# The Value of Institutional Brokerage Relationships: Evidence From The Collapse of Lehman Brothers*

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Using the sudden collapse of Lehman Brothers as a natural experiment, we examine whether mutual funds derive value from their institutional brokerage relationships. We find the impact of a damaged institutional brokerage relationship is greatest among mutual fund clients with concentrated brokerage networks and funds that specialize in small-cap stocks. Based on a difference-in-difference analysis, we find a drop in monthly fund alphas ranging from 34.2 and 70.9 basis points per month in risk-adjusted returns arising from a weakening brokerage relationship. Collectively, our results support the view that mutual funds significantly leverage their relationship capital with brokers.

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**Abstract**

Using the sudden collapse of Lehman Brothers as a natural experiment, we examine whether mutual funds derive value from their institutional brokerage relationships. We find the impact of a damaged institutional brokerage relationship is greatest among mutual fund clients with concentrated brokerage networks and funds that specialize in small-cap stocks. Based on a difference-in-difference analysis, we find a drop in monthly fund alphas ranging from 34.2 and 70.9 basis points per month in risk-adjusted returns arising from a weakening brokerage relationship. Collectively, our results support the view that mutual funds significantly leverage their relationship capital with brokers.

# 1 Introduction

How valuable are institutional brokerage relationships to mutual fund managers? The mutual fund industry pays billions of dollars in commissions each year to the sell-side industry in return for premium brokerage services (see e.g., Goldstein et al. (2009); Greenwich Associates (2011)). The value of these services for brokerage clients such as mutual funds is documented to include superior trade execution (Anand et al. (2011); Cici et al. (2014)), profitable analyst recommendations (Green (2006); Irvine et al. (2007)); Xie (2014)), favorable initial public offering (IPO) allocations (Reuter (2006); Goldstein et al. (2011)), access to management conferences (Green et al. (2014)), and liquidity support (Aitken et al. (1995)).[1]

Thus, the literature reports evidence suggesting that institutional brokerage services serve as valuable input to a fund's portfolio performance. However, the literature to date does not directly measure the overall incremental contribution of these services to mutual fund return performance. Recent empirical evidence shows problems that arise from brokerage relationships. For example, brokerage relations built around soft dollar payment arrangements may have (un)intended consequences of excessive churning by fund managers that could lead to detrimental effects on fund returns (Edelen et al. (2012, 2013)).[2] Further, soft dollar relations may result in a conflict of interest that hurts fund investors' returns if fund managers choose brokers based on their ancillary services rather than seeking providers who can best execute trades at the lowest costs. John Bogle (Bogle (2009), p. 52), founder of Vanguard, questions the value of these brokerage services, stating,

> *"... the constant updating of financial information by talented, often brilliant, security analysts and strategists clearly enhances market efficiency and lowers execution costs. But the failure of the analyst community to foresee the unhappy results of the flawed financial statements of Enron Corporation, WorldCom, and, more recently, scores of*

[1]The practice of bundling trade executions and research services is permitted under the safe harbor clause of Section 28(e) of the Securities and Exchange Act so long as the managers are acting in good faith that the commission payments are reasonable in relation to the value of the brokerage and research services provided (see, e.g., `https://www.sec.gov/rules/interp/34-23170.pdf`).

[2]For instance, Goldstein et al. (2011) find direct evidence on institutions engaging in churning stocks and paying abnormally large commissions to the lead underwriters of upcoming favorable IPOs.

*banks and investment banks hardly suggests a high-value-added research product."* (see Bogle (2009) p. 52).

Consequently, there is no clear evidence on whether additional sell-side services in managerial investment decisions substantially outweigh the excess trading commissions paid. There is still much that we do not know about how fund managers' performance is related to their long-term relationships with their institutional brokers, primarily due to the inherent difficulty in capturing and measuring the value of this relationship capital. In this paper, we advocate a new empirical approach to tackle the issue by addressing a mirror question: What happens to the mutual fund's portfolio performance when brokerage relationships are disturbed or broken due to external factors? The answer to this question is central to understanding whether institutional brokers create value for their clients. Our main contribution to the fund–brokerage relationship literature is that we exploit the recent collapse of Lehman Brothers as a quasi-natural experimental setting that allows us to measure the value of mutual funds' relations with their institutional brokers.[3]

The demise of Lehman Brothers on September 15, 2008 marks the largest bankruptcy event in U.S. corporate history. Although its brokerage arm was initially excluded from the parent company's bankruptcy, the complexity of the intra-organizational dependency ultimately led to the unit's liquidation.[4] Within days, Barclays Capital announced its intention to acquire Lehman's North American investment banking, trading, and brokerage divisions. Upon obtaining approval from the bankruptcy court, the majority of Lehman's former clients were transferred to Barclays on September 23, 2008. Figure 1 traces the brokerage relationships between Lehman Brothers and its mutual fund clients over time. Given the significant presence of Lehman in the U.S. brokerage landscape, it is not surprising to observe that over 60% of mutual funds employed Lehman Brothers as one of their top brokers prior to the bankruptcy. In the aftermath, a sizeable portion of Lehman's

[3]The impact of Lehman's collapse on the financial market has been investigated extensively across many studies, such as those of Aragon and Strahan (2012), Fernando et al. (2012), May (2014), and Dumontaux and Pop (2013).

[4]The problems faced by the brokerage arm unit are precisely described in the Trustee Preliminary Investigation Report: "*Tangible negative effects on [Lehman Brothers] from the crisis confidence rendered [its brokerage unit] unable to obtain adequate financing on an unsecured or even secured basis, caused the departure of customers, and spurred an increase in failed transactions and additional demands for collateral by clearing banks and others.*" (Trustee Report, p. 26). For a more in-depth discussion on the Lehman Brothers' bankruptcy resolution process, see Fleming and Sarkar (2014), Wiggins et al. (2014), and Wiggins and Metrick (2014a,b)

former mutual fund clients ended up with Barclays' brokerage services. Although Barclays also assimilated a significant number of former Lehman employees into its business, as many as one-third of these employees were immediately laid off, with another one-third leaving in the subsequent years.[5] This hastily drawn-up acquisition has been described as abrupt and chaotic.[6] More importantly, it constitutes an ideal platform for us to observe the disruption of valued brokerage relationships that mutual funds had with Lehman as a result of its drastic internal downsizing and restructuring.

[Insert Figure 1 here]

The question of whether Lehman's collapse was followed by poor performance for its mutual fund clients goes to the heart of our motivation to test and measure the value of brokerage relationships. In a knowledge-intensive industry such as that of institutional brokerage houses, it is reasonable to entertain the notion that human capital may well be the most important input of the firm's production function. As Mailath and Postlewaite (1990) postulate, a firm is "*a network of people, each with an understanding about how information and goods move within the firm. They know whom to contact about particular problems that may arise and they know the strengths and weaknesses of their co-workers.*" Empirical studies of the institutional brokerage industry also lend support to this statement. For instance, some papers point out that the differential performance of individual analysts can be attributed to a number of factors, including the resources and support they receive from their brokerage firms (Clement (1999); Jacob et al. (1999)), the quality of colleagues (Groysberg and Lee (2008)), and social network connectivity (Horton and Serafeim (2009)). The importance of these relationships is succinctly described by Josie Esquivel (see Groysberg and Healy (2013), p. 30), a former Lehman's star analyst, who once commented: "*How do you get*

[5] As part of the acquisition agreement, Barclays only retained approximately 9,000 former Lehman employees out of 25,000. Although Barclays also took on a potential liability of $2.5 billion to be paid as severance as part of the agreements, this only applied if it decided not to keep those Lehman employees beyond the guaranteed 90 days. Follow-up evidence suggests there were significant layoffs, with some 65% of Lehman's former employees initially taken on by Barclays leaving in the first two years (see `http://www.cnbc.com/id/100453209` and `http://www.ft.com/intl/cms/s/0/2c3436a8-a947-11dd-a19a-000077b07658.html\#axzz3jmi5gBJD,`).

[6] As described by James Peck, the court bankruptcy judge who handled the Lehman case, "*I have to approve this transaction because it is the only available transaction. This is the most momentous bankruptcy hearing I've ever sat through. It can never be deemed precedent for future cases. It's hard for me to imagine a similar emergency.*" Available at `http://news.bbc.co.uk/2/hi/business/7626624.stm`.

*things done in a service organization? You leverage your relationships, the relationships it took you years to build. They're based on trust, and trust is not easy to come by on Wall Street.*" Motivated by these stylized facts, we hypothesize that the drastic change within Lehman's brokerage unit may have damaged its relationships with mutual fund clients, leading to the deterioration of fund performance in the aftermath.[7]

There are several plausible counterfactuals that could bias against finding evidence in favor of our hypothesis. First, it is reasonable to expect that the handling of Lehman's brokerage unit by both the authorities and Barclays ensured little disruption for its mutual fund clients. For instance, while Barclays had retrenched many of Lehman's former executives, it probably kept many of its core, highly valued employees, thus minimizing the fallout for its significant client relationships. Second, due to major regulatory changes such as Regulation Fair Disclosure and the Global Research Analysts Settlement in the early 2000s, the value of institutional brokerage to mutual funds may have been significantly diminished anyway, for example through the loss of opportunities for the transfer of private information to mutual fund clients (see Kadan et al. (2009); Goldstein et al. (2009); Bhojraj et al. (2012)), reducing the chances of finding further fund performance deterioration following the Lehman collapse. Third, the negative effects of a rupture in brokerage relationships can also be countered by the existence of other brokerage firms to which mutual funds could transfer. For instance, mutual fund giants such as Fidelity are often engaged with multiple brokerage firms, allowing them to spread their trades and solicit multiple research inputs (see Table A1 in the Appendix for details). Fourth, buy-side institutional investors such as mutual funds often undertake some of their research in-house to reduce reliance on sell-side providers. Using proprietary information on in-house research produced in a large fund management company, Rebello and Wei (2014) find that buy-side analysts' recommendations have significant influence over portfolio managers' investment decisions. This effectively reduces the reliance on

[7]The unexpected removal of Lehman's past employees by Barclays' downsizing decisions could have unintended negative consequences on client mutual funds' performance via at least two channels, for example. First, the direct brokerage relationships between the departed employees and their client mutual funds were cut or became obsolete. Second, from the point of view of existing Lehman employees who continued with Barclays, the departure of former colleagues severed their working relationships, which could have weakened their service to mutual fund clients.

information input from sell-side analysts (see Cheng et al. (2006)). For these reasons, therefore, we may not expect to find the Lehman collapse followed by poor fund performance but, rather, for it to only affect certain categories of mutual fund clients.

