ONLINE APPENDIX

Who moves markets in a sudden market-wide crisis?

1) Errors in closed-end fund net asset values

2) Market-model cumulative abnormal returns following nine-eleven

3) Other market-wide crisis events

4) Numerical illustration of data coding for Table 5 regressions

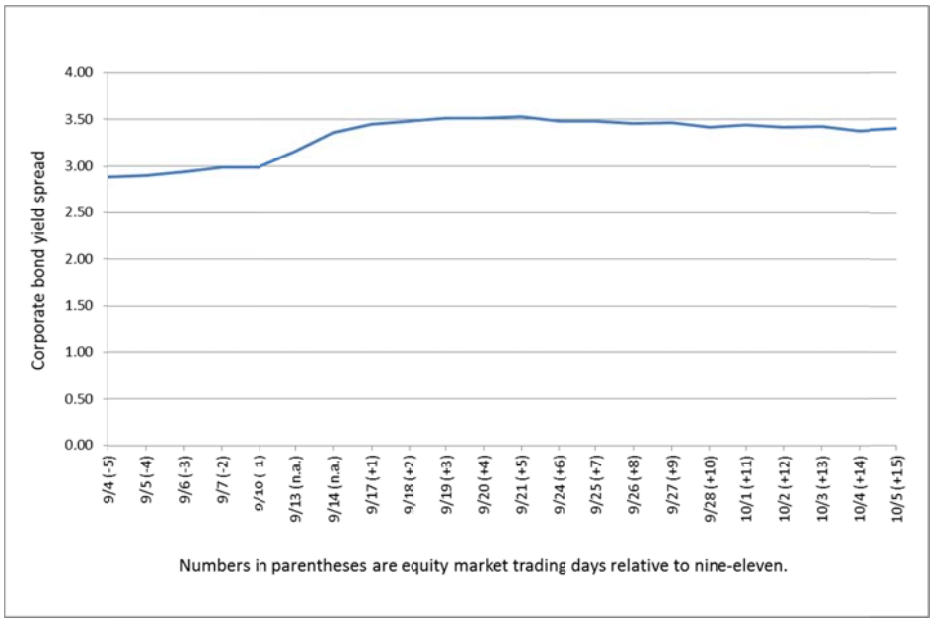
1 Errors in closed-end fund net asset values

We first consider whether the evidence is potentially explained by errors in reported NAVs. Suppose NAVs during the first week after nine-eleven (and on Friday, 9/21, in particular) were overstated because they were not updated after non-eleven due to the disrupted environment. If that were the case, negative abnormal returns could be due to errors in the NAVs. However, we find that only one fund has the same NAV both on the last trading day prior to nine-eleven and at the end of the first trading week (9/21) after nine-eleven. Thus, NAVs were updated during the first trading week following nine-eleven.

Another possibility is that, although reported NAVs were updated, some of the asset prices used in NAV calculations were stale. This could have resulted in valuation errors immediately after nine-eleven. For example, suppose the risk of default increased immediately following nine-eleven. If bond prices for NAV calculations were stale or matrix-priced based on a pre-nine-eleven risk assessment, they would have been too high (relative to true fundamentals) and caused overstated fixed-income NAVs.

The figure below plots the Baa-rated corporate bond yield spread (above the 10-year treasury yield) and shows that the default premium did increase following nine-eleven. However, the patterns of price and NAV returns are not consistent with NAVs being overstated because of increased default risk. As shown in the figure below, the default premium remains somewhat higher through 10/05. And yet, cumulative price returns recovered to the level of cumulative NAV returns instead of cumulative NAV returns converging to cumulative price returns (see Figure 3 in the paper). If bond prices were erroneously high and did not reflect the increased default premium at first, then as bond prices became increasingly accurate, cumulative NAV returns should have converged to cumulative price returns instead of vice versa.

Corporate Bond Yield Spreads

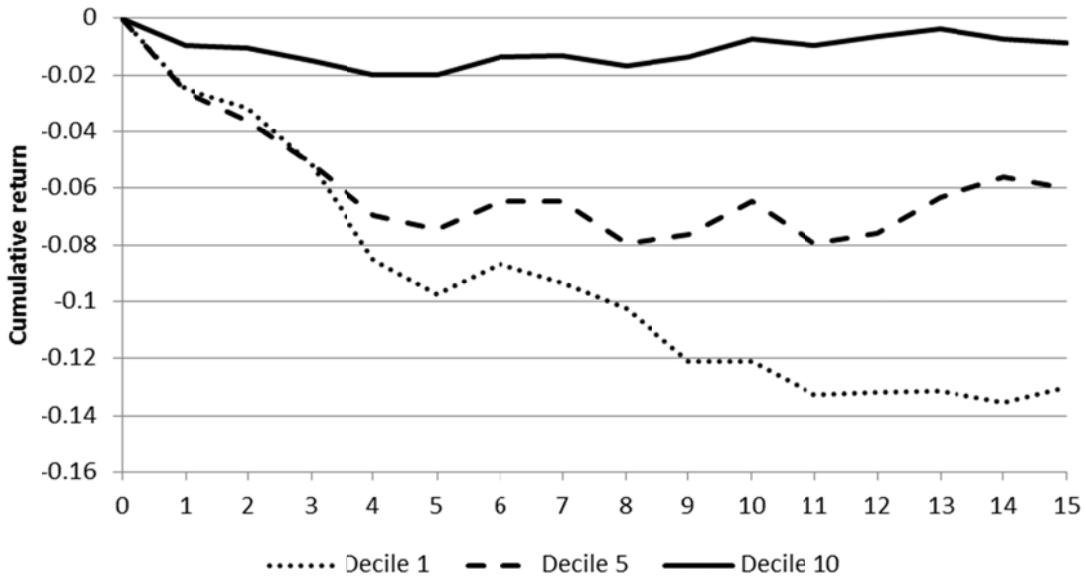


As an additional check, we spoke with multiple people responsible for the NAV calculations of a variety of CEFs. They assured us that prior to Friday, 9/21, accurate, updated secondary-market based prices were being used to calculate the NAVs of fixed-income CEFs. The evidence strongly supports the idea that NAVs for Friday 9/21 are appropriately updated and therefore not stale.

