Who moves markets in a sudden market-wide crisis? Evidence from nine-eleven

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Abstract

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JEL classifications: G12, G14

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Abstract

We compare reactions in the prices and trading patterns of common stocks and closed-end funds (CEFs), which have substantially different investor clienteles, to the September 11, 2001 terrorist attacks. When the market reopened six days later, retail investors sold and there were sharp price declines—even in assets with net institutional buying. In the subsequent two weeks, price reversals were substantially security-specific and thus not simply due to improved systematic sentiment. Consistent with microstructure theory, comparisons between CEFs and common stocks show the speed of these reversals depended significantly on the relative quality and availability of information about fundamental values.

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1. Introduction

How do stock markets respond to a sudden crisis? A rich literature finds inefficient stock price reactions to ordinary news events such as corporate earnings announcements. But how does the stock market respond to sudden crises that pose the threat of significant financial loss? And how do retail and institutional investors interact in such crisis periods? It is surprising that little is known about this question because unanticipated, crisis events that adversely affect a cross-section of assets (e.g., oil spills, powerful weather events, and major industrial accidents) occur frequently. And although less frequent, crisis periods in the broader stock market could have large implications, because even well-diversified investors could experience significant wealth loss. Do retail investors, who may be less able to effectively measure and manage such downside risk, engage in panicked selling? To what extent does institutional trading act as a stabilizing force by providing liquidity? How important is the quality and accessibility of information in how asset prices are affected?

In this paper we use the setting of the terrorist attacks of September 11, 2001 (hereafter "nine-eleven") to study how investor clienteles interact and security prices react in a sudden, market-wide crisis, which we define as an abrupt period of adversity that brings the threat of significant wealth loss for stock market investors. Although empirically identifying such a crisis may often be somewhat arbitrary, nine-eleven clearly qualifies.[1] Moreover, the choice of nine-eleven is also justified by an ex post, empirical method we offer as a potential way to identify such market crises.

[1]Nine-eleven was highly salient, and news reports at the time stated that investors feared the terrorist attack would lead to a sharp decline in both the economy and stock prices. For example, see "Attacks raise fears of a recession," by G. Ip and J. McKinnon (*The Wall Street Journal*, September 12, 2001, Section A, page 1).

To infer whether retail and institutional investors traded differently, we use microstructure trading measures such as trade size and the direction of trade initiation (i.e., buy- versus sell-initiated, as indicated by Lee and Ready's 1991 signing algorithm) and compare trading patterns among securities well known to have different investor clienteles. In particular, retail investors play a more prominent role in trading closed-end funds (CEFs) (Weiss 1989; Lee, Shleifer, and Thaler 1991) and small-cap stocks, whereas institutional investors dominate trading in large-cap stocks (Sias and Starks 1997). Therefore, we analyze the trading and price patterns of these security classes separately to further infer differential investor responses. As we motivate later in the paper, we limit the closed-end fund sample to only those with portfolios consisting of fixed-income securities.

Our main findings are summarized as follows. During the first post-nine-eleven trading week, which started six calendar days after nine-eleven, the average fixed-income CEF we study had a cumulative price return loss that was more than 5% larger in absolute terms than the cumulative loss in its net asset value (NAV). The majority of dollar volume was sell-initiated for CEFs and small-cap stocks, but buy-initiated for large-cap stocks, and trades larger than $50,000 in large-cap stocks were more buy- than sell-initiated in every day of trading. Such institutional buying is consistent with Lipson and Pucket (2010), who find that pension plan sponsors and money managers trade opposite to extreme market movements. Despite net institutional buying during the first post-nine-eleven trading week, prices declined significantly across CEFs and all common stock deciles.[2]

[2]Kumar and Lee (2006) and Barber, Odean, and Zhu (2009) show that correlated retail trading can move prices during normal trading conditions To the extent that retail selling impacted prices in the aftermath of nine-eleven, our results suggest that prices can move in the direction of retail trading during a crisis period even if very large, presumably institutional, trades are in the opposite direction.

Prices recovered during the second and third post-nine-eleven trading weeks, and cross-sectional regressions show that the size of a security's recovery was significantly related to the security's initial price decline. Interestingly, these security-specific reversals primarily occurred during the second week for CEFs but during the third week for common stocks. We speculate that the faster, security-specific recoveries in CEFs were due to regularly disclosed NAVs, which provide natural benchmarks for fundamental values. This potential explanation is consistent with classic models such as Grossman and Stiglitz (1980) in which a higher ratio of informed to uninformed investors improves price efficiency. The intuition in these models could be extended to predict that any departures from fundamentals following a news shock will be reversed faster in assets with more public information about fundamentals.

Although our research setting draws on a single event and is thus a case study in some respects, it is important to note that we study the reactions of more than 1,600 different securities in multiple asset classes. The simultaneity of the event across the securities eliminates the need to align in event time observations that actually occurred at different times and in different economic climates. In this sense, our study is a natural experiment that examines how asset prices react to a macroeconomic shock, similar to Pearce and Roley (1985) and Anderson, Bollerslev, Diebold, and Vega (2003). In our online appendix, we examine other market-wide crises and present suggestive evidence that our main findings extend to other periods in the market.

We find evidence of heavy retail investor selling in the crisis period set off by nine-eleven, similar to the "flight" response the psychology literature documents as a potential reaction to a threat. Institutions responded by providing liquidity and were net buyers, but prices nonetheless declined throughout the first trading week. The return patterns and trading statistics we document suggest that different segments of financial markets respond differently to the same market-wide news due to not only different risk characteristics but also heterogeneity in the relative proportion and trading of institutional and retail investors. Moreover, our results suggest that the quality and accessibility of information becomes particularly important during a crisis period, both in terms of how asset prices respond during the crisis and how quickly they recover as the crisis dissipates.

2. Related Literature

Our analysis of CEFs is related to Klibanoff, Lamont, and Wizman (1998), who document underreaction to new information in closed-end country funds (CEFs whose underlying assets are foreign). They attribute the underreaction to unsophisticated investors dominating the trading and note that CEFs, like small-cap stocks, have a clientele that is primarily small retail investors.[3] Papers that directly measure individual investor trading include Barber, Odean, and Zhu (2009), Barber and Odean (2008), Hvidkjaer (2008), and Kumar and Lee (2006), all of whom show that correlated retail trading can move prices. Dennis and Strickland (2002) and Lipson and Puckett (2010), in turn, investigate how correlated trading by institutional investors affects prices on volatile market days (which include both gains and losses of more modest magnitude than what we examine). None of these studies investigate simultaneous differences in retail and institutional investor trading.

Among papers that investigate other aspects of nine-eleven, Epstein and Schneider (2008) argue that "ambiguity-averse" investors react more strongly to bad news than good news, and that nine-eleven triggered "a learning process whereby market participants were trying to infer the possibility of a structural change to the U.S. economy from unfamiliar signals." The notion that a learning process took place is consistent with our finding that the market did not begin to reverse the initial reaction until the second post-nine-eleven

[3] Supporting this characterization of CEFs' investor clientele, Weiss (1989) finds that institutions own only about seven percent of this asset class, and Lee, Shleifer, and Thaler (1991) find that CEFs have a relatively high proportion of trades smaller than $10,000.

trading week. Burch, Emery, and Fuerst (2003) examine closed-end fund prices across nine-eleven and argue that broad small-investor sentiment played an important role in how their price-to-NAV discounts reacted to the event. Using survey data, Glaser and Weber (2005) report a relatively high expected return by individual investors around the weekend of August 4-5, 2001, and Graham and Harvey (2003) report a relatively low expected market return by Chief Financial Officers (CFOs) based on survey data gathered September 12-14, 2001. Glaser and Weber conclude that their results do not coincide with those in Graham and Harvey, but as we discuss later, our findings appear to reconcile the two.

3. Nine-Eleven as a Market-Wide Crisis

We begin by reviewing briefly the climate and timing of the extraordinary market closures following nine-eleven. In the months prior, the U.S. economy had been showing signs of weakness, and the S&P 500 index had gradually declined more than 20% during the prior four months. Many feared the event would push both the economy and stock market into a steep decline.

The U.S. financial markets did not open the Tuesday morning of nine-eleven, and the equity markets remained closed until six days later on Monday, September 17, 2001. On that day the S&P 500 index declined 4.9%, and continued to fall throughout the trading week to close 11.6% below its September 10, 2001 level. The fixed-income markets were also affected—but only moderately. They were closed for only two days (September 11 and 12), and Treasury yields actually declined, in part due to Federal Reserve interventions to inject liquidity and stimulate the economy. Although spreads on risky bonds did increase, by Monday, September 17, the 10-year Baa corporate-to-Treasury spread was only about 50 basis points higher than before nine-eleven (see Section 1 in our online appendix for a graph).

It is perhaps obvious that nine-eleven was perceived as a sudden market-wide financial crisis that could cause panicked selling, but how would other crisis periods be identified? We propose that crisis events satisfy three criteria. First, a crisis event should be abrupt, negative, and have sufficient economic magnitude so as to greatly increase investor attention and the perceived likelihood of sharp stock market decline. Second, investor expectations of market volatility should increase. Finally, the economic magnitude of the crisis and increase in expected volatility should stand out relative to recent market conditions.