In this study, we identify Lehman mutual fund clients using Form N-SAR, which mandates all mutual funds to disclose their brokerage connections to the U.S. Securities and Exchange Commission (SEC) semi-annually. We use a standard difference-in-difference (DiD) approach to compare the performance between 730 Lehman and 366 non-Lehman mutual fund clients over the 48-month period between September 2006 and August 2010. We find the causal impact of Lehman's collapse is centered on funds with concentrated brokerage networks and specialization in small-cap investments. Our results indicate that these funds extract significant value from their long-term relationships with brokers.

Our finding of a discernible impact from damaged brokerage relationships on client funds that have concentrated brokerage networks is consistent with the view that these funds are more likely to depend on sell-side research services. For example, using transactional-level information on institutional trades, Goldstein et al. (2009) find that portfolio managers, especially smaller players, strategically channel a large portion of their order flows to a few brokers to increase their total commission payments in return for premium brokerage services. Based on the DiD analysis, our estimation of the drop in subsequent raw returns for these Lehman client funds averages $-0.709\%$ per month (or $-8.51\%$ per year) during the post-Lehman collapse period. Using Carhart's four-factor model as the metric yields similar results: On average, these funds experience a drop of $-0.508\%$ per month in alphas during the first year immediately after the collapse. However, the losses arising from a disrupted brokerage relationship diminish gradually over a longer time horizon. In contrast, we do not observe significant performance deterioration associated with a weakening brokerage relationship among client mutual funds that have large brokerage networks. Xie (2014) shows mutual fund managers tend to earn better returns on stocks that are covered by multiple brokerage analysts than on stocks that are not. By the same token, we highlight the risks of mutual funds that rely heavily on research services from a single broker because their performance is more

likely to be adversely affected should the relationship turn sour, since they have limited contact with other brokerage firms.

We also show the impact of Lehman's collapse has undesirable performance consequences on its small-cap mutual fund clients. The literature contends that the central function of sell-side industry in securities markets is the alleviation of information asymmetries, particularly for small stocks, which are hard to value in nature (see, e.g., Womack (1996); Jegadeesh et al. (2004); Demiroglu and Ryngaert (2010); Mola et al. (2013)). Despite the findings that buy-side research helps to reduce reliance on sell-side analysts' research input, the literature also emphasizes that the value of the sell-side industry tends to concentrate in stocks not followed by buy-side analysts or in funds with low overall buy-side coverage (see Rebello and Wei (2014); Frey and Herbst (2014)). Moreover, Groysberg et al. (2013) point out that buy-side analysts typically cover significantly more stocks than sell-side analysts, which could lead to reduced depth and value in their analyses of any given stock, especially among those with small market capitalization. Lacking information on buy-side brokerage research, we instead hypothesize a brokerage relationship perturbation could have a larger undesired effect on small-cap mutual funds than on others. Again, we find that, among small-cap mutual funds, those that received brokerage services from Lehman suffered significantly more in the aftermath: The disturbance of brokerage ties led to a drop in raw returns of $-0.342\%$ per month during the years following the Lehman collapse. The drop in performance, using either factor-based alphas or objective-adjusted returns, is both statistically and economically significant, ranging between $-0.203\%$ and $-0.495\%$ per month. This observation does not extend to funds with other investment objectives, such as a large-cap investment style. Taken together, we interpret the results as being consistent with the view that funds that specialize in hard-to-value securities are more likely to leverage their relationship with sell-side brokerage firms.

Lastly, we extend our baseline results by identifying the relevant channels that drive the observed performance effects. We identify two possible channels. The first channel is the information channel. For instance, Green (2006), Irvine et al. (2007), and Xie (2014) find that early access to stock recommendations provides brokerage firm clients with incremental investment value. The

second channel is the liquidity or trade execution channel. Both Anand et al. (2011) and Cici et al. (2014) argue that the trade implementation process is economically important and can contribute to relative portfolio performance. Reuter (2006) also shows fund managers routinely receive favorable IPO allocations from lead underwriters with whom they have good business relationships. Following the return decomposition approach of Daniel et al. (1997) and Kacperczyk et al. (2008), we find strong evidence in support of the information channel. On average, severance of brokerage relationships leads to a drop in fund managers' stock selectivity skills of 3.96% to 5.76% per year, consistent with the classical view that sell-side analysts help their clients make better investment choices (Maber et al. (2014)). Moreover, the estimated magnitudes are comparable to those of Xie (2014), who shows mutual fund managers earn 6.3% in excess returns per year on stocks covered by their brokers relative to uncovered stocks.

Apart from contributing to the unsettled debate on the value of brokerage services in mutual fund performance, our paper also joins the emerging literature that studies the role of institutional brokerage firms in affecting fund managers' returns and trading behavior. For instance, Brown et al. (2013) show mutual fund herding behavior is strongly influenced by sell-side analysts' recommendation changes. Chung and Kang (2014) document strong comovement in the returns of hedge funds sharing the same prime broker, attributing the results to hedge funds' access to common information from the brokers. Neither paper, however, seeks to address the incremental value of brokerage services to mutual fund returns. More broadly, our paper contributes to the literature on the intersection of organizational science and finance targeting corporate downsizing, defined as any firm activities that are related to restructuring, making redundant, retrenching, and reducing the workforce, among others (see Datta et al. (2010)). While studies focus on how downsizing effects impact organizational performance (see, e.g., Chen et al. (2001)) and employee performance (see, e.g., Wagar (1998) and McElroy et al. (2001)), little is documented on how downsizing affects client services and their performance or profitability. In this paper, we make a direct contribution to this sparse literature, directly answering the call for research of Datta et al. (2010), who recognized the need to consider "*the impact of downsizing on intermediate outcomes such as customer service, and*

*product quality*." The availability of comprehensive mutual fund data, well-established performance measurement metrics, and transparently disclosed brokerage relationships coupled with the collapse of Lehman Brothers in late 2008 make the mutual fund industry an ideal laboratory for studying the implications of weakening relationship ties on client performance.

The rest of our paper is structured as follows. Section 2 describes the data on mutual funds and their brokerage network disclosure. Section 3 presents the empirical methodology and results. Section 4 concludes the paper.

# 2 Data

We assemble the mutual fund sample from the Centre for Research in Security Prices (CRSP) Mutual Fund Database (MFDB). Following Kacperczyk et al. (2005), Kacpercyzk and Seru (2007), and Kacperczyk et al. (2008), we focus exclusively on actively managed domestic equity mutual funds. Because of their constant efforts to identify securities mispricing and their high portfolio turnover, it is reasonable to expect these actively managed funds to be the most likely to benefit from stable long-term relationships with institutional brokers. Following Elton et al. (2001), we drop funds from the sample whose assets under management are less than $5 million in total to avoid incubation bias (see Evans (2010)). Other variables from the MFDB include fund monthly raw returns, fund size (total net assets (TNA) under management), fund family size (TNA of a fund's family), fund age, fund flows, the turnover ratio, and the expense ratio. To eliminate the issue of multiple fund share classes, we aggregate all observations pertaining to different share classes into one observation, since they have the same portfolio composition.[8] We compute each fund monthly raw return by dividing the fund's yearly total expense ratio by 12 and adding it back to the reported net returns in the CRSP MFDB. We also compute four additional mutual fund performance metrics commonly used in the literature: (1) Jensen (1968) alpha, (2) Fama and

[8]In the CRSP database, mutual funds are reported at the share class level, such as A, B, C, or institutional. The primary reason behind multiple fund share classes for the same fund, which share identical portfolio compositions, is due to clientele. They offer investors with various structures in front-end loads, rear-end loads, and 12b-1 fees (see Nanda et al. (2009) for an in-depth discussion.)

French (1993) alpha, (3) Carhart (1997) alpha, and (4) Khorana (1996, 2001) objective-adjusted return. To obtain the monthly Carhart alpha, for each fund–month observation, we estimate the past 36 months of factor loadings using Carhart's four-factor model:

$$R_{i,t} = \alpha_i + \beta_{1,i} R_{M,t} + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} UMD_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly mutual fund raw return, $R_{M,t}$ is the return to the value-weighted CRSP market index, and $SMB_t$, $HML_t$, and $UMD_t$ are the returns to the small-minus-big (SMB), high-minus-low (HML), and up-minus-down (UMD) portfolios to control for size, book-to-market, and return momentum effects, respectively. This approach helps to isolate the impact of Lehman's collapse on client mutual funds by controlling for these market-wide systematic effects. Using the estimated factor loadings, we compute Carhart's alpha by subtracting the expected return implied by the estimated four-factor model from the fund's current-month raw return. Similar procedures apply in computing Jensen's alpha, which retains the market factor only, and Fama and French's alpha, which retains all but the momentum factor. As Khorana (1996, 2001), we compute the fund's monthly objective-adjusted return as the difference between the fund's return and the average return of other funds with the same non-missing investment objective.