2 Market model cumulative abnormal returns following nine-eleven

To see how stock returns behaved after nine-eleven after controlling for market risk, below we plot cumulative abnormal returns relative to market model predicted returns. The market model's parameters are estimated on a stock-specific basis over trading days -125 to -5 and using the value-weighted CRSP return (including dividends) as the market proxy. We plot only deciles 1, 5, and 10 to show a less cluttered graph. The deciles not shown plot in between deciles 1 and 10, except during trading days 5 through 15 when decile 2 plots somewhat beneath decile 1. As represented by deciles 1 and 10 below, small-cap stocks experienced significantly more pronounced market-risk-adjusted price declines than large-cap stocks. Hence, the significantly worse returns experienced by smaller-cap stocks and plotted in Figure 1 in the paper are not explained by market risk exposure.

Cumulative abnormal returns relative to market model (Day 1 = Close on September 17, 2001)



3 Other market-wide crisis events

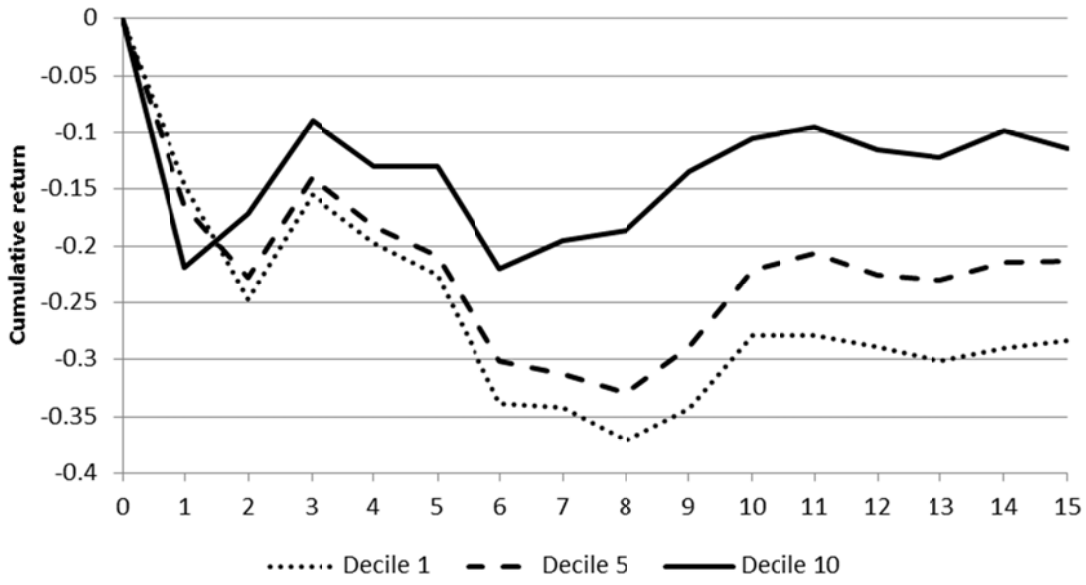
The methodology described in Section 3 of the paper identifies nine-eleven, as well as the following four market-wide crisis event days: (3.1) October 19, 1987, (3.2) October 13, 1989, (3.3) October 27, 1997, and (3.4) August 8, 2011. Below we provide three graphs for each that help the reader compare reactions in common stocks and fixed-income closed-end funds to those observed after nine-eleven. The first graph displays cumulative log returns for the average firm in NYSE deciles 1, 5, and 10, where the horizontal axis identifies trading days relative to the event day. The second graph displays cumulative abnormal returns for the deciles relative to a market model, where the market model's parameters are estimated on a stock-specific basis using the value-weighted CRSP return (including dividends) over trading days -125 to -5 relative to the event day. The third graph plots cumulative log price and net asset value (NAV) returns for fixed-income funds both before and after the event date.[1] We provide a short description of each event above its graphs. Following all twelve graphs, in section (3.5) we provide a brief discussion of commonalities and differences.

[1] NAVs for the October 19, 1987 event are from various issues of *The Wall Street Journal* and are available only weekly, so we plot the weekly return data points as well an interpolation of daily returns. Price returns are daily, from CRSP. NAV and price data for the October 13, 1989, October 17, 1997, and August 8, 2008 events are from Morningstar and include both surviving and defunct funds. For the October 13, 1989 event, almost no funds report daily NAVs and hence we again plot weekly NAV returns as well as interpolated return. The October 17, 1997 and August 8, 2008 events use funds reporting NAVs on a daily basis. The closed-end fund graph for September 17, 2001 event (the first trading day after nine-eleven) uses the data from Figure 3 in the paper, whose NAVs are from Thomson Reuters and prices are from CRSP.