For completeness, we offer an ex post empirical method of identifying sudden market-wide crisis periods using inspection of daily returns in the DJIA and the VXO index, a measure of expected volatility derived from trading in options on the S&P 100 index.[4,5] Our identification strategy has an advantage over searching for negative news, for example, in that it is based on hard data as opposed to inferring severity and tone in a subjective way. Although implementation of our strategy is objective, specification of required levels of changes in the DJIA and VXO remains somewhat arbitrary. Also, our method will not

[4]Including a volatility metric is important to distinguish a true crisis period from stock market days that are merely volatile, the focus in Dennis and Strickland (2002) and Lipson and Puckett (2010). These studies investigate volatile days in which the CRSP value-weighted or equal-weighted market index rises or falls at least 2%. The criteria we propose differs in using an index more highly visible to investors (the DJIA), identifies only market losses instead of both gains and losses, requires a trading-day return with considerably larger magnitude, and requires a substantial increase in uncertainty. Our methodology will also not identify events that are largely intraday price declines and recoveries, such as the flash crash of May 2010.

[5]The VXO was originally introduced in 1986 with ticker symbol VIX. In 2003, the methodology for the VIX was changed to one based on options on the S&P 500 index, and the original index was renamed and disseminated under the ticker symbol VXO. We use the VXO (sometimes called the "old VIX") simply because its series begins in January 1986, whereas the revised VIX has been calculated only back to January 1990.

identify a crisis event that did not actually result in a substantial trading-day decline in the DJIA or an increase in expected volatility from one market close to the next.

To be specific, we propose identifying the sudden onset of crisis by requiring (1) a trading day in which the DJIA closes down 5% or more from the prior day, (2) the DJIA's loss to exceed five times the standard deviation in daily DJIA returns during the prior year, and (3) the VXO return from the prior day to be positive and exceed five times its daily standard deviation during the prior year. These criteria identify the onset of a crisis period based on a subsequent sharp decline in the highly visible DJIA that is large relative to recent market conditions and accompanied by a large increase in perceived uncertainty as measured by the VXO. We should note that we do not require pinning down a specific piece of economic news that triggers the crisis. For example, "Black Monday" in October 1987 marks the beginning of a crisis event according to our criteria, even though there is no *single* piece of news that offers a reason for the crash—the crisis period began with the crash itself. This prescription identifies a total of five sudden crisis periods during 1986-2012 (including October 1987 and nine-eleven), and in our online appendix, we present suggestive evidence that our major findings for nine-eleven extend to the other identified market-wide crisis events.

4. Data

Daily returns and market capitalization information for NYSE common stocks and CEFs are from the Center for Research in Security Prices (CRSP), and intraday trading data is from the New York Stock Exchange Trade and Quote (TAQ) database. The period we study begins June 1, 2001 and ends December 31, 2001. For the common stock sample we exclude stocks without the necessary coverage in the CRSP and TAQ databases, and also closed-end funds, real-estate investment trusts, companies incorporated outside the US, primes, scores, depository receipts, certificates, shares of beneficial interest, and units. The result is a sample of 1,463 common stocks.

The CEF sample consists of NYSE-listed CEFs that are classified as fixed-income funds by Barron's, covered in CRSP and TAQ, and report NAVs on a daily basis over the period June 1, 2001 to October 31, 2001. NAVs are from Thomson Reuters, and there are 199 funds with the required CRSP, TAQ, and NAV data. Our focus on fixed-income funds is motivated by their values depending primarily on interest rates and credit spreads. This means that, in addition to NAVs (which were updated and disclosed as usual, as we discuss in the online appendix), investors could obtain information about fundamental values from interest rate movements and the fixed-income markets more broadly for two full trading days (Thursday and Friday, 9/13-9/14) before CEFs themselves began to trade on Monday, 9/17.

For each security (common stock and CEF), we construct the following variables:

- *Market capitalization* (*Market cap*) is based on September 10, 2001 closing data.
- *Tradesize* is the mean dollar value of all trades during a given day.
- *Share price* is the closing trading price according to CRSP.
- *Effective spread* is the mean of the effective spread for all trades during a given day, where the effective spread for a trade equals the bid-ask spread divided by the midpoint, and the midpoint is the sum of the bid and ask divided by two.
- *Turnover* is the number of shares traded in a given day, divided by the number of outstanding shares.
- *Percentage of buys* is dollar buy-initiated trades divided by the sum of dollar buy- and sell-initiated trades during a given day, where buy- and sell-initiated trades are identified by the Lee and Ready (1991) trade signing algorithm. For expositional simplicity, we often refer to buy- (sell-) initiated trades as buys and sells.

- *Tradesize proportion* is the percentage (based on the number of trades) of all trades during a given day falling into one of five possible size categories (<\$5K, \$5-10K, \$10-20K, \$20-50K, and >\$50K).

A security-level metric for a given multi-day period is the median across security-days in the time period. Log price returns are calculated on a close-of-trading-day to close-of-trading-day basis. For example, the return for Monday, 9/17, the first day of trading after nine-eleven, is from the 9/10 close to the 9/17 close. Consequently, the log price return for a security for day t, denoted RP_t, is

$$RP_t = Ln(P_t + D_t) \; - \; Ln(P_{t-1}), \tag{1}$$

where P_t is the closing price on trading day t, D_t is the dividend on trading day t, and Ln is the natural log operator. The log NAV return for a CEF for day t (denoted RN_t) is similarly defined, using NAVs in place of closing prices. Because NAVs are calculated using closing prices of the funds' assets, NAV returns provide a good benchmark for price returns (Klibanoff, Lamont, and Wizman 1998). Therefore, when analyzing CEFs we sometimes include abnormal returns (AR_t), defined as the price return minus the NAV return ($AR_t = RP_t - RN_t$).

5. Return Patterns and Investor Expectations

Table 1 shows cumulative returns over six different time periods for common stocks, CEFs, and also the S&P 500. We report statistics by market-capitalization deciles, measured as of September 10, 2001 (decile 1 denotes the smallest stocks and decile 10 denotes the largest). Cumulative returns for 6/1-9/10 document the down market in the months prior to nine-eleven, while returns from 9/10 to 9/21 document a large price decline during the first post-nine-eleven trading week. There was a strong rebound in the subsequent trading week (9/21-9/28) for all of the classes of securities except for stock decile 1. In the third week of trading (9/28-10/05), all security classes continued to recover except for stock deciles 1 and 3.

Note that cumulative returns for the broader time period (9/10-10/5) are almost monotonic across the deciles, with small deciles experiencing more pronounced cumulative price declines than larger deciles following nine-eleven. Sias and Starks (1997) show that retail investors play a more significant role in small-cap stocks due to lower institutional trading. Hence, these price patterns are consistent with increasingly pronounced retail selling in smaller-cap stocks. Also contributing to the monotonicity across deciles is the more pronounced trading role institutions play in larger stocks. Evidence we present later implies that institutions as a group were net buyers even during the first post-nine-eleven trading week.

CEFs are not heavily traded by institutional investors (Weiss 1989; and Lee, Shleifer, and Thaler 1991), and yet in this case they experienced smaller price declines (and subsequent recoveries) than large-cap stocks. One potential reason, of course, is that the funds we study are claims on baskets of fixed-income securities, whose values were much less affected by nine-eleven compared to equities. Also, Bradley, Brav, Goldstein, and Jiang (2010) note that "closed-end funds constantly attract arbitrageurs" who trade to exploit differences between prices and NAVs. As discounts widened during the initial trading days after nine-eleven, arbitrage traders may have bought funds and helped to mitigate price declines.

Figure 1 graphs cumulative price returns during the September 17-October 5 period. Every category shows a sharp price decline in the first five days of trading after nine-eleven, followed by a sharp recovery that begins on the sixth day of trading (9/24) and generally continues throughout days seven through fifteen. The only exception is decile 1, which experiences a recovery on the sixth trading day but then shows negative returns throughout the rest of the period. These plots are consistent with Table 1, and align with retail investors being net sellers after nine-eleven and institutions being net buyers except in the smallest stocks.

5.1. Benchmarking Return Patterns

Using NAV returns as a benchmark for CEF returns is common and is often the primary motivation for studying a wide variety of phenomena using CEFs (e.g., Dimson and Minio-Kozerski 1999; Gemmill and Thomas 2002; and Klibanoff, Lamont, and Wizman 1998). Likewise, we examine how CEF prices move relative to NAVs. We begin with Figure 2, which plots March 2001 cumulative price and NAV returns for our sample of fixed-income CEFs and also a sample of 59 equity closed-end mutual funds (whose underlying assets are common stocks).[6] In addition, Figure 2 plots cumulative price returns for the S&P 500 index.

Figure 3 plots cumulative price and NAV returns, along with cumulative abnormal returns (price returns minus NAV returns) for the CEFs from August 20 to October 31, 2001. Figure 3 shows that prior to nine-eleven, cumulative price returns closely track NAV returns, just as they do in Figure 2. Then, in the first week of trading following nine-eleven, cumulative price returns fall dramatically below cumulative NAV returns. Cumulative price returns begin to recover during the second week and then move back to roughly track cumulative NAV returns during the third week and beyond. The same pattern is, of course, also clearly visible in the cumulative abnormal returns. In our online appendix, we show that this pattern is not due to errors in NAVs.

[6] We select March because it is the month during January-August 2001 with the largest five-day price decline in the S&P 500 index. Hence, it is especially useful for illustrating how closed-end fund returns typically behave during short-term market declines.