Next, we obtain details on mutual fund brokerage networks from Form N-SAR provided in the SEC Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database. Under the Investment Company Act of 1940, all registered investment companies (including mutual funds) are required to file Form N-SAR semi-annually and, among other things, disclose the top ten brokerage firms to which the funds paid the most commissions during the six-month reporting period. The recent literature highlights the role of the fund family in determining the performance of individual funds managed under its umbrella (see, e.g. Chen et al. (2004); Gaspar et al. (2006); Bhojraj et al. (2012)). Based upon the economies of scale argument, it is reasonable to expect individual mutual funds within a family to benefit from research products and services acquired by other fund members. Following Reuter (2006), we therefore define our fund–brokerage relationship at the fund family level. Lastly, we merge these brokerage networks data with our mutual fund sample and

provide comprehensive details in the Appendix. Our sample consists of 1,096 unique mutual funds associated with 162 fund families covering the 48 months from September 2006 to August 2010.

Table 1, Panel A, plots the yearly aggregate commissions paid by the mutual fund industry from 1993 to 2011. Institutional commission payments constitute a lucrative form of revenue for brokerage houses. The total commission paid increases from $3 billion in 1995 to $9.5 billion in 2007. However, these commission payments are far from uniformly distributed among brokerage firms. Take 2007, for instance: 46% of the aggregate payments goes to the top ten brokerage houses. It is also evident that the share of the top ten brokerage firms is increasing over the years, consistent with the industry consolidation trend of recent years. Panel B provides a snapshot of these top ten brokerage firms in 2007 together with their respective percentage share of total commissions. Goldman Sachs appears to be the number one brokerage firm, receiving 6.45% of total payments, followed by Merrill Lynch (6.07%) and Credit Suisse (5.94%). Prior to its bankruptcy, Lehman Brothers was ranked in fourth place, receiving 5.78% of the total commissions, which is economically significant on its own. These bulge bracket firms generally also have a large group of mutual fund clients.[9] For example, approximately 60% of all mutual fund families use Lehman Brothers as one of their top brokers. Although Deutsche Bank generally has a smaller mutual fund client network, it still forms business ties with one-third of the mutual fund families, further emphasizing the concentration of the industry.

[Insert Table 1 here.]

We report the summary statistics of our mutual fund sample in Table 2. The average mutual fund monthly return is 0.43% per month, with a standard deviation of 5.96%. Both factor model-based alphas and objective-adjusted returns are smaller, ranging between four and 18 basis points per month. A typical mutual fund has $1710.97 million under management, is 16.85 years old, and has a turnover ratio of 84.3% and an expense ratio of 1.18%. Mutual funds typically engage in multiple bulge bracket firms, with 5.14 top ten relationships at a time, on average. Less than 25%

[9]Throughout the paper, a bulge bracket firm is defined as the top ten largest brokerage firms as of 2007: Goldman Sachs, Merrill Lynch, Credit Suisse, Lehman Brothers, Citigroup, UBS, Morgan Stanley, J.P. Morgan, Deutsche Bank, and Bear Stearns (see Panel B of Table 1).

of the funds use fewer than two brokerage firms. Overall, our sample statistics are consistent with past studies (see, e.g., Xie (2014); Edelen et al. (2012)).

[Insert Table 2 here.]

# 3 Empirical Results

## 3.1 Impact of Lehman's collapse on client mutual funds with concentrated brokerage networks

Next we turn to estimating the value of the long-term relationships capital mutual funds had with their brokers. Based on Fig. 1, we take advantage of the fact that some mutual funds are clients of Lehman Brothers but not of others and estimate the causal impact of Lehman's collapse on these mutual funds' performance using a DiD methodology. Under the DiD methodology, funds that engaged in Lehman's brokerage services as of August 31, 2008 are designated as the treated group (N = 730) and funds that did not serve as the control group (N = 366). Our DiD regression is thus specified as follows:

$$RawReturn_{i,t} = \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post_{i,t} + \beta_3 Lehman_{i,t} * Post_{i,t} + \epsilon_{i,t}, \tag{3.1}$$

where the dependent variable $RawReturn_{i,t}$ is fund $i$'s raw return in month $t$; $Lehman_{i,t}$ is an indicator variable that takes the value of one if fund $i$ was connected to Lehman Brothers as of August 31, 2008 and zero otherwise; and *Post* is an indicator variable that takes the value of one after September 15, 2008 and zero otherwise. We cluster standard errors at the fund level, allowing an unrestricted covariance structure over time within funds. Bertrand et al. (2004) show this approach works well when the number of clusters is reasonably large, as in our current context. Under the DiD approach, we are effectively exploiting both the time series and cross-sectional variation in the data because we are comparing the performance of treated funds before and after Lehman's collapse with the performance of control funds over the same time period. Our coefficient of interest is $\beta_3$

in Eq. (3.1), which is the return differential from being a Lehman mutual fund client in the pre-collapse period compared to the post-collapse period. It measures the causal impact of Lehman's collapse on its clients' return performance.

As shown in Table 2, 50% of mutual funds in our sample receive research services from at least six bulge brokerage firms. Consequently, the majority of these Lehman client funds can instead seek brokerage support from their other brokers in the aftermath, hindering one from detecting any significant impact from the Lehman collapse. On the other hand, smaller fund players may not be similarly endowed. Constrained by size, they tend to route a significant portion of their trades to a few brokers to boost their client status with the brokerage house and receive premium brokerage services (see Goldstein et al. (2009)). Based on this reasoning, we hypothesize funds that rely exclusively on services from a few brokerage firms will fare worse should their relationship with one of their brokers be damaged. To test our conjecture, we split our fund sample into two: funds that have concentrated brokerage networks and funds that engaged in multiple brokerage firms. We classify a fund as having a concentrated brokerage network if it employs fewer than four bulge bracket brokerage firms; otherwise, the fund is said to have a large brokerage network.

[Insert Table 3 here.]

Panel A of Table 3 shows the estimation results for funds with concentrated brokerage networks. Column (1) shows the estimation results for Eq. (3.1). Before the collapse, the average return of a non-Lehman client fund is 0.357% per month, which is not significantly different from a Lehman client fund (the coefficient for *Lehman* is insignificant). As a whole, the mutual fund industry suffers significant performance deterioration in the two-year period following the collapse and is statistically significant at the 1% level. Pertaining to our hypothesis, we find substantial differences in performance between Lehman and non-Lehman client funds both before and after the collapse, since the estimated coefficients for *Lehman*Post* appear to be highly significant. The collapse of Lehman Brothers had a sizeable impact on funds that were highly dependent on the institutional broker: On average, these funds lost 0.709% per month during the two years in the aftermath because of the impediment in brokerage exchange.

In Column (2) of Panel A of Table 3, we relax the implicit assumption behind Eq. (3.1), which assumes the impact of Lehman's collapse on fund performance is the same every year. To allow for a time varying effect, we construct three separate timing indicator variables: *Post1*, *Post2*, and *Post3*. Specifically, *Post1* takes the value of one in the first year after Lehman's collapse and zero otherwise. The variables *Post2* and *Post3* take the value of one for the six-month periods between September 2009 and February 2010 and between March 2010 and August 2010, respectively, and zero otherwise. Upon replacing these timing indicators with *Post* in Eq. (3.1), we obtain

$$\begin{aligned} RawReturn_{i,t} \quad &= \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post1_{i,t} + \beta_3 Lehman_{i,t} * Post1_{i,t} \\ &+ \beta_4 Post2_{i,t} + \beta_5 Lehman_{i,t} * Post2_{i,t} \\ &+ \beta_6 Post3_{i,t} + \beta_7 Lehman_{i,t} * Post3_{i,t} + \epsilon_{i,t}. \end{aligned} \tag{3.2}$$

Under this specification, our coefficients of interest are $\beta_3$, $\beta_5$, and $\beta_7$. Now, by way of illustration, $\beta_3$ captures the impact of Lehman's collapse on its mutual fund clients during the first year immediately after the collapse (September 2008 to August 2009). A similar interpretation applies to $\beta_5$ and $\beta_7$. To control for any systematic differences in our sample, Column (3) of Panel A of Table 3 includes a host of other mutual fund variables, such as fund size, fund family size, fund age, fund flows, the turnover ratio, and the expense ratio. We take the logarithmic transformation of fund size, fund family size, and fund age. We lag the variables to partially mitigate the endogeneity issue. Consistent with our hypothesis, the adverse impact of Lehman's collapse on its mutual fund clients is greatest during the first year: These clients lost 1.123% per month during the first year in the aftermath. Nonetheless, such adverse impacts decayed over the years and are negligible beyond the first year (*Lehman*Post2* is insignificant and *Lehman*Post3* is marginally significant at the 10% level).