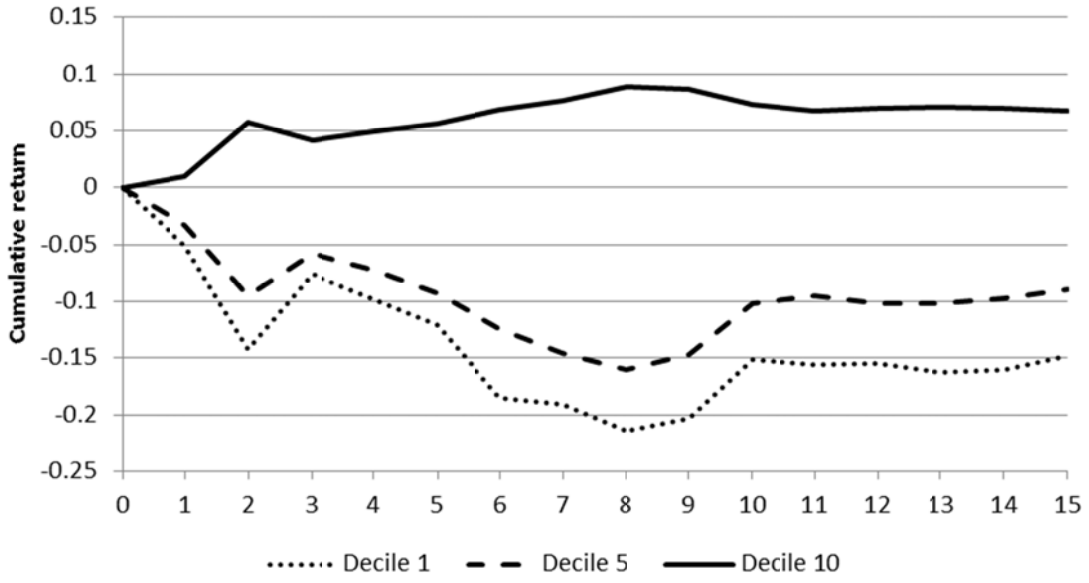
3.1 October 19, 1987 crisis event

On Friday, October 16, 1987, the DJIA closed down 9.5% from the prior Friday's close. The next day (Saturday 10/17/87), a front-page article in The New York Times reported "After the sharp selloff of recent days, these retail investors and mutual fund owners are wondering if the long, euphoric period is finally over. The nervousness of so many little investors, however, is not shared by market professionals." On Monday, Oct. 19, 1987, the DJIA dropped closed 22.6% from its close on Friday, 10/16, its largest ever one-day drop. The event came to be known as "Black Monday."

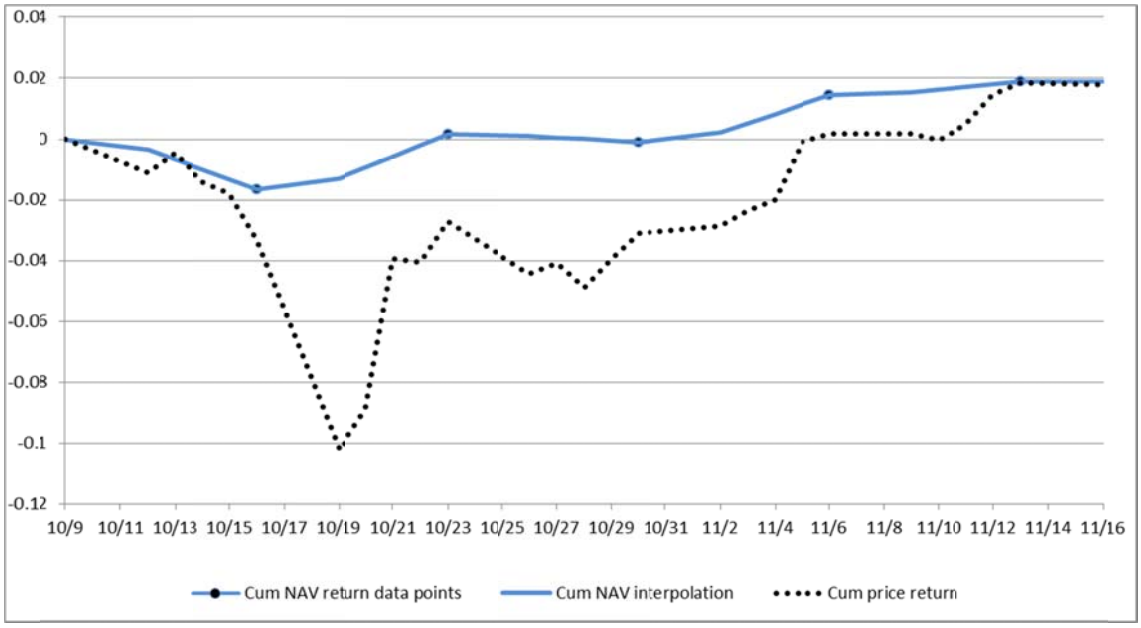
Cumulative log returns (Day 1 = Close on October 19, 1987)



Cumulative abnormal returns relative to market model (Day 1 = Close on October 19, 1987)



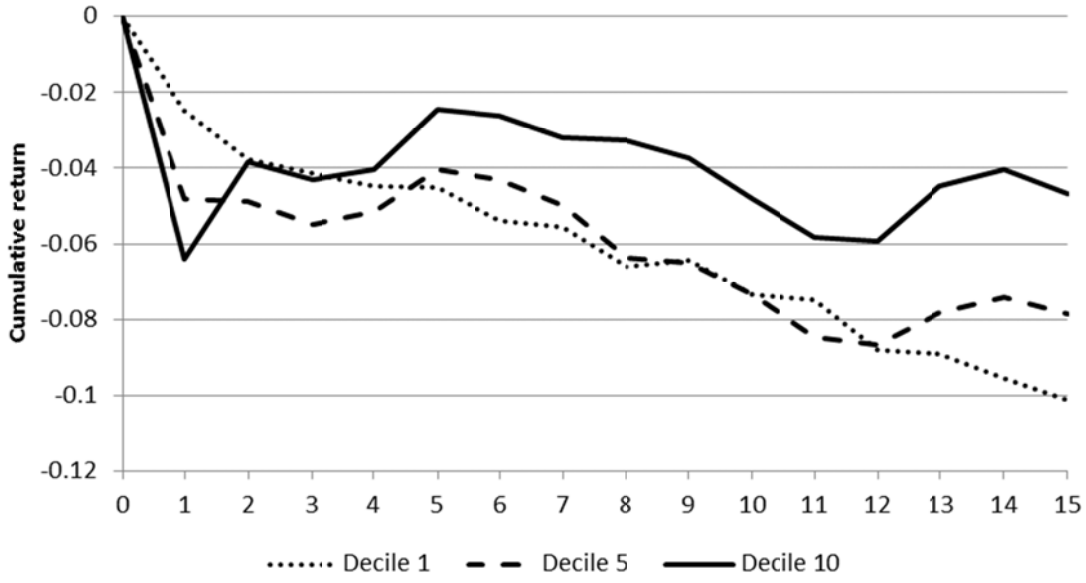
Fixed-income closed-end fund cumulative price and NAV returns