After observing how fixed-income CEF prices sharply declined and recovered, both in isolation and also relative to NAVs, it is worth revisiting Figure 1 to observe how strikingly similar the price return patterns for NYSE common stocks are to those of fixed-income CEFs. This similarity supports the idea that common stocks were also in turmoil, as their prices declined and recovered to varying degrees based on variation in the trading proportion of retail versus institutional investors as proxied by relative market capitalization. Further below we discuss evidence that return pattern differences among deciles are not explained by variation in market-risk exposures.

5.2. Changes in Investor Expectations

Graham and Harvey's (2003) survey of CFOs during September 12-14, 2001 indicates lower forecasts of the one-year equity premium compared to pre-nine-eleven forecasts, implying an expected fall in market prices. In a survey of individual investors over the weekend of September 22-23, Glaser and Weber (2005) find expectations of *higher* returns compared to pre-nine-eleven expectations, which implies an expected *increase* in market prices. Glaser and Weber compare their findings to those in Graham and Harvey and conclude that these two results "do not coincide."

The return patterns we document appear consistent with both studies, and suggest that the seeming inconsistency between the two surveys is due to the difference in their timing. The expectation during September 12-14 in Graham and Harvey of an impending market decline was subsequently realized during first post-nine-eleven week of September 17-21, and similarly, the expectation during September 22-23 that Glaser and Weber find, of an impending market increase, was also subsequently realized during the two weeks that followed. Therefore, the realized returns we document coincide extremely well with the expectations expressed in both surveys.

5.3. Other Sudden Market-Wide Crises and Market Risk Exposure

Although performing a complete analysis of other market-wide crisis events is beyond the scope of this paper, our online appendix provides an exploratory analysis of whether the return patterns we document for nine-eleven are comparable to those of other crisis periods. To do so, we employ the identification method described earlier and identify four additional events for which we plot cumulative returns (the method also identifies nine-eleven). Overall, patterns for common stocks are similar to those for nine-eleven in that price declines are larger, and recoveries are smaller, for small-cap stocks compared to large-cap stocks. Patterns are also similar for fixed-income CEFs, in that discounts widen and then eventually narrow.

We also show that return pattern differences among deciles are not merely due to small- and large-cap stocks having different market-risk exposures. Specifically, we include graphs of cumulative abnormal returns (CARs), where abnormal returns are defined relative to stock-specific market model predicted returns. Differences in the patterns for small- and large-cap stocks are striking, with large-cap-stock CARs typically displaying very slight downward or upward drifts, but small-cap stock CARs displaying significant negative drifts. We provide a similar graph for nine-eleven, which shows the same pattern. These plots make it clear that the raw return patterns we document are not explained by different exposures to market risk.

6. Trading Statistics

We now report trading statistics for the periods before and after nine-eleven. These statistics provide additional insight into the composition of retail and institutional trading that coincided with return patterns we observe.

6.1. Pre-Nine-Eleven Trading Statistics

To establish a baseline, we first examine the period from June 1 through September 10, 2001. Panel A of Table 2 reports the medians of the various metrics defined in the data section for eleven different groups of securities: ten common stock deciles defined by market capitalization, and fixed-income CEFs. As can be seen, the patterns among the stock deciles are quite regular. For example, *tradesize*, *share price*, and *effective spread* change almost monotonically across the decile columns. *Turnover* increases to a maximum for decile 8, and then declines with deciles 9 and 10. Finally, the *percentage of buys* increases monotonically from a low of 44.56% in decile 1 to a high of 56.00% in decile 6, and then remains around 55-56% for the remaining deciles.

The CEFs are quite similar to small-cap stocks with respect to *turnover* and *share price*. Average *turnover* for the CEFs is 0.077%, which is only slightly larger than that of decile 1 (0.063%), and *share price* for the CEFs is $12.81, which is slightly larger than it is for decile 2 ($11.49).[7] Interestingly, the CEFs have significantly lower values of *effective spread* than small-cap stocks (deciles 1 and 2), and hence trading costs are less than one might expect. It seems reasonable that this enhanced liquidity is due to the superior information environment that the funds offer due to regularly disclosed NAVs and underlying assets that are fixed-income securities. Such a superior information environment should presumably lower the costs and risks of providing liquidity.

Panel B of Table 2 reports the distribution of *tradesize*. Again, the patterns among the deciles are quite regular. For example, the proportion of trades in the smallest dollar category (<$5K) decreases monotonically from the smallest to the largest decile, while the proportion

[7] It could be that CEFs deliberately maintain a relatively low share price in order to appeal to a small-investor shareholder base. See Fernando, Krishnamurthy, and Spindt (1999) for an analysis of share price management by open-end fund managers.

in the two largest dollar value categories (\$20K-\$50K and >\$50K) increases monotonically. The percent of trades in the smallest *tradesize* categories for CEFs is similar to that of stock deciles 6-7.

Lee and Radhakrishna (2000) and Malmendier and Shanthikumar (2007) use trades of \$20K or less to identify small investors and trades of more than \$50K to identify institutional investors. Barber, Odean, and Zhu (2009) also infer trader identity from trade size, but warn that starting in 2001, institutional investors began to use computers to break up trades and hence the number of small trades that actually originate from institutions began to increase. Hence, we rely more heavily on very large trades to compare CEFs to common stocks, because it is reasonable to assume such trades continued to originate from institutional investors. Panel B shows the *tradesize proportion* of large trades (>\$50K) for CEFs is between that of deciles 2 and 3, and hence closer to small-cap stocks. Therefore, although CEFs are not like small-cap stocks in their portions of very small trades, they are fairly similar to small-cap stocks in their *lack* of very *large* trades.

Panel C reports the median *percentage of buys* for trades larger than \$50K, as a measure of institutional trading. Based on this metric, there was net institutional buying in all classes except decile 1 and the CEFs during the pre-nine-eleven period. In the next section, we investigate the extent to which institutional investors continued to be net buyers after nine-eleven.

6.2. Post-Nine-Eleven Trading Statistics

In Table 3, we report summary statistics during five time periods, which cover June 1, 2001 through December 31, 2001. In the first row of each panel, we repeat the statistics for the pre-nine-eleven period to aid in making comparisons.

Panel A of Table 3 reports the median *percentage of buys*, as well as changes from pre-nine-eleven levels. In the week of 9/17–9/21, the *percentage of buys* (as well as its change, which is universally negative) increases almost monotonically from deciles 1 through 8 and remains at the level of decile 8 for deciles 9 and 10. Its level is smallest for decile 1 by a wide margin and second smallest for decile 2, also by a wide margin. Thus, during the first post-nine-eleven trading week, sell-initiated trades were especially dominant in small-cap stocks. To a lesser extent, deciles 3 and 4 also had more sells than buys. For deciles 5 through 10, however, there remained more buy-initiated trades than sell-initiated trades. In fact, in results not tabulated here (but available upon request), there were more buys than sells in deciles 6 through 10 on each individual day during the first trading week. We also note that, although the *percentage of buys* is smaller than in the pre-nine-eleven period, the decrease is much less for large-cap compared to small-cap stocks.

Selling also became pervasive in the CEFs: *percentage of buys* is 33.37% in the week of 9/17–9/21, slightly lower than for decile 1 and a drop of 16.1% from the pre-nine-eleven level. We conclude that there was a massive rush by retail investors to sell small-cap stocks and fixed-income CEFs, but that there continued to be more buying than selling in mid- and large-cap stocks just as there was before the event. Among common stocks, these results are consistent with a relative flight to quality (for a parallel flight to quality in the banking system, see Caballero and Krishnamurthy 2008 and McAndrews and Potter 2002).

Figure 1 shows that price returns rebounded during the second and third post-nine-eleven trading weeks. Thus, it is not surprising that *percentage of buys* is higher in all security classes during these two weeks (9/24–10/05), and that the swing was strongest in the CEFs and small-cap stocks. On average, net buying continued through the rest of the year as well (10/08–12/31), except for in decile 1 and the CEFs.

Panel B of Table 3 reports the *percentage of buys* based only on signed trades >$50K, which were those likely executed by institutional investors. For every security class, the *percent of buys* is smaller in the week following nine-eleven (9/17–9/21) than beforehand. Strikingly, however, there remained net institutional buying in deciles 5 and larger.

The dramatic reduction in buy-signed trades for both CEFs and small-cap stocks (deciles 1 and 2), together with the small-investor base of these securities, provides additional evidence that retail traders engaged in heavy selling during the first trading week after nine-eleven. And the fact that the *percentage of buys* for mid- and large-cap stocks remained above 50% suggests that if retail investors also sold these stocks heavily, institutional investors must have bought them at least as heavily, on average. Consistent with this, trades $50K and larger indicate institutional net buying in these deciles. This is key because these buying and selling patterns, together with Figure 1, show that in an environment with heavy retail selling but institutional buying (at least in larger trades), prices moved lower.

Panel C reports tradesize statistics. In most cases there is a modest increase in average *tradesize* in the week following nine-eleven, but decile 10 increased from $67,951 to $103,366 (a relative increase of 52%). This does not seem to have been caused by one-sided trading aimed at liquidating large positions, because Panel B shows that the *percentage of buys* for trades larger than $50K only fell to 53.33% during this week, from 55.41% beforehand. Hence, any increase in sell-initiated trade size must have been offset by larger buy trades such that the majority of larger trades remained buy-initiated.

Panel D shows, not surprisingly, that *turnover* increased in all security classes following nine-eleven. Panel E reports statistics for *effective spread*. As with *turnover*, *effective spread* is also substantially larger for all security classes following nine-eleven. As one might expect, the largest increases were for the CEFs and deciles 1 and 2. The *percentage of buys* during the first post-nine-eleven trading week (see panel A) indicate that selling pressure was heaviest in these securities, and so it is not surprising that liquidity providers demanded higher levels of compensation for providing liquidity.