We also replace our dependent variable with either the fund's alpha (obtained from the factor models) or fund's objective-adjusted return. Replacing the fund's monthly raw returns with the Jensen's one-factor-alpha, we continue to find significant impact of Lehman's collapse on its mutual

fund clients who have few other brokerage firms to rely upon. The estimated impact stands at $-0.912\%$ per month during the one year period immediately after September 2008. The results using the Fama-French three-factor-alpha and Carhart's four-factor-alpha are comparable, where *Lehman*Post1* is estimated to be $-0.99$ and $-0.508$, respectively. When we use the objective-adjusted return as the performance metric, the estimated impact is even larger: these mutual funds experience a significant deterioration in performance by $-0.988\%$ per month. Panel B of Table 3 repeats the analyses for funds with large brokerage networks. Across all specifications, the variables *Lehman*Post*, *Lehman*Post1*, *Lehman*Post2*, and *Lehman*Post3* appear to be either insignificant or marginally significant at the 10% level. There is also little noticeable impact of Lehman's collapse on funds that engage in multiple bulge bracket brokerage firms because the magnitude of these coefficients are generally less than 0.1% per month. Taken together, our results confirm the view that smaller fund players are significantly more dependent on the relationship with their brokers and losing such a relationship is detrimental to their performance.

Our results on the control variables can be summarized as follows. Consistent with Chen et al. (2004) and Yan (2008), we find that the logarithm of TNA ($LOGTNA$) is negatively related to fund performance. This indicates that large fund size is generally associated with inferior performance due to liquidity issues. In general, older funds or funds that are associated with a larger family complex are positively correlated with fund adjusted returns. This finding is in line with previous literature that argues there are economies of scales for trading commissions and research support for each individual fund (see Chen et al. (2004); Gaspar et al. (2006)). Lastly, funds that charge a higher expense ratio generally have better performance measures.

## 3.2 Impact of Lehman's collapse on client mutual funds with a small-cap investment objective

Next, in addition to sell-side research input, it is also common for buy-side managers such as mutual funds to seek internal advice from their own in-house research division. For instance, Cheng et al. (2006), using a large sample of U.S. equity funds for the period 2000–2002, document

fund managers place an average weight of over 70% on buy-side analysts' research, 25% on sell-side analysts' research, and the remaining on independent research. It is, therefore, reasonable to expect the availability of buy-side research to reduce managers' reliance on sell-side input. However, both Groysberg et al. (2013) and Rebello and Wei (2014) point out the value of sell-side research revolves around stocks that are small and hard to value. In contrast to buy-side analysts who cover a large number of stocks, sell-side analysts are highly specialized, which allows them to produce research insights of greater value. Following these arguments, we conjecture that the collapse of Lehman should have had a larger impact on small-cap mutual funds than on others.

[Insert Table 4 here.]

Panels A and B of Table 4 examine funds that specialized in small-cap securities and those that did not, respectively. We classify a fund as specializing in small-cap securities if its Lipper classification code is either SCCE, SCGE, or SCVE; its Strategic Insight Objective code is SCG; or its Wiesenberger Objective Code is SCG. It is evident that Lehman's collapse significantly affected the performance of small-cap mutual funds. The coefficient estimate for *Lehman*Post* in Column (1) of Panel A shows the deterioration in monthly returns due to the Lehman collapse was about $-0.342\%$ per month. Using Eq. (3.2), we find these adverse impacts are mainly concentrated in the first year but become negligible beyond that. Using other performance metrics, such as a fund's alpha and objective-adjusted returns, we also show small-cap funds generally lost between 20.3 and 49.5 basis points per month. Taken together, we show that our results are not driven by particular performance measurements. Consistent with the prediction that sell-side brokerage firms play an important role in alleviating the presence of information asymmetry in small-cap stocks, we observe no similar effects for non–small-cap mutual funds.

## 3.3 Channel for the Lehman's bankruptcy impact on mutual fund performance

Our analyses at this stage reveal that a long-term brokerage relationship is valuable for buy-side managers. We have not, however, considered the possible channels that give rise to the observed performance effect. On one hand, the literature suggests that both analysts' recommendations and investor conferences can add value to the overall buy-side manager's profitability (Green (2006); Irvine et al. (2007); Xie (2014); Green et al. (2014)). On the other hand, brokerage houses can help managers to devise efficient trade executions, effectively lowering their transaction costs (Anand et al. (2011); Cici et al. (2014); Aitken et al. (1995)). Further, Reuter (2006) documents fund managers who have good business relationships with brokerage houses that serve as lead underwriters tend to be rewarded with favorable IPO allocations. To shed further insight on these issues, we turn to the recent mutual fund performance literature and decompose a fund's monthly raw returns as follows:

$$RawReturn = \underbrace{DGTW_{AS} + DGTW_{CS} + DGTW_{CT}}_{PortfolioReturn} + ReturnGap,$$

where $DGTW_{AS}$, $DGTW_{CS}$, and $DGTW_{CT}$ are the fund's average style, characteristic selectivity, and characteristic timing measures, respectively, proposed by Daniel et al. (1997); $DGTW_{AS}$ measures the returns earned by a fund due to its tendency to hold stocks with certain characteristics; and $DGTW_{CS}$ and $DGTW_{CT}$ measure the fund's overall stock selection and timing abilities, respectively. The sum of these three components equals the fund' hypothetical buy-and-hold portfolio return. As pointed out by Daniel et al. (1997), this decomposition provides a more accurate way to determine how funds generate returns. Lastly, *ReturnGap* measures the difference between the actual fund's returns and holdings returns. Kacperczyk et al. (2008) show *ReturnGap* captures funds' unobserved actions, including hidden benefits (e.g., interim trades and IPO allocations) and hidden costs (trading costs and commissions).

[Insert Table 5 here.]

Table 5 presents the estimation results for Eq. (3.2) by replacing the dependent variable with either $DGTW_{CS}$, $DGTW_{CT}$, or *ReturnGap*. We observe that Lehman mutual fund clients with concentrated brokerage networks experienced significant deterioration in their overall stock selectivity skills after the collapse. Economically, the severance of the brokerage relationship translates into a decrease of 48 basis points per month in fund manager stock selection ability. This finding supports the view that sell-side analysts add value to their clients by helping them make better investment decisions. Our interpretation is consistent with that of Xie (2014), who shows stocks covered by a fund's brokers outperform uncovered stocks by 6.3% per year, on average. On the other hand, a damaged brokerage relationship does not have a major impact on managers' stock timing skills. We also show the adverse impacts of the collapse extended to managers' unobserved actions in the longer time period, since the coefficient estimate for *Lehman*Post3* is both statistically and economically significant. Similarly observations can be made when we look at small-cap mutual funds. Consistent with our earlier argument, we show these small-cap funds, which operate in a highly opaque investment environment, experienced a significant drop in their stock selectivity performance. The drop in the monthly $DGTW_{CS}$ measure arising from a weakening brokerage relationship amounts to 33 basis points per month. Based on these results, we contend that a loss of information advantage in the investment environment gives rise to the observed performance effects.

# 4 Conclusion

This paper exploits a natural experimental strategy to evaluate the value of brokerage relationships by studying the Lehman Brothers' bankruptcy event and its impact on the institutional broker's mutual fund clients. While previous studies on the fund–brokerage relationship are persuasive, it is possible that unobservable factors partially drive the results. Complementing past studies, we offer an alternative estimation technique to quantify these brokerage values. Our findings suggest that exogenous damage to a relationship with an important brokerage partner has a significant impact on funds that rely heavily on fewer brokers and that specialize in small-cap investing. Overall,

our results suggest there is value in establishing stable long-term brokerage relationships with the sell-side industry, for it is an important determinant of mutual fund performance.

Owing to data limitations, our present investigation focuses solely on U.S. actively managed equity funds. Subsequent studies can extend our analyses by considering the fixed-income mutual funds segment. Unlike equity trading, most fixed-income securities are traded in the over-the-counter market and hence require dealers to execute principal transactions on their own accounts. Dealers are compensated by imposing a mark-up or mark-down spread on the transacted prices. In this setting, the dealer–client relationship basically involves reputation establishment and repeated interactions. From the client's perspective, the dealer's reputation is contingent on his or her willingness to quote a reasonable bid–ask spread, whereas, from the dealer's perspective, a client's reputation is based on his or her frequent acceptance of the dealer's terms of trade. Thus, the issue of the fund–brokerage relationship is especially important in the fixed-income market. We leave this extension to future work.

# References


Aitken, M. J., G. T. Garvey, and P. L. Swan. 1995. How Brokers Facilitate Trade for Long-Term Clients in Competitive Securities Markets. *Journal of Business* 68:1–33.

Anand, A., P. Irvine, A. Puckett, and K. Venkataraman. 2011. Performance of Institutional Trading Desks: An Analysis of Persistence in Trading Costs. *Review of Financial Studies* 25:557–598.

Aragon, G. O., and P. E. Strahan. 2012. Hedge funds as liquidity providers: Evidence from the Lehman bankruptcy. *Journal of Financial Economics* 103:570–587.

Bertrand, M., E. Duflo, and S. Mullainathan. 2004. How Much Should We Trust Differences-In-Differences Estimates? *Quarterly Journal of Economics* 119:249–275.

Bhojraj, S., Y. Jun Cho, and N. Yehuda. 2012. Mutual Fund Family Size and Mutual Fund Performance: The Role of Regulatory Changes. *Journal of Accounting Research* 50:647–684.

Bogle, J. C. 2009. The End of Soft Dollars? *Financial Analysts Journal* 65:48–53.

Brown, N. C., K. D. Wei, and R. Wermers. 2013. Analyst Recommendations, Mutual Fund Herding, and Overreaction in Stock Prices. *Management Science* 60:1–20.

Carhart, M. M. 1997. On Persistence in Mutual Fund Performance. *Journal of Finance* 52:57–82.

Chen, J., H. Hong, M. Huang, and J. D. Kubik. 2004. Does Fund Size Erode Mutual Fund Performance? The Role of Liquidity and Organization. *American Economic Review* 94:1276–1302.

Chen, P., V. Mehrotra, R. Sivakumar, and W. W. Yu. 2001. Layoffs, Shareholders' Wealth, and Corporate Performance. *Journal of Empirical Finance* 8:171–199.