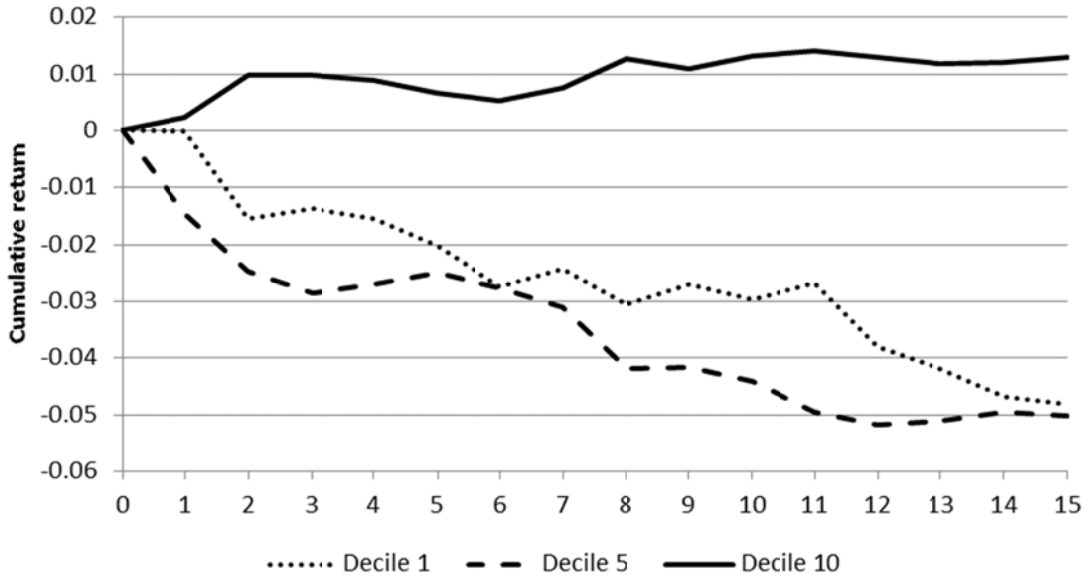
3.2 October 13, 1989 crisis event

On Friday, Oct. 13, 1989, the DJIA closed down 6.9% from the prior day's (10/12/87) close. Numerous articles recalled "Black Monday" in October 1987, and raised concerns about panicked selling by nervous small investors. For example, a front-page article in *The New York Times* ("Is It 1987 Again?") noted that "The market was suddenly swamped by customers wishing to sell, and except for a few firms, like Goldman, Sachs & Company, that stepped in…" Some articles cited experts who reassured people that the fundamentals of the market and economy were sound, and others noted the Federal Reserve was moving quickly to provide liquidity. On Monday (10/16/89), the DJIA rebounded and closed up 3.4%.

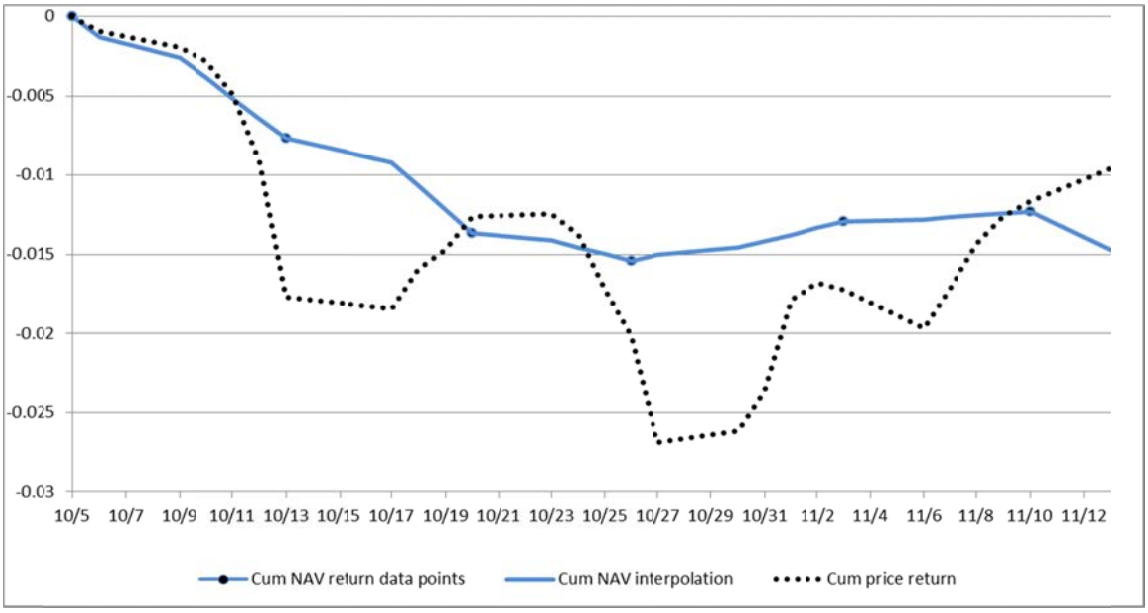
Cumulative log returns (Day 1 = Close on October 13, 1989)