In summary, trading patterns show that in the immediate aftermath of nine-eleven there was more dollar selling than buying in CEFs and the smaller common stock deciles, and more dollar buying than selling in the larger deciles. This is consistent with retail selling and institutional buying. Given the respective investor bases of small- and large-cap stocks, such disparate trading behavior may explain the differences in return patterns we observe in Figure 1 for small- versus large-cap stocks, in which small-cap stocks had much larger price declines than large-cap stocks. It is also particularly interesting that large-cap stocks suffered significant price declines after nine-eleven despite institutional buying as indicated by more dollar-weighted buys than sells, both overall and in trades >$50K. This finding demonstrates that as a market-wide crisis unfolds, prices can move in the direction of correlated retail trading and against the direction implied by large, institutional trades.

7. Pooled, Cross-Sectional Time Series Regressions

We now proceed to cross-sectional regressions of weekly (Friday-to-Friday) returns, with three goals in mind. First, regressions will establish whether price declines and recoveries are statistically significant. Second, regression analysis allows us to control for the closed-end fund leverage return effects documented in Elton, Gruber, Blake, and Shachar (2013), in which the use of leverage increases returns but also return volatility.[8] Finally, regression analysis allows us to document the extent to which price recoveries for both funds and

[8]We thank Christopher Blake for providing leverage data for the funds in the Elton et al. paper's sample. We supplement this data by hand-collecting leverage as of the latest date prior to nine-eleven, obtained from financial statements on the Securities and Exchange Commission's EDGAR website.

common stocks are due to a general improvement in sentiment versus a reversal of security-specific price declines.

7.1. Regressions of Pre-Nine-Eleven Returns

Our initial regressions provide benchmark results based on the 48-week period prior to nine-eleven, which identify weekly return autocorrelations (price momentum or reversal). All of our pooled, cross-sectional time-series models include unreported security-specific constants (i.e., fixed effects) and allow for autocorrelated and heteroscedastic error terms.[9] For all securities, we regress weekly (Friday-to-Friday) price returns on lagged price returns. For the CEFs, we also estimate the regression with abnormal returns in place of price returns.

The model we estimate and report in Table 4 is:

$$R_{i,t} = \alpha_i \ + \ \beta_1 R_{i,t-1} \ + \ \beta_2 R_{i,t-2} \ + \ \varepsilon_{i,t}, \tag{2}$$

where $R_{i,t}$ is the return for security i in week t, and α_i is a security-specific constant (fixed effects).

The first regression column of Table 4 shows a positive coefficient of 0.176 on $R_{i,t-1}$, which is significant both statistically and economically. This indicates a one-week security-specific price momentum of 0.176% for every 1% return in the prior week. The coefficient on $R_{i,t-2}$ is insignificant. The second regression column repeats this regression but also includes

[9] We estimate time-series, cross-sectional models using the Gauss-Newton method of Davidson and McKinnon (1980) to allow for first-order autocorrelation among the residuals of each fund and obtain unbiased estimates of this correlation. In addition, we allow for heteroscedasticity among funds. The regression results for both the pre-nine-eleven sample that we discuss here and the sample that spans nine-eleven that we discuss below are qualitatively similar if we use alternative techniques, including simple ordinary least squares both with and without fixed effects.

Leverage, defined as the sum of liabilities plus preferred stock divided by the sum of liabilities plus net assets. Cherkes, Sagi, and Stanton (2008) note that "CEFs make substantial use of leverage." We are unable to locate leverage information for 12 funds, and hence the sample of funds decreases from 199 to 187. Consistent with Elton, Gruber, Blake, and Shachar (2013), fund returns are positively correlated with *Leverage*. However, the coefficient on $R_{i,t-1}$ is relatively unchanged in magnitude and statistical significance.

The third and fourth regression columns repeat the first two regressions using abnormal returns (log price returns minus log NAV returns) in place of price returns. The third regression shows that the CEF abnormal returns have insignificant one-week momentum (coefficient for $R_{i,t-1}$ = 0.068, p-value = 0.069), followed by significant two-week reversal (coefficient for $R_{i,t-2}$ = -0.083, p-value $<$ 0.001). In column four, *Leverage* is insignificant and the coefficient for $R_{i,t-2}$ remains statistically significant with a slightly lower magnitude.

Table 4 also reports baseline regressions for the common stock deciles. On average, stock prices are significantly reversed with a two-week lag as indicated by the significantly negative coefficients on $R_{i,t-2}$ for every decile. The coefficients on $R_{i,t-1}$, however, are mixed—six are insignificant, two are significantly positive, and two are significantly negative.

7.2. Regressions of Returns Before, Across, and After Nine-Eleven

We now turn to regressions that include a total of 54 weekly observations for each security: 48 pre-nine-eleven weekly return observations, the return across nine-eleven itself, and five post-nine-eleven weekly return observations. Note that the return across nine-eleven spans two calendar weeks, 9/7 to 9/21, because of the market closure. Therefore, we allow for a distinct error term for the return across nine-eleven, which corrects for increased volatility due to the event itself and the greater than usual number of calendar days over this return's measurement period.

The model we estimate is:

$$
\begin{aligned}
R_{i,t} &= \alpha_i + \lambda_0 E_t + \lambda_1 E_{t-1} + \beta_1(-E_{t-1}R_{i,t-1}) + \lambda_2 E_{t-2} \\
&\quad + \beta_2(-E_{t-2}R_{i,t-2}) + \beta_3(1-E_{t-1})R_{i,t-1} + \beta_4(1-E_{t-2})R_{i,t-2} + \varepsilon_{i,t}, \qquad (3)
\end{aligned}
$$

where $R_{i,t}$ is the return for security i in week t, α_i is a security-specific constant (fixed effects), and E_t is an indicator variable equal to 1 if the weekly return $R_{i,t}$ spans nine-eleven (the return over Friday, 9/7 to Friday, 9/21). Hence, λ_0 measures the systematic reaction to nine-eleven (the first-week reaction), and λ_1 and λ_2 measure systematic recoveries in the second and third weeks, respectively. We also use the E_t indicators to partition how the current return (the left-hand-side variable) depends on lagged returns $R_{i,t-1}$ and $R_{i,t-2}$, based on whether the lagged returns span nine-eleven. Specifically, $R_{i,t-1}$ is partitioned into $E_{t-1}R_{i,t-1}$ and $(1-E_{t-1})R_{i,t-1}$, and $R_{i,t-2}$ is partitioned into $E_{t-2}R_{i,t-2}$ and $(1-E_{t-2})R_{i,t-2}$.

For our purposes, the key variables here are $E_{t-1}R_{i,t-1}$ and $E_{t-2}R_{i,t-2}$. Their coefficients, β_1 and β_2, measure the extent to which security-specific recoveries are directly tied to the initial security-specific price declines. Note that we perform simple transformations and actually use $(-E_{t-1}R_{i,t-1})$ and $(-E_{t-2}R_{i,t-2})$ in the specifications we estimate. By making these terms negative, positive values for β_1 and β_2 indicate recovery, or positive returns. This is because for a given security i, the return $R_{i,t-1}$ is negative when $E_{t-1} = 1$ due to the security's negative return reaction to nine-eleven, and similarly, $R_{i,t-2}$ is negative when $E_{t-2} = 1$. Section 4 in our online appendix provides a numerical example of the coding scheme.

7.2.1. CEF regressions

Table 5 presents the results. The coefficient E_t for the CEF price returns (first regression column) is -0.056, which is both economically and statistically significant ($p < 0.001$). This implies that the average first-week price reaction to nine-eleven was -5.6%, which is somewhat smaller than the -7.8% mean return reported in Table 1. However, this regression controls for the momentum in the prior two weeks of returns by including the variables $(1 - E_{t-1})R_{i,t-1}$ and $(1 - E_{t-2})R_{i,t-2}$.

Table 1 reports a mean recovery return of 4.56% in the second week of trading. The regression shows that the systematic component of this return is statistically significant, but only 0.6% (the coefficient for $E_{t-1} = 0.006$, with p-value $= 0.047$). In marked contrast, the fund-specific component of this second-week recovery return is quite large: The coefficient on $(-E_{t-1}R_{i,t-1})$ is 0.409, implying that 40.9% of each fund's distinct initial price return decline over the first post-nine-eleven trading week was reversed during the second week. The systematic return in the third week is similar to that in the second week at 0.006, and the third week's fund-specific recovery component is insignificant.

The second regression adds both *Leverage* and *Leverage* interacted with E_{t-1}, the nine-eleven return indicator. As in the prior results using only pre-nine-eleven data, the coefficient for *Leverage* is statistically significant with a coefficient of 0.002. The interaction term is insignificant. Importantly, the nine-eleven coefficient of E_t is relatively unchanged with a coefficient of -0.060 and a p-value < 0.001, and the second-week security-specific recovery term of $(-E_{t-1}R_{i,t-1})$ is even less affected.