Cheng, Y., M. H. Liu, and J. Qian. 2006. Buy-Side Analysts, Sell-Side Analysts, and Investment Decisions of Money Managers. *Journal of Financial and Quantitative Analysis* 41:51.

Chung, J.-W., and B. U. Kang. 2014. Prime Broker-Level Comovement in Hedge Fund Returns: Information or Contagion?

Cici, G., L. K. Dahm, and A. Kempf. 2014. Trading Efficiency of Fund Families: Impact on Fund Performance and Investment Behavior.

Clement, M. B. 1999. Analyst Forecast Accuracy: Do Ability, Resources, and Portfolio Complexity Matter? *Journal of Accounting and Economics* 27:285–303.

Daniel, K., M. Grinblatt, S. Titman, and R. Wermers. 1997. Measuring Mutual Fund Performance with Characteristic-Based Benchmarks. *Journal of Finance* 52:1035–1058.

Datta, D. K., J. P. Guthrie, D. Basuil, and A. Pandey. 2010. Causes and Effects of Employee Downsizing: A Review and Synthesis. *Journal of Management* 36:281–348.

Demiroglu, C., and M. Ryngaert. 2010. The First Analyst Coverage of Neglected Stocks. *Financial Management* 39:555–584.

Dumontaux, N., and A. Pop. 2013. Understanding the market reaction to shockwaves: Evidence from the failure of Lehman Brothers. *Journal of Financial Stability* 9:269–286.

Edelen, R., R. Evans, and G. Kadlec. 2013. Shedding Light on Invisible Costs: Trading Costs and Mutual Fund Performance. *Financial Analysts Journal* 69.

Edelen, R. M., R. B. Evans, and G. B. Kadlec. 2012. Disclosure and agency conflict: Evidence from mutual fund commission bundling. *Journal of Financial Economics* 103:308–326.

Elton, E. J., M. J. Gruber, and C. R. Blake. 2001. A First Look at the Accuracy of the CRSP Mutual Fund Database and a Comparison of the CRSP and Morningstar Mutual Fund Databases. *Journal of Finance* 56:2415–2430.

Evans, R. B. 2010. Mutual Fund Incubation. *Journal of Finance* 65:1581–1611.

Fama, E. F., and K. R. French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33:3–56.

Fernando, C. S., A. D. May, and W. L. Megginson. 2012. The Value of Investment Banking Relationships: Evidence from the Collapse of Lehman Brothers. *Journal of Finance* 67:235–270.

Fleming, M. J., and A. Sarkar. 2014. The Failure Resolution of Lehman Brothers. *FRBNY Economic Policy Review* pp. 175–206.

Frey, S., and P. Herbst. 2014. The influence of buy-side analysts on mutual fund trading. *Journal of Banking and Finance* 49:442–458.

Gaspar, J.-M., M. Massa, and P. Matos. 2006. Favoritism in Mutual Fund Families? Evidence on Strategic Cross-Fund Subsidization. *Journal of Finance* 61:73–104.

Goldstein, M. A., P. Irvine, E. Kandel, and Z. Wiener. 2009. Brokerage Commissions and Institutional Trading Patterns. *Review of Financial Studies* 22:5175–5212.

Goldstein, M. a., P. Irvine, and A. Puckett. 2011. Purchasing IPOs with Commissions. *Journal of Financial and Quantitative Analysis* 46:1193–1225.

Green, T. C. 2006. The Value of Client Access to Analyst Recommendations. *Journal of Financial and Quantitative Analysis* 41:1–24.

Green, T. C., R. Jame, S. Markov, and M. Subasi. 2014. Broker-hosted investor conferences. *Journal of Accounting and Economics* 58:142–166.

Greenwich Associates. 2011. Greenwich Report: As Analysts Workload Gets Heavier, Institutions Lean on Sell-Side Research and Services.

Groysberg, B., P. Healy, G. Serafeim, and D. Shanthikumar. 2013. The Stock Selection and Performance of Buy-Side Analysts. *Management Science* 59:1062–1075.

Groysberg, B., and P. M. Healy. 2013. Wall Street Research: Past, Present, and Future.

Groysberg, B., and L.-E. Lee. 2008. The effect of colleague quality on top performance: the case of security analysts. *Journal of Organizational Behavior* 29:1123–1144.

Horton, J., and G. Serafeim. 2009. Security Analyst Networks, Performance, and Career Outcomes.

Irvine, P., M. Lipson, and A. Puckett. 2007. Tipping. *Review of Financial Studies* 20:741–768.

Jacob, J., T. Z. Lys, and M. A. Neale. 1999. Expertise in Forecasting Performance of Security Analysts. *Journal of Accounting and Economics* 28:51–82.

Jegadeesh, N., J. Kim, S. D. Krische, and C. M. C. Lee. 2004. Analyzing the Analysts: When Do Recommendations Add Value? *Journal of Finance* 59:1083–1124.

Jensen, M. C. 1968. The Performance of Mutual Funds in the Period 1945-1964. *Journal of Finance* 23:389–416.

Kacpercyzk, M., and A. Seru. 2007. Fund Manager Use of Public Information: New Evidence on Managerial Skills. *Journal of Finance* 62:485–528.

Kacperczyk, M., C. Sialm, and L. Zheng. 2005. On the Industry Concentration of Actively Managed Equity Mutual Funds. *Journal of Finance* 60:1983–2011.

Kacperczyk, M., C. Sialm, and L. Zheng. 2008. Unobserved Actions of Mutual Funds. *Review of Financial Studies* 21:2379–2416.

Kadan, O., L. Madureira, R. Wang, and T. Zach. 2009. Conflicts of Interest and Stock Recommendations: The Effects of the Global Settlement and Related Regulations. *Review of Financial Studies* 22:4189–4217.

Khorana, A. 1996. Top Management Turnover: An Empirical Investigation of Mutual Fund Managers. *Journal of Financial Economics* 40:403–427.

Khorana, A. 2001. Performance Changes Following Top Management Turnover: Evidence from Open-End Mutual Funds. *Journal of Financial and Quantitative Analysis* 36:371.

Maber, D. A., B. Groysberg, and P. M. Healy. 2014. Sell-Side Information Services and Compensation for Investment Research: Evidence from Broker Votes.

Mailath, G. J., and A. Postlewaite. 1990. Workers Versus Firms: Bargaining Over a Firm's Value. *The Review of Economic Studies* 57:369.

May, A. D. 2014. Corporate Liquidity and the Contingent Nature of Bank Credit Lines: Evidence on the Costs and Consequences of Bank Default. *Journal of Corporate Finance* 29:410–429.

McElroy, J. C., P. C. Morrow, and S. N. Rude. 2001. Turnover and Organizational Performance: A Comparative Analysis of the Effects of Voluntary, Involuntary, and Reduction-in-Force Turnover. *Journal of Applied Psychology* 86:1294–9.

Mola, S., P. R. Rau, and A. Khorana. 2013. Is There Life after the Complete Loss of Analyst Coverage? *The Accounting Review* 88:667–705.

Nanda, V. K., Z. J. Wang, and L. Zheng. 2009. The ABCs of mutual funds: On the introduction of multiple share classes. *Journal of Financial Intermediation* 18:329–361.

Rebello, M., and K. D. Wei. 2014. A Glimpse Behind a Closed Door: The Long-Term Investment Value of Buy-Side Research and Its Effect on Fund Trades and Performance. *Journal of Accounting Research* 52:775–815.

Reuter, J. 2006. Are IPO Allocations for Sale? Evidence from Mutual Funds. *Journal of Finance* 61:2289–2324.

Wagar, T. H. 1998. Exploring the Consequences of Workforce Reduction. *Canadian Journal of Administrative Sciences* 15:300–309.

Wiggins, R. Z., and A. Metrick. 2014a. The Lehman Brothers Bankruptcy E: The Effect on Lehman's U.S. Broker-Dealer. *Yale Program on Financial Stability Case Study 2014-3E-V1* .

Wiggins, R. Z., and A. Metrick. 2014b. The Lehman Brothers Bankruptcy H: The Global Contagion. *Yale Program on Financial Stability Case Study 2014-3H-V1* .

Wiggins, R. Z., T. Piontek, and A. Metrick. 2014. The Lehman Brothers Bankruptcy A: Overview. *Yale Program on Financial Stability Case Study 2014-3A-V1* .

Womack, K. 1996. Do Brokerage Analysts' Recommendations Have Investment Value? *Journal of finance* 51:137–167.

Xie, L. 2014. Above and Beyond Recommendations : How Analysts Add Value to Their Fund Clients. *Working paper* .

Yan, X. S. 2008. Liquidity, Investment Style, and the Relation between Fund Size and Fund Performance. *Journal of Financial and Quantitative Analysis* 43:741.

# Appendix: Form N-SARs

This appendix has two objectives: 1) to illustrate the content in Form N-SAR and 2) to describe the merging process between Form N-SAR and the CRSP MFDB. We download 116,243 N-SAR Forms from the SEC EDGAR database. There are 133 information items reported in Form N-SAR. The central piece of information pertaining to our paper is the business relationships between mutual funds and their brokers: that is, the top ten brokerage firms that received the most commissions (Item 20) and the total brokerage commissions paid (Item 21).

