stocks that are harder to objectively value, a result that has previously been documented for market-wide sentiment measures. We also find short-term persistence to be higher for firms with lower levels of institutional shareholdings. This is to be expected given that retail investors are the ones more likely to be affected by sentiment. Third, we document that stocks with high short-term overnight returns underperform those with low short-term overnight returns over the next 12 months. This suggests

temporary mispricing due to the sentiment-driven demand of individual investors and is consistent with the evidence given by Hvidkjaer (2008) and Barber et al. (2009) of long-run underperformance of stocks with strong retail investor demand relative to those with weak retail investor demand.

Developing a measure of firm-specific investor sentiment is important for the study of the effect of sentiment on decisions and prices at the individual firm level. We illustrate this by using overnight returns to investigate the impact of sentiment on the price reaction to earnings announcements. We find that the price response is lower the more positive is investor sentiment, consistent with the notion that objective evidence (reported earnings) serves to correct the effect of sentiment on stock prices. Our finding stands in contrast to the mixed results reported in prior studies, which employed a market-wide measure of investor sentiment, and illustrates the potential usefulness of overnight returns for future research that examines the effect of sentiment on decision making and prices at the firm level.

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