The regressions of CEF abnormal returns (third and fourth regressions) show fairly similar results for our main variables of interest. One difference is that the security-specific recovery coefficient for the third week $(-E_{t-2}R_{i,t-2})$ is also significant in the column three regression. This term is not quite significant in regression four. Overall, regressions three and four show that abnormal returns after nine-eleven were significantly reversed on a fund-specific basis, mostly during the second post-nine-eleven trading week.[10]

[10] We also construct a systematic sentiment factor which is, for each week, the cross-sectional mean of the difference between the fund price and NAV returns. Including this

7.2.2. Common stock regressions

The right-most ten columns in Table 5 show the regression results for the common stock deciles. As expected, the coefficients on E_t, which measure the average price return during the first post-nine-eleven trading week, are significantly negative for every decile group. In the second week, there is significant systematic market-wide recovery in all but decile 1, as coefficients on E_{t-1} are positive and significant. Except for decile 4, however, there is no significant evidence of security-specific recovery in the second week, as the coefficients for $(-E_{t-1}R_{i,t-1})$ are insignificant.

During the third week, there is no evidence of systematic recovery—none of the coefficients on E_{t-2} are significantly positive (although deciles one and three are significantly negative). Of note, however, stocks do show significant security-specific recoveries during the third week following nine-eleven: The coefficients on $(-E_{t-2}R_{i,t-2})$ are positive and significant for all deciles except two and three. This implies that for the most part, common stocks, like fixed-income CEFs, experienced a security-specific reversal of the nine-eleven price declines. The difference is that the security-specific reversals for common stocks occur during the third week following nine-eleven instead of the second.

Comparing the CEF and common stock regressions, both statistically validate significant negative returns followed by both systematic and security-specific reversals during the second or third post-nine-eleven trading weeks. In addition, the regressions show that initial reactions were more severe for common stocks than for fixed-income CEFs. As noted previ-

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as a regressor in the CEF abnormal return regression results in a coefficient (p-value) on $(-E_{t-1}R_{i,t-1})$ of 0.472 (<0.001). In addition, we estimate a regression in which we include the sentiment factor times a fund-specific sentiment beta (estimated using pre-nine-eleven data). In this regression, the coefficient (p-value) on $(-E_{t-1}R_{i,t-1})$ is 0.311 (<0.001). Hence, the evidence of fund-specific recoveries is robust to these alternative ways of controlling for systematic sentiment.

ously, less severe first-week price declines and faster security-specific reversals in fixed-income CEFs than in common stocks support the intuition in classic models such as Grossman and Stiglitz (1980) in which greater numbers of informed traders make pricing more efficient. The availability of NAVs, and information from two full trading days in fixed-income securities before trading in CEFs resumed, implies that both retail investors and arbitrageurs should have been better informed about the fair values of fixed-income closed-end funds than those of common stocks.

8. Did Retail Investors Overreact?

To summarize, return plots and cross-sectional regressions show that prices of common stocks declined sharply during the first trading week (which started almost a week after nine-eleven) but then rebounded thereafter in most market-cap deciles. Fixed-income closed-end funds exhibited a similar pattern, even though their underlying fixed-income assets experienced a relatively modest decline as shown by NAV returns. Ownership patterns, as well as trading statistics, indicate that there was pronounced selling pressure by retail investors, whereas there was continued institutional buying. It appears that retail investors engaged in panicked selling, while institutional investors provided liquidity, albeit at higher cost as evidenced by lower transaction prices and increases in the average *effective spread*. One possible and perhaps controversial interpretation of this evidence is that retail investors overreacted, at least relative to the reactions of institutional traders. Below we briefly summarize arguments for and against an overreaction explanation.

For common stocks, the case for overreaction is primarily made on the basis of the short-term reversal pattern we observe. Two papers that interpret short-term reversals as overreaction are Tetlock (2011), and Huang, Nekrasov, and Teoh (2012). For the CEFs we study, which are known to be primarily traded by retail investors, additional evidence is that prices sharply declined and recovered relative to NAVs, which are commonly used as benchmarks for fundamental value. Finally, as the regression analysis shows, price recoveries were substantially security-specific reversals of initial post-nine-eleven returns. This is consistent with the notion that security-specific price recoveries reflect security-specific mispricing.

An argument against overreaction is that strong retail selling was due to a sharp increase in aversion to risk or ambiguity, because retail investors are relatively unsophisticated in their ability to measure and manage downside risk. Arguably the *simplest* reaction to a perceived threat of a significant wealth loss is to sell, even if it means accepting substantial price concessions to compensate liquidity providers, and Figure 1 suggests that in most asset classes liquidity providers were well compensated. We leave it to the reader's interpretation whether the rush to sell by retail investors should be viewed as overreaction.

9. Conclusion

We exploit the nine-eleven terrorist event to study the interaction between retail and institutional traders and how prices react during a market-wide crisis. In our analysis we benchmark price returns against NAV returns for fixed-income closed-end funds. When the market reopened six days after nine-eleven, retail investors sold and closed-end fund prices declined substantially, even relative to NAVs, during the first week of trading. This was followed by security-specific reversals during the second and third weeks of trading. NYSE common stocks experienced a similar, but even more dramatic, pattern during the same three-week period. This return pattern holds even for large-cap stocks, despite evidence that institutions were net buyers in these stocks.

Our study extends the literature in at least two important respects. First, while prior studies examine trading by retail or institutional investors, we examine how both sets of investors trade simultaneously during a crisis period. We find that in an environment with heavy retail investor selling, prices can move opposite to the net trading direction of institutional investors. An open question is whether this finding extends to industry- or firm-specific crisis periods. It is possible that retail and institutional investors interact similarly in such crises, but it is also possible that many retail investors are sufficiently well diversified as not to respond to a narrower crisis with the same level of urgency.

Second, we find that prices reversed sooner in fixed-income closed-end funds than in common stocks, particularly those in the smallest capitalization deciles. Potentially this was due to fixed-income CEFs having a superior information environment through regularly disclosed NAVs or being claims on fixed income securities. Such an explanation is consistent with predictions stemming from classic microstructure theory, wherein a greater proportion of informed traders should speed the movement of prices toward fundamental values. This explanation would also suggest that the quality and availability of information plays a particularly important role in the ability of asset prices to recover during a crisis period.

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Table 1

Means of cumulative log price returns during six different time periods before, across, and after nine-eleven, for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks, 199 fixed-income closed end funds, and the S&P 500 Stock Index. Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001.

	Common stock deciles partitioned by market capitalization											
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	CEFs	S&P 500
Pre: 6/1-9/10	-21.89%	-9.82%	-8.29%	-5.35%	-11.61%	-6.70%	-5.34%	-12.37%	-8.04%	-11.20%	4.38%	-13.93%
9/10-9/21	-16.69%	-19.14%	-21.02%	-17.89%	-16.71%	-13.95%	-14.54%	-15.79%	-12.49%	-12.49%	-7.80%	-12.33%
9/21-9/28	-2.11%	1.26%	6.62%	6.46%	5.79%	5.87%	6.55%	6.14%	6.13%	6.81%	4.56%	7.49%
9/28-10/5	-1.53%	1.72%	-0.51%	2.46%	2.99%	2.68%	2.42%	2.97%	2.24%	2.05%	1.50%	2.88%
9/10-10/5	-20.33%	-16.17%	-14.91%	-8.97%	-7.93%	-5.41%	-5.57%	-6.68%	-4.12%	-3.63%	-1.74%	-1.96%
10/5-12/31	2.89%	11.26%	15.57%	14.17%	13.60%	15.18%	12.63%	12.16%	6.43%	3.88%	6.91%	7.16%

Table 2

Summary statistics during the pre-nine-eleven period, June 1 through September 10, 2001, for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks and 199 fixed-income closed end funds. Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001. The reported statistics are medians of security-day observations, except for *Tradesize* distributions (panel B) which are means.

	Common stock deciles partitioned by market capitalization										
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	CEFs
Panel A: Median characteristics											
Market Cap ($m)	52	170	331	539	860	1,290	2,077	3,470	6,996	23,985	194
Tradesize ($)	3,218	6,576	9,360	12,236	16,772	19,667	25,844	30,987	39,243	67,951	11,835
Share price ($)	3.37	11.49	15.85	19.90	25.11	27.08	31.39	30.40	39.90	44.81	12.81
Effective Spread	2.27%	0.84%	0.57%	0.41%	0.30%	0.26%	0.20%	0.17%	0.14%	0.10%	0.46%
Turnover	0.063%	0.127%	0.175%	0.208%	0.294%	0.310%	0.345%	0.376%	0.327%	0.277%	0.077%
Percentage of buys	44.56%	51.44%	53.30%	54.66%	55.46%	56.00%	55.87%	56.09%	55.30%	55.03%	49.45%
Panel B: Distribution of trades by *Tradesize*											
Trades < $5K	77.11%	65.98%	57.77%	49.85%	42.13%	37.05%	30.39%	26.64%	20.63%	12.07%	34.75%
Trades $5-$10K	12.44%	15.87%	18.04%	19.75%	19.69%	20.69%	19.39%	19.75%	20.56%	16.95%	23.31%
Trades $10-$20K	6.51%	9.77%	12.69%	14.90%	17.73%	18.73%	19.96%	19.56%	20.15%	18.42%	23.46%
Trades $20-$50K	3.08%	5.80%	7.84%	10.55%	13.52%	15.12%	18.43%	19.80%	22.04%	25.26%	15.31%
Trades > $50K	0.85%	2.57%	3.66%	4.94%	6.93%	8.41%	11.83%	14.25%	16.62%	27.30%	3.17%
Trades < $20K	96.06%	91.62%	88.49%	84.50%	79.55%	76.47%	69.73%	65.95%	61.34%	47.44%	81.52%
Panel C: *Percentage of buys* ($ buys / ($ buys + $sells)) among Lee and Ready signed trades larger than $50,000											
Percentage of buys (>$50K)	46.37%	54.03%	56.29%	57.28%	57.17%	57.59%	56.57%	57.12%	56.10%	55.41%	41.34%

Table 3

Summary statistics during five different time periods between June 1 and December 31, 2001 for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks and 199 fixed-income closed end funds. Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001. The reported statistics are medians of security-day observations in the time period, except for *Tradesize* distributions (panel B) which are means.