The N-SAR reports are organized at the registrant level, which consists of one or more funds within a fund family, generally grouped together because of a common inception date (see Edelen et al. (2012)). Although Form N-SAR provides separate information for each individual fund, such as their TNA, it only discloses brokerage commission details at the registrant level. As an illustration, Table A1 provides a snapshot of N-SAR filing information for Fidelity Advisor Series I. In our example, Fidelity Advisor Series I is the registrant, consisting of 14 distinct mutual fund portfolios. It filed its Form N-SAR on January 31, 2008 for the six-month reporting period that ended in November 30, 2008. The total commission paid by these 14 mutual fund portfolios was approximately $\$43,376,000$. Goldman Sachs received $\$5,095,000$, the largest amount of commissions during this period among all brokers. The top ten brokerage firms contributed 76% of the total paid commissions. We point out one imperfection in our data is that we are not able to track down the precise timing of these commission payments. In addition, other registrants within the same fund family could have different filing dates. We follow Reuter (2006) to aggregate brokerage commission payments across individual funds within the same family. To do so, we first convert the half-yearly payments into monthly payments by assuming the commission payments were uniformly paid during the reporting period. For each month, we add these monthly payments across all funds to estimate the total brokerage commission payments made by each mutual fund family to their brokers.

[Insert Table A1 here.]

We merge Form N-SAR with the CRSP MFDB. Due to a lack of common identifiers between the two, we perform the matching based on fund names. To minimize matching errors due to fund name changes, our matching process is conducted at the fund-date level. We implement a battery of robustness checks by comparing the fund's TNA reported in both Form N-SAR and the CRSP MFDB. Specifically, we perform three comparisons: 1) between TNA in Form N-SAR (Item 74T) and TNA in the CRSP MFDB, 2) the six-month TNA average in Form N-SAR (Item 75B) and the six-month TNA average in the CRSP MFDB, and 3) the net asset value in Form N-SAR (Items 74V1 and 74V2) and that in the CRSP MFDB. We require the reported discrepancies between the two databases to be no more than 10% for at least two of the three criteria. Table A2 compares between the CRSP mutual funds universe and the sample of funds that we are able to match with N-SAR Forms from 1999 onward. On average, matched funds are larger and older and have lower turnover ratios than non-matched funds. The number of matched funds and statistics are largely consistent with recent studies that also employ Form N-SAR.

[Insert Table A2 here.]

Figure 1: Collapse of Lehman Brothers and its mutual fund clientele.

This figure presents the monthly percentage of U.S. mutual funds that employ Lehman Brothers as one of their top ten brokerage firms between September 2001 and August 2011. We obtain the information from Form N-SARs recorded in the Securities and Exchange Commission Electronic Data Gathering, Analysis, and Retrieval database.

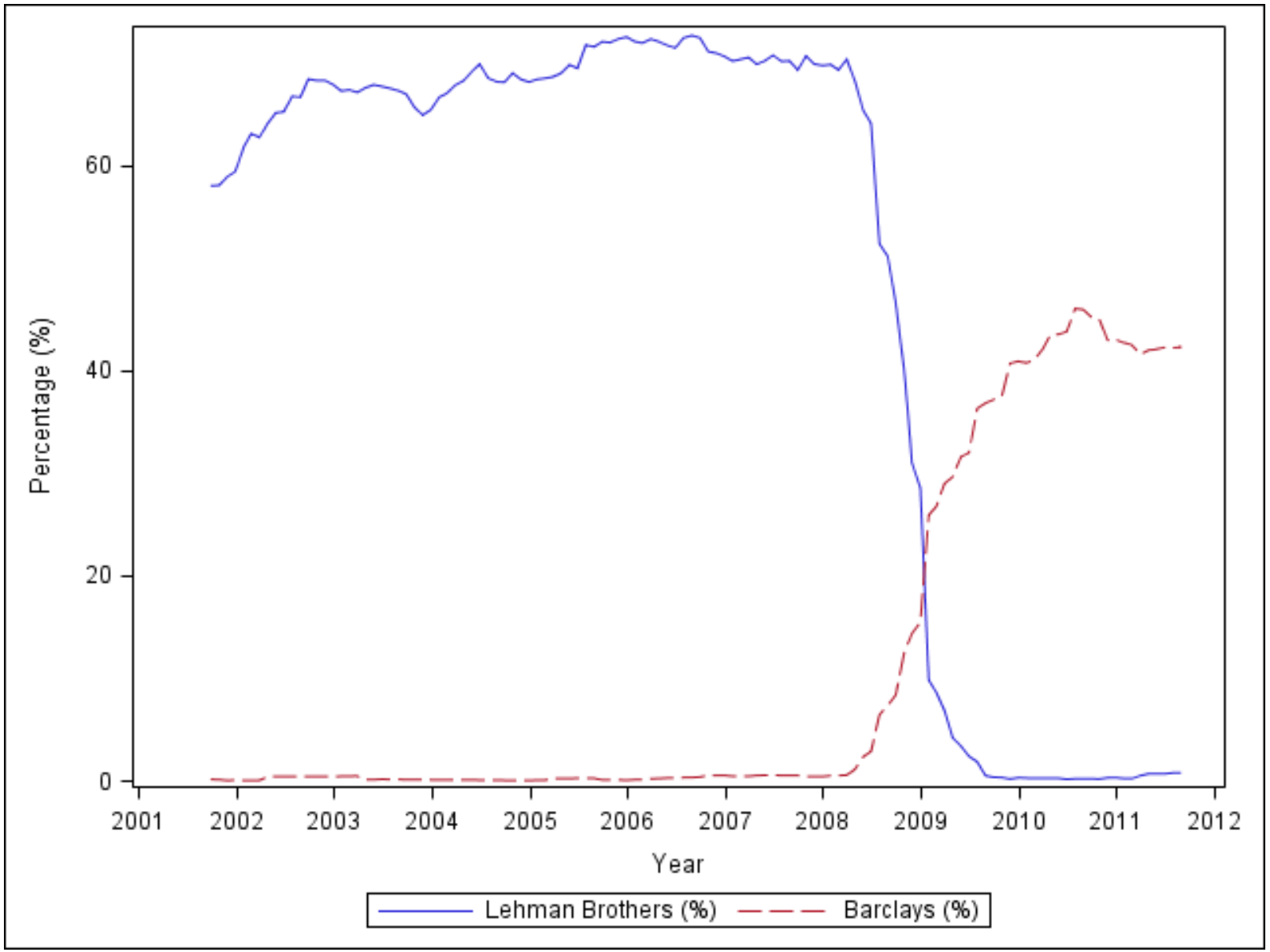

Table A1: Example of Form N-SAR.

This table displays the Form N-SAR filed by Fidelity Advisor Series I for the six-month reporting period ended in Nov, 30 2007. The registrant consists of 14 unique mutual fund portfolios, as indicated by the assigned series number. Form N-SAR provides the commission paid by the registrant to its top ten brokers during the six-month reporting period. The original form can be retrieved from `http://www.sec.gov/Archives/edgar/data/722574/000088019508000009/answer3785.fil`.

| | |
|---|---|
| **Period of report:** | Nov, 30 2007 |
| **Filed as of date:** | Jan, 31 2008 |
| | |
| **Registrant Name:** | Fidelity Advisor Series I |
| **File Number:** | 811-03785 |

**List the name of each series or portfolio:**

| **Series Number** | **Series name** |
|---|---|
| 1 | Fidelity Advisor Equity Growth Fund |
| 2 | Fidelity Advisor Large Cap Fund |
| 3 | Fidelity Advisor Mid Cap Fund |
| 4 | Fidelity Advisor Growth & Income Fund |
| 5 | Fidelity Advisor Strategic Growth Fund |
| 6 | Fidelity Advisor Growth Opportunities Fund |
| 7 | Fidelity Advisor Value Strategies Fund |
| 8 | Fidelity Advisor Small Cap Fund |
| 10 | Fidelity Advisor Equity Income Fund |
| 12 | Fidelity Advisor Dividend Growth Fund |
| 13 | Fidelity Advisor Dynamic Capital Appreciation Fund |
| 14 | Fidelity Advisor Fifty Fund |
| 15 | Fidelity Advisor Equity Value Fund |
| 16 | Fidelity Advisor Leveraged Company Stock Fund |

**List the top 10 brokers which recived the largest amount of brokerage commissions:**

| **Name of Broker** | **Gross commissions received (in thousands of dollars)** |
|---|---|
| Goldman Sachs & Co. | 5,095 |
| UBS AG | 4,508 |
| Merrill Lynch & Co., Inc. | 4,125 |
| Credit Suisse Group | 4,086 |
| Lehman Brothers Holdings, Inc. | 3,596 |
| Morgan Stanley | 3,171 |
| Citigroup, Inc. | 2,657 |
| JP Morgan Chase & Co. | 2,066 |
| Deutsche Bank AG | 1,893 |
| Bank of American Corporation | 1,851 |
| **Total top 10 brokerage commissions** | 33,048 |
| **Total brokerage commissions paid** | 43,376 |

Table A2: Comparison between Centre for Research in Security Prices (CRSP) mutual funds and Form N-SAR matched mutual funds.