Cumulative abnormal returns relative to market model (Day 1 = Close on October 13, 1989)



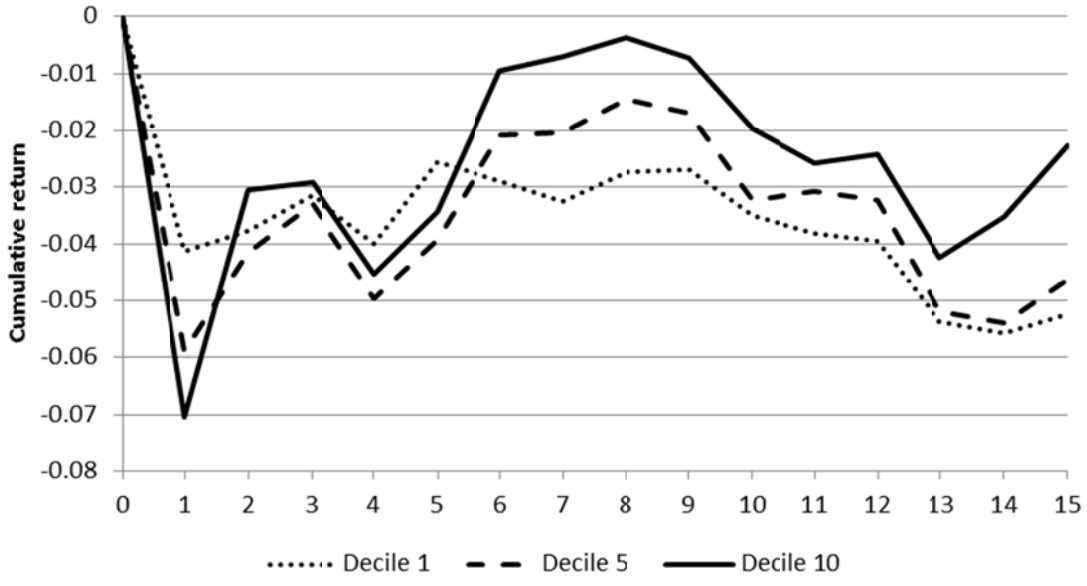
Fixed-income closed-end fund cumulative price and NAV returns



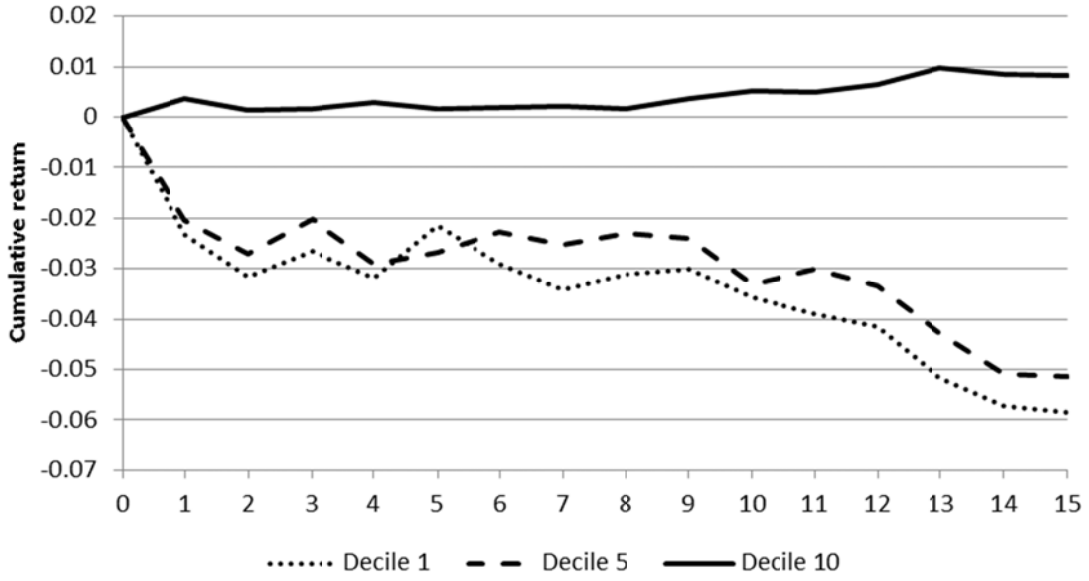
3.3 October 27, 1997 crisis event

On Friday, Oct. 24, 1997, a front-page article in *The New York Times* described an Asian crisis as starting with economic trouble in Thailand, growing over the subsequent months with tremendous currency turmoil across Asia, and "producing selloffs in nearly every stock market in the world" and resulting in the Hong Kong Market stock market falling 23 percent in one week. The article noted the DJIA was "down 2.3 percent, [which] was the mildest among major markets." On Monday, Oct. 27, 1997, however, the DJIA closed down 7.2% from its close the prior Friday (10/24/97). A different front-page *New York Times* article ("The Market Plunge: The Selloff") on Tuesday (10/28/1997) described the turmoil and stated "A worldwide plunge in stock prices erased more than 7 percent from the Dow Jones industrial average yesterday and forced the New York Stock Exchange to halt trading. The only other interruptions like this came after the wounding of President Ronald Reagan and the assassination of President John F. Kennedy."