	Common stock deciles partitioned by market capitalization										
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	CEFs
Panel A: *Percentage of buys* ($ buys / ($ buys + $sells)) among Lee and Ready signed trades											
Pre: 6/1-9/10	44.56%	51.44%	53.30%	54.66%	55.46%	56.00%	55.87%	56.09%	55.30%	55.03%	49.45%
9/17-9/21	33.65%	41.99%	47.24%	48.22%	50.98%	52.11%	53.37%	53.66%	53.31%	53.37%	33.37%
Change (from pre-nine-eleven)	-10.9%	-9.5%	-6.1%	-6.4%	-4.5%	-3.9%	-2.5%	-2.4%	-2.0%	-1.7%	-16.1%
9/24-9/28	47.55%	51.71%	56.06%	56.68%	56.29%	56.81%	56.25%	56.84%	55.61%	56.36%	53.35%
Change (from pre-nine-eleven)	3.0%	0.3%	2.8%	2.0%	0.8%	0.8%	0.4%	0.8%	0.3%	1.3%	3.9%
10/1-10/05	44.85%	52.05%	53.64%	56.62%	56.77%	57.15%	56.53%	57.58%	57.08%	57.56%	53.39%
Change (from pre-nine-eleven)	0.3%	0.6%	0.3%	2.0%	1.3%	1.2%	0.7%	1.5%	1.8%	2.5%	3.9%
10/8-12/31	48.02%	51.51%	53.85%	55.85%	56.13%	56.48%	56.70%	56.70%	56.18%	55.86%	45.31%
Change (from pre-nine-eleven)	3.5%	0.1%	0.6%	1.2%	0.7%	0.5%	0.8%	0.6%	0.9%	0.8%	-4.1%
Panel B: *Percentage of buys* ($ buys / ($ buys + $sells)) among Lee and Ready signed trades larger than $50,000											
Pre: 6/1-9/10	46.37%	54.03%	56.29%	57.28%	57.17%	57.59%	56.57%	57.12%	56.10%	55.41%	41.34%
9/17-9/21	41.58%	43.96%	49.34%	46.38%	52.04%	54.78%	53.78%	54.38%	53.34%	53.33%	9.89%
Change (from pre-nine-eleven)	-4.8%	-10.1%	-6.9%	-10.9%	-5.1%	-2.8%	-2.8%	-2.7%	-2.8%	-2.1%	-31.5%
9/24-9/28	60.67%	62.07%	59.62%	57.48%	56.30%	56.17%	56.07%	56.86%	56.48%	56.64%	59.84%
Change (from pre-nine-eleven)	14.3%	8.0%	3.3%	0.2%	-0.9%	-1.4%	-0.5%	-0.3%	0.4%	1.2%	18.5%
10/1-10/05	68.49%	56.66%	53.58%	59.08%	57.36%	58.25%	56.25%	58.71%	58.10%	58.13%	48.19%
Change (from pre-nine-eleven)	22.1%	2.6%	-2.7%	1.8%	0.2%	0.7%	-0.3%	1.6%	2.0%	2.7%	6.9%
10/8-12/31	53.00%	56.61%	57.23%	57.54%	57.22%	57.39%	57.41%	57.99%	56.77%	56.46%	31.16%
Change (from pre-nine-eleven)	6.6%	2.6%	0.9%	0.3%	0.1%	-0.2%	0.8%	0.9%	0.7%	1.0%	-10.2%

Table 3 (continued)

	Common stock deciles partitioned by market capitalization										
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	CEFs
Panel C: *Tradesize* (dollars)											
Pre: 6/1-9/10	3,218	6,576	9,360	12,236	16,772	19,667	25,844	30,987	39,243	67,951	11,835
9/17-9/21	3,115	6,990	10,294	14,164	18,505	22,287	29,613	35,639	45,795	103,366	13,407
Change (from pre-nine-eleven)	-103	414	933	1,928	1,734	2,620	3,769	4,652	6,552	35,414	1,572
9/24-9/28	2,824	6,374	9,560	11,641	15,536	19,290	24,314	29,970	38,581	75,036	11,779
Change (from pre-nine-eleven)	-395	-202	200	-595	-1,236	-377	-1,530	-1,017	-662	7,085	-56
10/1-10/05	2,518	5,720	8,167	10,181	14,292	16,660	22,806	26,935	35,964	64,083	11,587
Change (from pre-nine-eleven)	-700	-856	-1,194	-2,055	-2,480	-3,007	-3,038	-4,051	-3,278	-3,868	-248
10/8-12/31	2,729	5,217	7,736	9,960	12,923	15,844	21,478	25,326	33,362	59,301	11,456
Change (from pre-nine-eleven)	-489	-1,359	-1,624	-2,276	-3,849	-3,823	-4,366	-5,661	-5,880	-8,651	-379
Panel D: *Turnover* (shares traded / shares outstanding)											
Pre: 6/1-9/10	0.063%	0.127%	0.175%	0.208%	0.294%	0.310%	0.345%	0.376%	0.327%	0.277%	0.077%
9/17-9/21	0.096%	0.185%	0.260%	0.322%	0.445%	0.477%	0.579%	0.693%	0.599%	0.600%	0.142%
Change (from pre-nine-eleven)	0.03%	0.06%	0.08%	0.11%	0.15%	0.17%	0.23%	0.32%	0.27%	0.32%	0.07%
9/24-9/28	0.085%	0.196%	0.238%	0.281%	0.411%	0.465%	0.508%	0.568%	0.497%	0.453%	0.100%
Change (from pre-nine-eleven)	0.02%	0.07%	0.06%	0.07%	0.12%	0.16%	0.16%	0.19%	0.17%	0.18%	0.02%
10/1-10/05	0.068%	0.144%	0.172%	0.239%	0.353%	0.377%	0.437%	0.525%	0.426%	0.386%	0.089%
Change (from pre-nine-eleven)	0.00%	0.02%	0.00%	0.03%	0.06%	0.07%	0.09%	0.15%	0.10%	0.11%	0.01%
10/8-12/31	0.082%	0.118%	0.177%	0.213%	0.282%	0.317%	0.352%	0.394%	0.352%	0.309%	0.086%
Change (from pre-nine-eleven)	0.02%	-0.01%	0.00%	0.01%	-0.01%	0.01%	0.01%	0.02%	0.02%	0.03%	0.01%

Table 3 (continued)

	Common stock deciles partitioned by market capitalization										
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	CEFs
Panel E: *Effective spread*											
Pre: 6/1-9/10	2.27%	0.84%	0.57%	0.41%	0.30%	0.26%	0.20%	0.17%	0.14%	0.10%	0.46%
9/17-9/21	3.47%	1.33%	0.88%	0.61%	0.43%	0.37%	0.29%	0.25%	0.19%	0.15%	0.82%
Change (from pre-nine-eleven)	1.2%	0.5%	0.3%	0.2%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.4%
9/24-9/28	3.51%	1.27%	0.80%	0.59%	0.41%	0.32%	0.26%	0.22%	0.17%	0.13%	0.70%
Change (from pre-nine-eleven)	1.2%	0.4%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%
10/1-10/05	3.46%	1.15%	0.72%	0.52%	0.38%	0.31%	0.24%	0.20%	0.16%	0.12%	0.63%
Change (from pre-nine-eleven)	1.2%	0.3%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.2%
10/8-12/31	2.62%	0.97%	0.60%	0.42%	0.30%	0.25%	0.20%	0.17%	0.13%	0.10%	0.54%
Change (from pre-nine-eleven)	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%

Table 4

Pooled, cross-sectional time-series regressions for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks and 199 fixed-income closed end funds that explain weekly Friday-to-Friday returns for the 48 return-weeks immediately preceding nine-eleven. Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001. The main regression specification is $R_{i,t} = \alpha_i + \beta_1 R_{i,t-1} + \beta_2 R_{i,t-2} + e_{i,t}$, where $R_{i,t}$ is the cumulative log return for security i in week t, and α_i is a security-specific constant (i.e., fixed effects, the coefficients on which are not reported in the table for brevity). The second and fourth closed-end fund regressions additionally include the regressor *Leverage*, which is the closed-end fund's leverage ratio measured at the latest available date prior to nine-eleven. Cumulative log price returns are used except for the closed-end fund regressions with the dependent variable labeled abnormal, in which case the return is the cumulative log price return minus the cumulative log NAV return. Error terms allow for both heteroscedasticity and first-order autocorrelation. The Chi-square p-value measures the joint significance of only the coefficients reported (it excludes the unreported fixed effects indicator variables), and *p*-values are shown in parentheses beneath coefficients (* and ** indicate statistical significance at the 5% and 1% level, respectively).