This table compares between the CRSP universe of mutual funds and the N-SAR matched mutual funds for the period between 1999 and 2012. We focus on actively managed domestic equity funds. We aggregate the total net assets (TNA) for all fund share classes. For expense ratio, turnover ratio, and fund age, we compute the TNA-weighted average across all fund share classes. Expense ratio is the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. Turnover ratio is the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month TNA of the fund. Fund age is the number of years since inception.

| | **CRSP mutual funds** | | | | | | **N-SAR matched funds** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Number of funds** | **Number of families** | **TNA** | **Expense ratio (%)** | **Turnover ratio (%)** | **Age** | **Number of funds** | **Number of families** | **TNA** | **Expense ratio (%)** | **Turnover ratio (%)** | **Age** |
| 1999 | 2149 | 333 | 1015.92 | 1.29 | 92.04 | 10.46 | 1277 | 310 | 1230.74 | 1.27 | 83.08 | 11.88 |
| 2000 | 2389 | 393 | 1149.33 | 1.31 | 99.45 | 10.32 | 1329 | 349 | 1410.60 | 1.27 | 94.98 | 11.35 |
| 2001 | 2470 | 407 | 876.78 | 1.33 | 112.69 | 10.51 | 1393 | 356 | 1079.04 | 1.30 | 101.83 | 11.62 |
| 2002 | 2521 | 403 | 743.38 | 1.37 | 113.18 | 11.03 | 1542 | 370 | 904.68 | 1.33 | 102.42 | 11.93 |
| 2003 | 2517 | 393 | 757.00 | 1.40 | 110.10 | 11.52 | 1536 | 360 | 883.55 | 1.38 | 99.52 | 12.24 |
| 2004 | 2488 | 387 | 936.94 | 1.38 | 97.40 | 12.01 | 1532 | 351 | 1143.54 | 1.36 | 88.66 | 13.04 |
| 2005 | 2454 | 369 | 1035.68 | 1.33 | 89.52 | 12.48 | 1470 | 330 | 1301.05 | 1.31 | 79.58 | 13.70 |
| 2006 | 2387 | 354 | 1168.31 | 1.29 | 86.42 | 13.02 | 1397 | 311 | 1428.39 | 1.26 | 78.28 | 14.15 |
| 2007 | 2324 | 337 | 1344.67 | 1.24 | 87.31 | 13.78 | 1398 | 299 | 1663.12 | 1.22 | 80.74 | 15.11 |
| 2008 | 2215 | 334 | 1091.21 | 1.20 | 88.82 | 14.94 | 1355 | 287 | 1236.69 | 1.19 | 84.17 | 15.67 |
| 2009 | 2085 | 315 | 994.58 | 1.22 | 103.41 | 16.25 | 1304 | 287 | 1166.83 | 1.20 | 96.79 | 17.21 |
| 2010 | 1903 | 305 | 1261.30 | 1.21 | 95.79 | 17.43 | 1206 | 273 | 1425.36 | 1.20 | 91.21 | 18.13 |
| 2011 | 1827 | 298 | 1421.14 | 1.18 | 84.36 | 18.38 | 1180 | 269 | 1651.21 | 1.16 | 76.35 | 19.06 |
| 2012 | 1719 | 276 | 1539.90 | 1.15 | 81.73 | 19.17 | 1071 | 247 | 1771.71 | 1.13 | 73.62 | 20.04 |

Table 1: Industrial organization of the mutual fund brokerage industry.

Panel A presents the aggregate brokerage commission (in billions of dollars) paid by the mutual fund industry from 1993 to 2011. We also report the market share of the top ten brokerage firms that received the most commissions each year. Panel B provides a snapshot on the top ten brokerage firms that received the most commissions in 2007.

**Panel A: Aggregate brokerage commissions paid by mutual fund industry**

| Year | Aggregate commissions | Commissions received by top 10 brokerage firm (%) |
|---|---|---|
| 1993 | 0.36 | 22.57 |
| 1994 | 1.81 | 26.31 |
| 1995 | 2.95 | 30.63 |
| 1996 | 3.93 | 30.22 |
| 1997 | 4.71 | 28.44 |
| 1998 | 5.60 | 30.98 |
| 1999 | 7.67 | 41.94 |
| 2000 | 7.76 | 39.14 |
| 2001 | 9.04 | 43.45 |
| 2002 | 9.29 | 48.62 |
| 2003 | 8.50 | 45.43 |
| 2004 | 8.97 | 44.65 |
| 2005 | 8.78 | 46.11 |
| 2006 | 9.64 | 45.47 |
| 2007 | 9.58 | 49.60 |
| 2008 | 8.63 | 51.83 |
| 2009 | 8.59 | 49.99 |
| 2010 | 8.24 | 49.74 |
| 2011 | 8.64 | 51.80 |

**Panel B: Top 10 brokerage firms in 2007**

| Brokerage firm | Commissions received as percentage of total (%) | Clients as percentage of all fund families (%) |
|---|---|---|
| Goldman Sachs | 6.45 | 45.76 |
| Merrill Lynch | 6.07 | 54.24 |
| Credit Suisse | 5.94 | 48.95 |
| Lehman Brothers | 5.78 | 54.81 |
| Citigroup | 5.49 | 52.51 |
| UBS | 5.36 | 50.95 |
| Morgan Stanley | 5.07 | 47.06 |
| J.P. Morgan | 4.08 | 44.00 |
| Deutsche Bank | 2.70 | 32.86 |
| Bear Stearns | 2.66 | 50.05 |

Table 2: Mutual fund summary statistics.

This table reports descriptive statistics of mutual funds used in this paper. The sample period spans between September 2006 and August 2010, with a total of 1,096 actively managed domestic equity mutual funds. We compute each mutual fund's monthly raw return by dividing the fund's yearly total expense ratio by 12 and adding it back to the reported net returns in the Center for Research in Security Prices Mutual Fund Database. We compute mutual fund monthly Jensen-$\alpha$, Fama-French-$\alpha$, and Carhart-$\alpha$ using each fund's past 36-month raw returns. We compute a mutual fund's objective-adjusted return by subtracting the average benchmark portfolio of other funds' monthly raw return which shares the same investment objective from the fund's monthly raw return. *TNA* represents the fund's month-end total net assets (TNA), in millions of dollars. *FTNA* is the fund family's month-end TNA, in millions of dollars. *FundAge* is the number of years the fund exists since inception. *FundFlows* measures the fund's monthly inflow and outflow of assets. *Expense* is the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. *FundTurnover* is the minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month TNA of the fund. *NBulgeBracket* is the number of bulge bracket brokerage firms the mutual fund employs. The bulge bracket brokerage firms are Merrill Lynch, Goldman Sachs, Morgan Stanley, J.P. Morgan, Bear Stearns, Citigroup, UBS, Credit Suisse, Deutsche Bank, and Lehman Brothers.

| | **Mean** | **Standard deviation** | **First quartile** | **Median** | **Third quartile** |
|---|---|---|---|---|---|
| Raw return (%) | 0.43 | 5.96 | -2.75 | 1.31 | 4.14 |
| Jensen-$\alpha$ (%) | 0.18 | 2.17 | -0.94 | 0.08 | 1.16 |
| Fama-French-$\alpha$ (%) | 0.09 | 1.98 | -0.85 | 0.07 | 1.02 |
| Carhart-$\alpha$ (%) | 0.06 | 1.97 | -0.85 | 0.04 | 0.95 |
| Objective-adjusted (%) | 0.04 | 2.94 | -0.89 | -0.02 | 0.88 |
| *TNA* (in millions) | 1710.97 | 3465.70 | 126.50 | 465.30 | 1475.90 |
| *FTNA* (in millions) | 149305.28 | 273833.96 | 8253.50 | 36262.40 | 94734.80 |
| *FundAge* (in years) | 16.85 | 13.22 | 8.17 | 13.33 | 21.25 |
| *FundFlows* (%) | -0.21 | 9.59 | -1.49 | -0.52 | 0.68 |
| *Turnover* (%) | 84.30 | 72.91 | 37.00 | 66.99 | 111.00 |
| *Expense* (%) | 1.18 | 0.40 | 0.93 | 1.16 | 1.40 |
| *NBulgeBracket* | 5.14 | 3.16 | 2.00 | 6.00 | 8.00 |

Table 3: Impact of Lehman Brother's bankruptcy on mutual funds with small and large brokerage networks.

This table presents the estimation results from difference-in-differences (DiD) regressions that analyze the impact of Lehman Brother's collapse on mutual fund performance. The sample period spans between September 2006 and August 2010, with a total of 1,096 actively managed domestic equity mutual funds. Panel A and B present the estimation results for mutual funds with small and large brokerage networks, respectively. We define a fund to have a small brokerage network if it employs less than four bulge bracket brokerage firms; otherwise the fund is defined as having a large brokerage network. The bulge bracket brokerage firms are Merrill Lynch, Goldman Sachs, Morgan Stanley, J.P. Morgan, Bear Stearns, Citigroup, UBS, Credit Suisse, Deutsche Bank, and Lehman Brothers. Column (1) presents the estimation results for Equation (3.1):

$$RawReturn_{i,t} = \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post_{i,t} + \beta_3 Lehman_{i,t} * Post_{i,t} + \epsilon_{i,t},$$

where the dependent variable $RawReturn_{i,t}$ is the mutual fund's monthly raw return. $Lehman_{i,t}$ is an indicator variable which takes the value of 1 if fund $i$ uses Lehman Brothers as one of its top ten brokers as of August 31, 2008, 0 otherwise. $Post_{i,t}$ is an indicator variable which takes the value of 1 after September 15, 2008, 0 otherwise. Column (2) presents the estimation results for Equation (3.2):

$$\begin{aligned} RawReturn_{i,t} \quad &= \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post1_{i,t} + \beta_3 Lehman_{i,t} * Post1_{i,t} \\ &+ \beta_4 Post2_{i,t} + \beta_5 Lehman_{i,t} * Post2_{i,t} \\ &+ \beta_6 Post3_{i,t} + \beta_7 Lehman_{i,t} * Post3_{i,t} + \epsilon_{i,t}, \end{aligned}$$

where *Post1* takes the value of 1 in the first year after the Lehman's collapse and 0 otherwise. *Post2* and *Post3* take the value of 1 for the period between September 2009 and February 2010 (6-month period) and March 2010 and August 2010 (6-month period), respectively, and 0 otherwise. We also include the fund characteristics as control variables in the regression analysis. *TNA* represents the fund's month-end total net assets (TNA), in millions of dollars. *FTNA* is the fund family's month-end TNA, in millions of dollars. *FundAge* is the number of years the fund exists since inception. *FundFlows* measures the fund's monthly inflow and outflow of assets. *Expense* is the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. *FundTurnover* is the minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month TNA of the fund. We took the logarithmic of *TNA*, *FTNA*, and *FundAge*. All control variables are lagged by one month. Column (3) - (6) replace the dependent variable with the fund's monthly Jensen-$\alpha$, Fama-French-$\alpha$, Carhart-$\alpha$, and objective-adjusted return, respectively. We compute mutual fund monthly Jensen-$\alpha$, Fama-French-$\alpha$, and Carhart-$\alpha$ using each fund's past 36-month raw returns. We compute a mutual fund's objective-adjusted return by subtracting the average benchmark portfolio of other funds' monthly raw return which shares the same investment objective from the fund's monthly raw return. All standard errors are clustered at the fund-level and are shown in parentheses under the estimated coefficients. The number of mutual funds and $R-$squared are presented. The superscripts $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% levels, respectively.