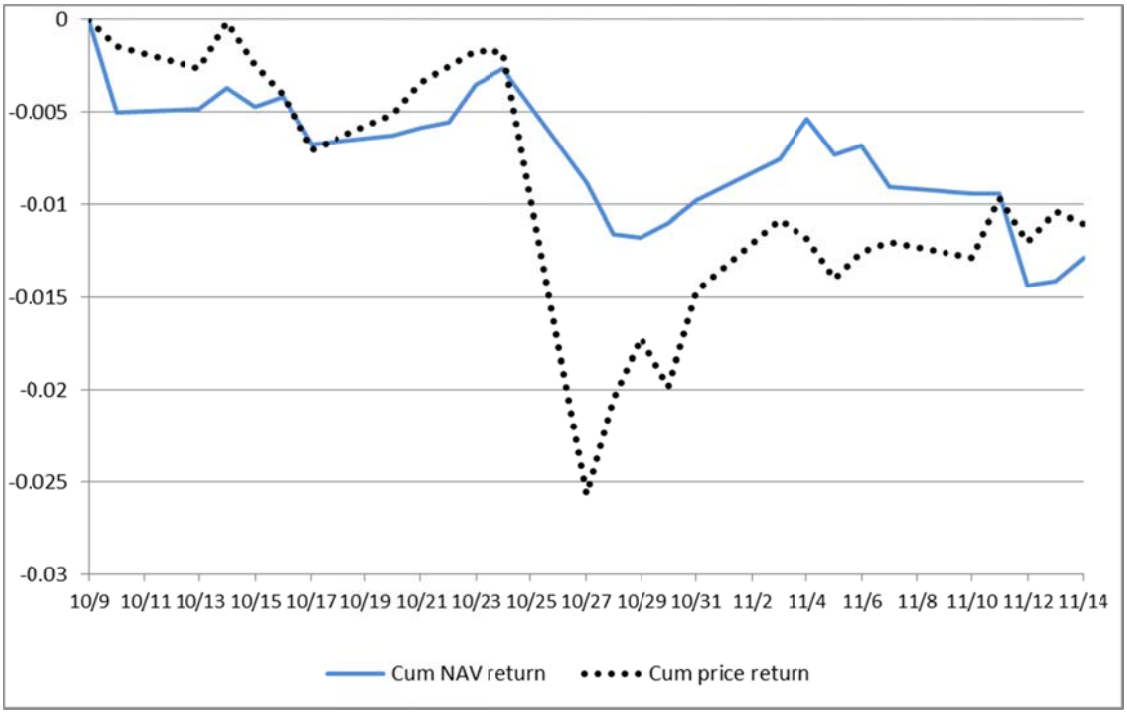
Cumulative log returns (Day 1 = Close on October 27, 1997)



Cumulative abnormal returns relative to market model (Day 1 = Close on October 27, 1997)



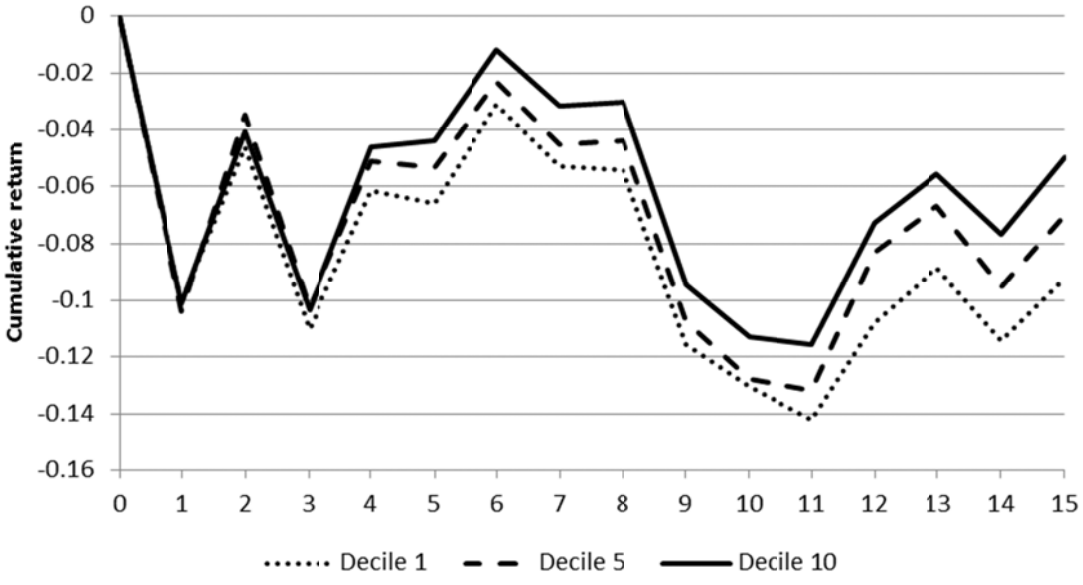
Fixed-income closed-end fund cumulative price and NAV returns