					Common stock deciles partitioned by market capitalization									
Sample	CEFs	CEFs	CEFs	CEFs	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Dependent. var. return type:	price	price	abnormal	abnormal	price	price	price	price	price	price	price	price	price	price
$R_{i,t-1}$ (lagged return)	0.176**	0.171**	0.068	0.051	-0.034	0.184**	0.108*	-0.117*	-0.032	-0.051	-0.110*	0.011	-0.049	-0.028
	(<0.001)	(<0.001)	(0.069)	(0.199)	(0.474)	(<0.001)	(0.024)	(0.023)	(0.551)	(0.298)	(0.045)	(0.833)	(0.264)	(0.545)
$R_{i,t-2}$ (twice-lagged return)	-0.016	-0.009	-0.083**	-0.075**	-0.038**	-0.089**	-0.067**	-0.074**	-0.061**	-0.051**	-0.068**	-0.069**	-0.108**	-0.132**
	(0.348)	(0.613)	(<0.001)	(<0.001)	(0.004)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Leverage		0.002*		-0.001										
		(0.036)		(0.314)										
Wald Statistic	33.53**	40.04**	44.84**	39.30**	9.26**	25.91**	15.75**	26.51**	23.40**	16.46**	23.36**	28.72**	76.36**	116.97**
Chi-square p-value	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.010)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)

Table 5

Pooled, cross-sectional time-series regressions for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks and 199 fixed-income closed end funds that explain weekly Friday-to-Friday returns over the 48 weeks immediately preceding nine-eleven, the return across nine-eleven, and five weekly returns after the nine-eleven return week (54 total return week observations). Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001. The main regression specification is $R_{i,t} = \alpha_i + \lambda_0 E_t + \lambda_1 E_{t-1} + \beta_1 (-E_{t-1}R_{i,t-1}) + \lambda_2 E_{t-2} + \beta_2 (-E_{t-2}R_{i,t-2}) + \beta_3 (1-E_{t-1})R_{i,t-1} + \beta_4(1-E_{t-2})R_{i,t-2} + e_{i,t}$, where $R_{i,t}$ is the cumulative log return for security i in week t, α_i is a security-specific constant (i.e., fixed effects, the coefficients on which are not reported in the table for brevity), and E_t is and indicator variable set to one if the return $R_{i,t}$ spans nine-eleven (the return over 9/7 – 9/21). The second and fourth closed-end fund regressions additionally include the regressors *Leverage* and (E_t)*Leverage* (an interaction term), where *Leverage* is the closed-end fund's leverage ratio measured at the latest available date prior to nine-eleven. The negative signs on $-E_{t-1}R_{i,t-1}$ and $-E_{t-2}R_{i,t-2}$ are so that positive coefficients indicate recoveries in the second and third return weeks following nine-eleven. Cumulative log price returns are used except for the closed-end fund regressions with the dependent variable labeled abnormal, in which case the return is the cumulative log price return minus the cumulative log NAV return. Heteroscedasticity is modeled between funds and also within funds for event and non-event weeks; in addition, first-order autocorrelation is permitted in the error terms of each fund, as well as a distinct error term across nine-eleven. The Chi-square p-value measures the joint significance of only the coefficients reported (it excludes the unreported fixed effects indicator variables), and *p*-values are shown in parentheses beneath coefficients (* and ** indicate statistical significance at the 5% and 1% level, respectively).

Sample		CEFs	CEFs	CEFs	CEFs	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
						Common stock deciles partitioned by market capitalization									
Dependent. var. return type:		Price	Price	Abnormal	Abnormal	Price	Price	Price	Price	Price	Price	Price	Price	Price	Price
First-week reaction to nine-eleven (negative coefficient indicates negative return reaction)															
E_t	(Systematic reaction)	-0.056**	-0.060**	-0.042**	-0.048**	-0.117**	-0.141**	-0.150**	-0.143**	-0.144**	-0.132**	-0.136**	-0.135**	-0.118**	-0.111**
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Second-week systematic and security-specific reactions to nine-eleven (positive coefficients indicate recovery)															
E_{t-1}	(Systematic reaction)	0.006*	0.005	0.005*	0.003	0.001	0.034**	0.066**	0.029**	0.042**	0.062**	0.054**	0.057**	0.043**	0.070**
		(0.047)	(0.154)	(0.033)	(0.236)	(0.928)	(0.002)	(<0.001)	(0.008)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$-E_{t-1} R_{i,t-1}$	(Security-spec. reaction)	0.409**	0.408**	0.557**	0.601**	0.015	-0.092	-0.008	0.159*	0.089	-0.067	0.041	-0.023	0.130	0.002
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.839)	(0.135)	(0.891)	(0.021)	(0.229)	(0.349)	(0.578)	(0.710)	(0.066)	(0.977)
Third-week systematic and security-specific reactions to nine-eleven (positive coefficients indicate recovery)															
E_{t-2}	(Systematic reaction)	0.006**	0.009**	-0.001	0.001	-0.031**	-0.010	-0.018*	0.001	-0.004	-0.006	-0.004	-0.009	0.001	-0.007
		(0.001)	(<0.001)	(0.755)	(0.708)	(0.001)	(0.253)	(0.038)	(0.852)	(0.644)	(0.470)	(0.596)	(0.227)	(0.858)	(0.308)
$-E_{t-2} R_{i,t-2}$	(Security-spec. reaction)	-0.014	-0.050	0.077*	0.064	0.143*	0.087	0.073	0.109*	0.133**	0.185**	0.138**	0.184**	0.115*	0.126**
		(0.644)	(0.107)	(0.036)	(0.103)	(0.017)	(0.063)	(0.053)	(0.014)	(0.009)	(<0.001)	(0.003)	(<0.001)	(0.023)	(0.010)
Correlations with non-nine-eleven lagged returns (positive coefficients indicate momentum, negative coefficients indicate reversals)															
$(1-E_{t-1})R_{i,t-1}$	(Once-lagged return)	0.192**	0.170**	0.083*	0.055	-0.019	0.195**	0.064	-0.024	0.026	0.018	-0.029	0.120**	-0.008	0.088*
		(<0.001)	(<0.001)	(0.023)	(0.159)	(0.696)	(<0.001)	(0.169)	(0.620)	(0.618)	(0.696)	(0.581)	(0.008)	(0.858)	(0.031)
$(1-E_{t-2})R_{i,t-2}$	(Twice-lagged return)	-0.047**	-0.035*	-0.095**	-0.086**	-0.031*	-0.094**	-0.060**	-0.055**	-0.055**	-0.048**	-0.050**	-0.079**	-0.103**	-0.132**
		(0.006)	(0.043)	(<0.001)	(<0.001)	(0.016)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Closed-end fund leverage															
Leverage			0.002*		-0.001										
			(0.042)		(0.433)										
(E_t) *Leverage*			-0.010		0.015										
			(0.298)		(0.129)										
Wald Statistic		2329.50**	2523.60**	1728.60**	1747.50**	207.77**	459.91**	513.09**	688.67**	629.46**	584.76**	623.30**	685.60**	677.09**	703.50**
Chi-square p-value		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)

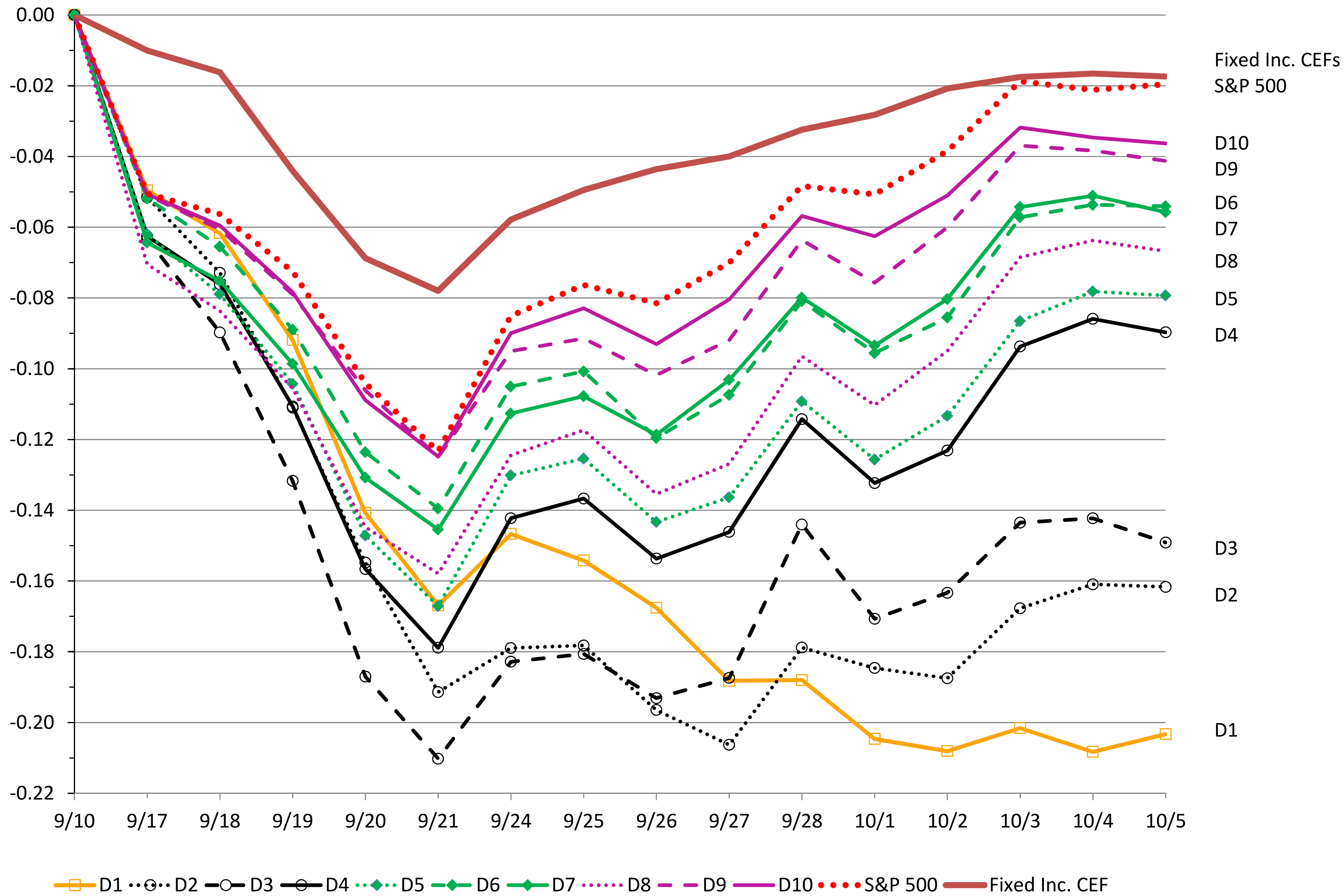

Fig. 1. Cumulative log price returns for ten market-capitalization-based deciles of 1,463 NYSE-listed stocks, the S&P 500 Stock Index, and 199 fixed-income closed-end funds over the September 10 through October 5, 2001 period. Decile partitions for common stocks (D1-D10) are based on market capitalizations as of September 10, 2001.