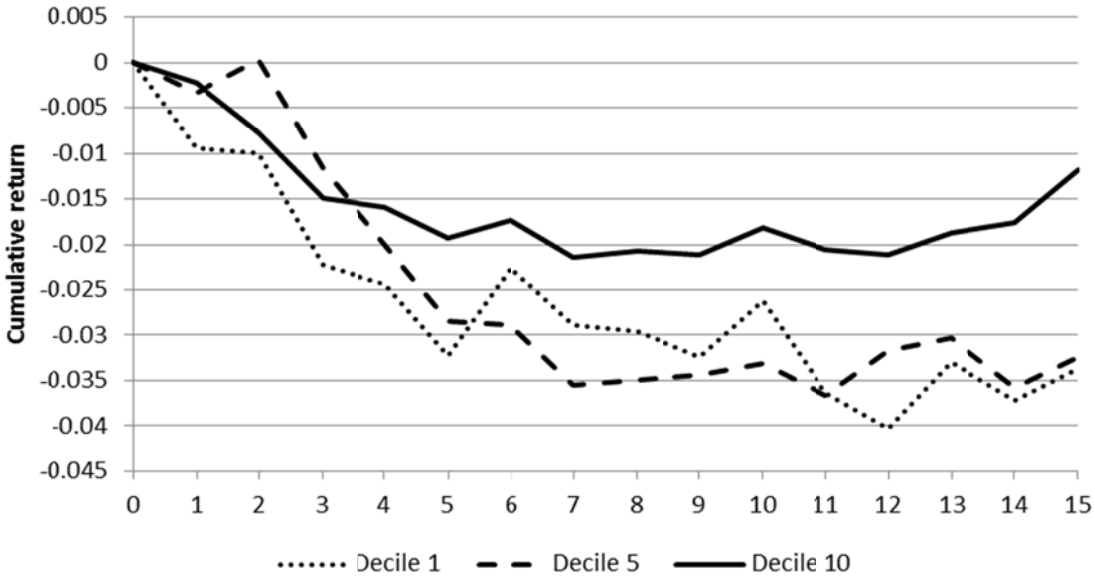
3.4 August 8, 2011 crisis event

On Thursday, Aug. 4, 2011, the DJIA closed down 4.3% from the previous day's close. The next day, a front-page *New York Times* article ("Stocks in Worst Tumble in 2 Years Amid Global Worry") started "What began as a weak day in the stock markets ended in the worst rout in more than two years, as investors dumped stocks amid anxiety that both Europe and the United States were failing to fix deepening economic problems. With a steep decline of around 5 percent in the United States on Thursday, stocks have now fallen nearly 11 percent in two weeks. Markets have been plunging as investors sought safer havens for their money—including Treasury bonds, which some had been avoiding during the debate over extending the nation's debt ceiling. Sparking the drop was an unsuccessful effort by the European Central Bank to reassure the markets, which instead ended up spooking investors." On Monday, Aug. 8, 2011, the DJIA closed down 5.5% from its the Friday (8/5/11) close.

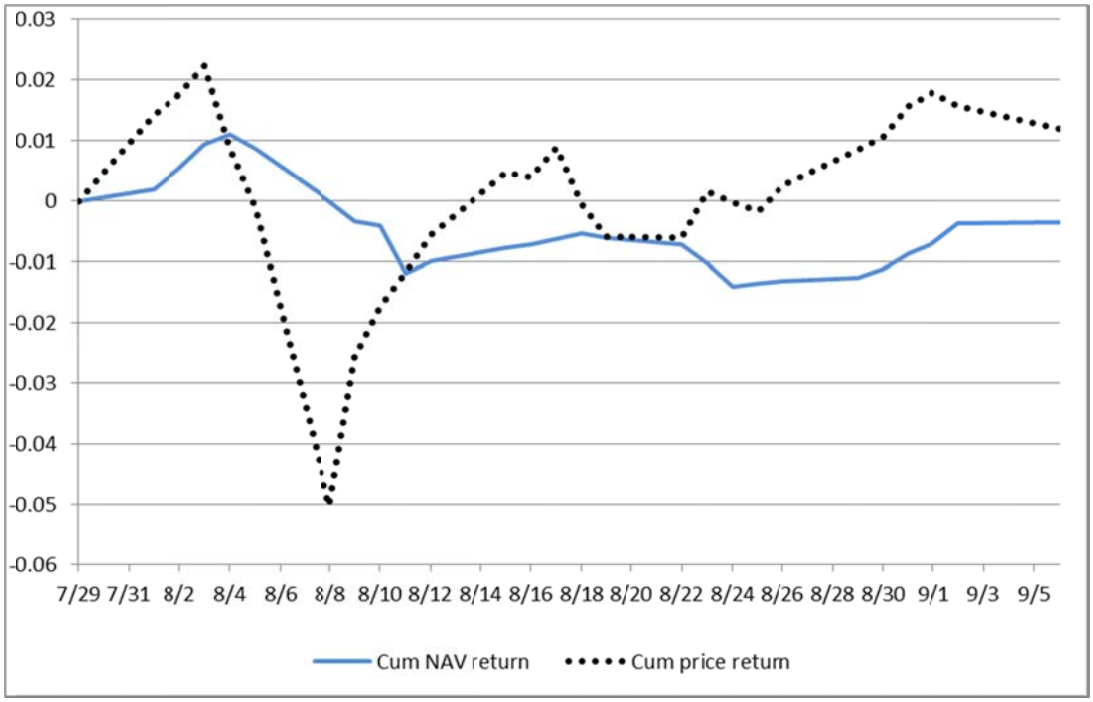
Cumulative log returns (Day 1 = Close on August 8, 2011)



Cumulative abnormal returns relative to market model (Day 1 = Close on August 8, 2011)



Fixed-income closed-end fund cumulative price and NAV returns



3.5 Discussion

As discussed extensively in the paper, the premise underlying our separately examining return patterns for stock deciles and closed-end funds is that retail investors, as prior literature documents, tend to play a relatively more prominent trading and ownership role in small stocks and closed-end funds than do institutional investors. If retail investors are more prone to engage in panicked selling during a market crisis period than institutional investors, then compared to large-cap stocks (decile 10), we would expect to see small-cap stocks (decile 1) suffer more significant price declines as the crisis unfolds and show smaller recoveries as the crisis abates. Generally, this is what the return patterns reveal, and this holds even more strongly once we control for market-risk by plotting cumulative abnormal returns relative to a market model.

Arguably the most dramatic market crisis of the four is October 19, 1987 ("Black Monday"), when the Dow Jones Industrial Average plummeted over 22% in a single day. As with the first trading day after nine-eleven, there is little difference in the first-day price decline between deciles 1 and 10. As shown, however, eventually price declines in decile 1 become more pronounced than in decile 10. The other three crisis periods seem less dramatic than October 1987 and nine-eleven, at least in the overall market reaction. For these events the eventual differences in price declines for deciles 1 and 10 are less pronounced.

Differences in price declines for deciles 1 and 10 are more significant once we control for market risk by plotting cumulative abnormal returns (CARs) relative to market model predicted returns. As the second graphs for each of the four events and the corresponding graph for nine-eleven (in Section 2 above) show, the plots for decile 10 exhibit only a modest decline, if any, whereas those for decile 1 show steady, sharper price declines. Thus, controlling for market risk shows that investor reaction in small stocks is more negative than in large stocks for all of the events.

Lastly, we also include plots of fixed-income price and NAV returns (the third graph for each event). Note that these plots begin several days before the event day that identifies the crisis. All four graphs show a pattern of price declines that were more severe than NAV declines (widening discounts), followed by price recoveries. A seeming difference with the 1989 crisis is that prices sharply decline relative to NAVs and recover twice during approximately a one-month period. This crisis period was prolonged with continued

volatility and a second occurrence: After the Friday (10/13/89) decline and Monday (10/16/89) rebound in the DJIA, the DJIA experienced exceptionally high volume for the week and closed almost 4.7% higher on Friday (10/20/89) along with a similar rebound in CEF prices. However, the DJIA experienced exceptionally high volatility on the following Monday (10/24/89), and a front-page article on Tuesday (10/25/89) titled "Dow Ends 3.69 Lower In Wild Day" contained the following description: "The stock market fluctuated wildly yesterday on heavy volume…. The early plunge, with investors' emotions still fragile after the 190-point tumble on Oct. 13, spurred speculation that the market had not returned to normal and prompted wide-spread selling." This market volatility and uncertainty apparently touched off a second decline in fixed-income CEF prices over the 10/24-10/27 period as the DJIA fell 2.35% over the same period.

4 Numerical illustration of data coding for Table 5 regressions

To illustrate the codings and coefficient sign interpretations, consider the simple example in the table that follows in which a security has a negative 10% return over the nine-eleven trading week (which is week 49 in the regression data). Note that the left-hand side variable is R_t, and that R_{t-1} and R_{t-2} are not included on the right-hand side on their own—they are only shown to clarify how the interaction-term variables are coded. For the week-49 observation, the non-zero regressor variables are coded as $E_t = 1$, $(1\text{-}E_{t-1})R_{i,t-1} = 3\%$, and $(1\text{-}E_{t-2})R_{i,t-2} = 1\%$. Because E_t is coded zero for all other weeks, the estimated coefficient for E_t in the cross-sectional regression will measure the average nine-eleven return that is not explained by the prior two lagged returns.

R_t = return (either price return or abnormal return) for week t. $E_t = 1$ if week t's return includes nine-eleven.

	Trading week	Friday-to-Friday return week period	Dep Var.	(These are not included as stand-alone regressors)		Regressor variables included in Table 5 regressions						
			R_t	R_{t-1}	R_{t-2}	E_t	E_{t-1}	E_{t-2}	$(-E_{t-1}R_{t-1})$	$(-E_{t-2}R_{t-2})$	$(1-E_{t-1})R_{t-1}$	$(1-E_{t-2})R_{t-2}$
	46	8/17 - 8/24	-3%	-1%	-2%	0	0	0	0%	0%	-1%	-2%
	47	8/24 - 8/31	1%	-3%	-1%	0	0	0	0%	0%	-3%	-1%
	48	8/31 - 9/7	3%	1%	-3%	0	0	0	0%	0%	1%	-3%
9/11 week	49	9/7 - 9/21	**-10%**	3%	1%	1	0	0	0%	0%	3%	1%
	50	9/21 - 9/28	7%	**-10%**	3%	0	1	0	**10%**	0%	0%	3%
	51	9/28 - 10/5	8%	7%	**-10%**	0	0	1	0%	**10%**	7%	0%
	52	10/5 - 10/12	2%	8%	7%	0	0	0	0%	0%	8%	7%
	53	10/12 - 10/19	1%	2%	8%	0	0	0	0%	0%	2%	8%
	54	10/19 - 10/26	0%	1%	2%	0	0	0	0%	0%	1%	2%

For the first recovery return week (which is week 50, the second week of trading after nine-eleven), the security experiences a positive return of $R_t = 7\%$. Our goal is to determine how much of the 7% recovery return is systematic across all securities in the regression, and how much is tied to a security-specific reversal of the security's prior-week return of -10%. The non-zero regressors for this observation (t = 50) are $E_{t-1} = 1$, $(\text{-}E_{t-1}R_{i,t-1}) = 10\%$, and $(1\text{-}E_{t-2})R_{i,t-2} = 3\%$. Note that E_{t-1} is zero in all other weeks. The coefficient estimated for E_{t-1} thus measures the recovery return that is common across all securities in the regression, and the

coefficient on ($-E_{t-1}R_{i,t-1}$) measures the extent to which the recovery returns are directly proportional to the security-specific initial return reactions to nine-eleven. Note also that recoveries (positive returns) are indicated by positive coefficients on these two variables. For example, given that $E_{t-1} = 1$ for t = 50, a coefficient of 0.05 on E_{t-1} would imply that 5% out of this security's 7% return in the $t = 50$ recovery week, or 71.4% (5/7), is due to a systematic recovery shared by all securities in the regression. And given that ($-E_{t-1}R_{i,t-1}$) = 10% for the $t = 50$ recovery week, a coefficient of 0.15 on ($-E_{t-1}R_{i,t-1}$) would imply that another 1.5% (which is 0.15 x 10%) out of the 7% recovery return, or 21.4% (1.5/7), is directly tied to this specific security's 10% loss during the nine-eleven trading week of $t = 49$.

The interpretations are similar for E_{t-2} and ($-E_{t-2}R_{i,t-2}$). For week $t = 51$ (the second week of recovery), $E_{t-2} = 1$ implying that the coefficient on E_{t-2} measures the second-week recovery common across all securities, and the coefficient on ($-E_{t-2}R_{i,t-2}$) measures the portion of the second-week recovery that is directly linked to the security's initial nine-eleven return reaction.