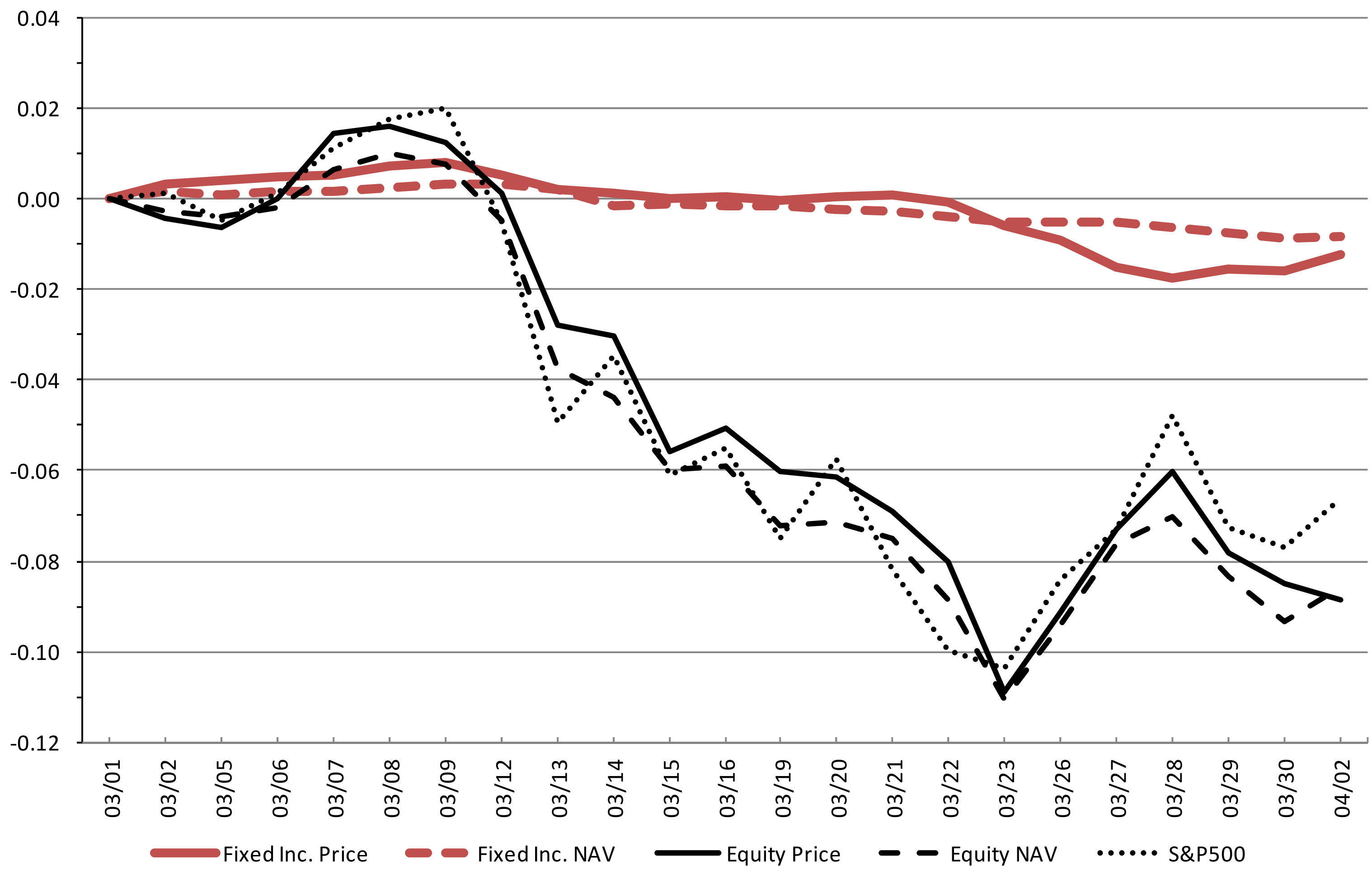

Fig. 2. Cumulative log price returns and cumulative log NAV return for 199 fixed-income funds and 59 equity closed-end funds, and cumulative price returns for the S&P 500 Stock Index, during March 2001.

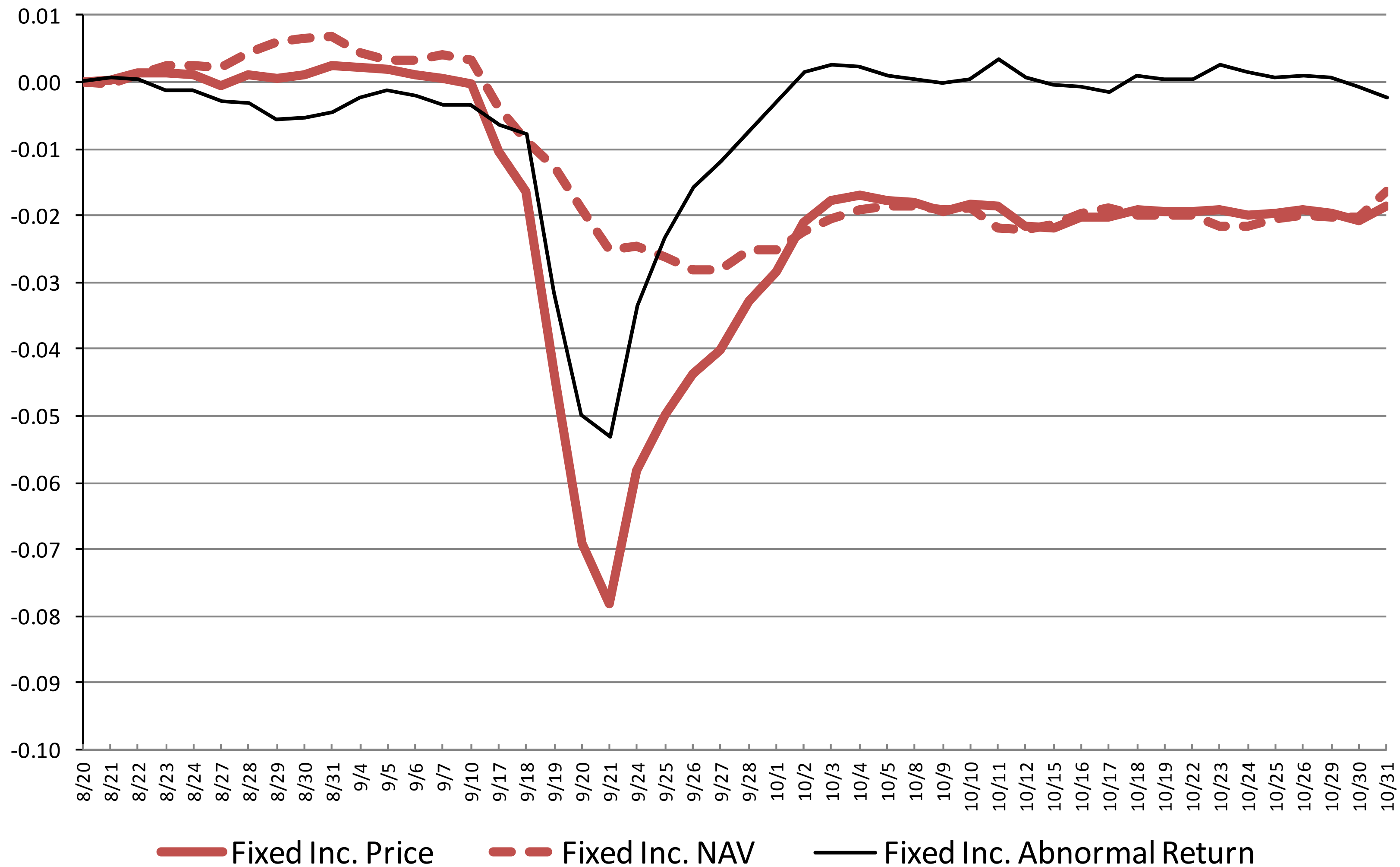

Fig. 3. Cumulative log price returns, cumulative log NAV returns, and cumulative abnormal returns (log price returns minus log NAV returns) for 199 fixed-income funds during August 20, 2001 and October 31, 2001.