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| Panel A: Small brokerage network | | | | | | |
|---|---|---|---|---|---|---|
| | **Raw** | | **Jensen** | **Fama-French** | **Carhart** | **Objective-adjusted** |
| *Constant* | 0.357*** | 0.327 | -0.200 | -0.214 | -0.344* | -0.209 |
| | (0.036) | (0.250) | (0.209) | (0.199) | (0.199) | (0.204) |
| *Lehman* | 0.167 | 0.133 | 0.170 | 0.243 | 0.153 | 0.167 |
| | (0.133) | (0.125) | (0.135) | (0.153) | (0.115) | (0.117) |
| *Post* | -0.337*** | | | | | |
| | (0.055) | | | | | |
| *Lehman*Post* | -0.709*** | | | | | |
| | (0.201) | | | | | |
| *Post1* | | -0.632*** | 0.426*** | 0.066 | 0.278*** | 0.302*** |
| | | (0.073) | (0.068) | (0.079) | (0.073) | (0.067) |
| *Lehman*Post1* | | -1.123*** | -0.912*** | -0.990*** | -0.508** | -0.988*** |
| | | (0.356) | (0.210) | (0.251) | (0.244) | (0.225) |
| *Post2* | | 2.818*** | -0.159*** | -0.257*** | -0.017 | 0.027 |
| | | (0.060) | (0.049) | (0.048) | (0.051) | (0.068) |
| *Lehman*Post2* | | -0.151 | -0.107 | -0.142 | -0.378* | -0.136 |
| | | (0.214) | (0.279) | (0.293) | (0.226) | (0.218) |
| *Post3* | | -0.695*** | 0.194*** | -0.036 | 0.140** | 0.112 |
| | | (0.063) | (0.064) | (0.067) | (0.065) | (0.068) |
| *Lehman*Post3* | | -0.355* | -0.311* | -0.365* | -0.308 | -0.295 |
| | | (0.182) | (0.179) | (0.211) | (0.189) | (0.210) |
| *LOGTNA* | | -0.080*** | -0.045** | -0.013 | -0.018 | -0.027 |
| | | (0.026) | (0.021) | (0.018) | (0.018) | (0.019) |
| *LOGFTNA* | | -0.028 | 0.027 | 0.021 | 0.024 | 0.003 |
| | | (0.022) | (0.018) | (0.017) | (0.017) | (0.017) |
| *LOGFundAge* | | 0.062 | 0.042 | 0.015 | 0.004 | -0.008 |
| | | (0.048) | (0.042) | (0.044) | (0.040) | (0.037) |
| *FundFlows* | | 0.014*** | -0.003* | -0.002 | -0.000 | -0.001 |
| | | (0.003) | (0.002) | (0.002) | (0.002) | (0.002) |
| *Turnover* | | 0.000 | 0.001 | 0.000 | 0.000 | -0.000 |
| | | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Expense* | | 0.095 | 0.142** | 0.185*** | 0.176*** | 0.198*** |
| | | (0.089) | (0.068) | (0.063) | (0.058) | (0.064) |
| Number of funds | 171 | 171 | 171 | 171 | 171 | 122 |
| R-squared | 0.001 | 0.029 | 0.009 | 0.005 | 0.004 | 0.007 |

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| Panel B: Large brokerage network | | | | | | |
|---|---|---|---|---|---|---|
| | **Raw** | | **Jensen** | **Fama-French** | **Carhart** | **Objective-adjusted** |
| *Constant* | 0.434*** | 0.491*** | -0.225** | -0.086 | -0.114 | -0.057 |
| | (0.028) | (0.121) | (0.100) | (0.084) | (0.082) | (0.115) |
| *Lehman* | -0.040 | 0.055 | -0.089** | -0.071* | -0.019 | -0.027 |
| | (0.033) | (0.038) | (0.036) | (0.036) | (0.031) | (0.040) |
| *Post* | -0.610*** | | | | | |
| | (0.045) | | | | | |
| *Lehman*Post* | 0.058 | | | | | |
| | (0.051) | | | | | |
| *Post1* | | -0.986*** | 0.109** | -0.127** | 0.208*** | -0.114* |
| | | (0.055) | (0.051) | (0.058) | (0.052) | (0.063) |
| *Lehman*Post1* | | 0.055 | 0.082 | 0.078 | 0.062 | 0.084 |
| | | (0.063) | (0.058) | (0.067) | (0.058) | (0.072) |
| *Post2* | | 2.542*** | -0.231*** | -0.322*** | -0.179*** | -0.047 |
| | | (0.039) | (0.033) | (0.036) | (0.034) | (0.047) |
| *Lehman*Post2* | | 0.069 | 0.079** | 0.089** | 0.051 | 0.060 |
| | | (0.046) | (0.039) | (0.042) | (0.040) | (0.055) |
| *Post3* | | -0.962*** | -0.085* | -0.235*** | -0.060 | -0.082 |
| | | (0.051) | (0.051) | (0.051) | (0.052) | (0.050) |
| *Lehman*Post3* | | 0.082 | 0.097* | 0.112* | 0.080 | 0.097* |
| | | (0.058) | (0.058) | (0.058) | (0.059) | (0.056) |
| *LOGTNA* | | -0.106*** | -0.044*** | -0.022*** | -0.026*** | -0.039*** |
| | | (0.011) | (0.008) | (0.007) | (0.007) | (0.010) |
| *LOGFTNA* | | -0.037*** | 0.032*** | 0.021*** | 0.009 | 0.017* |
| | | (0.009) | (0.008) | (0.007) | (0.006) | (0.009) |
| *LOGFundAge* | | 0.172*** | 0.089*** | 0.058*** | 0.058*** | 0.053*** |
| | | (0.022) | (0.017) | (0.014) | (0.014) | (0.018) |
| *FundFlows* | | 0.015*** | 0.001 | 0.001 | -0.001 | -0.000 |
| | | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Turnover* | | 0.001*** | 0.000** | 0.000 | 0.000* | -0.000** |
| | | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Expense* | | 0.098** | 0.139*** | 0.111*** | 0.073*** | 0.051 |
| | | (0.042) | (0.030) | (0.026) | (0.025) | (0.035) |
| Number of funds | 925 | 921 | 921 | 921 | 921 | 502 |
| R-squared | 0.002 | 0.031 | 0.004 | 0.003 | 0.005 | 0.001 |

Table 4: Impact of Lehman Brother's bankruptcy on mutual funds with small-cap and non-small cap investment objective.

This table presents the estimation results from difference-in-differences (DiD) regressions that analyze the impact of Lehman Brother's collapse on various mutual fund performances. The sample period spans between September 2006 and August 2010, with a total of $1,096$ actively managed domestic equity mutual funds. Panel A and B present the estimation results for mutual funds with small-cap and non-small-cap investment objective, respectively. We define a fund specializes in small-cap securities if its Lipper classification code is one with either "SCCE", "SCGE", or "SCVE", its Strategic Insight Objective code is "SCG", or its Wiesenberger Objective Code is "SCG". Column (1) presents the estimation results for Equation (3.1):

$$RawReturn_{i,t} = \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post_{i,t} + \beta_3 Lehman_{i,t} * Post_{i,t} + \epsilon_{i,t},$$

where the dependent variable $RawReturn_{i,t}$ is the mutual fund's monthly raw return. $Lehman_{i,t}$ is an indicator variable which takes the value of 1 if fund $i$ uses Lehman Brothers as one of its top ten brokers as of August 31, 2008, 0 otherwise. $Post_{i,t}$ is an indicator variable which takes the value of 1 after September 15, 2008, 0 otherwise. Column (2) presents the estimation results for Equation (3.2):

$$\begin{aligned} RawReturn_{i,t} \quad &= \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post1_{i,t} + \beta_3 Lehman_{i,t} * Post1_{i,t} \\ &+ \beta_4 Post2_{i,t} + \beta_5 Lehman_{i,t} * Post2_{i,t} \\ &+ \beta_6 Post3_{i,t} + \beta_7 Lehman_{i,t} * Post3_{i,t} + \epsilon_{i,t}, \end{aligned}$$

where *Post1* takes the value of 1 in the first year after the Lehman's collapse and 0 otherwise. *Post2* and *Post3* take the value of 1 for the period between September 2009 and February 2010 (6-month period) and March 2010 and August 2010 (6-month period), respectively, and 0 otherwise. We also include the fund characteristics as control variables in the regression analysis. *TNA* represents the fund's month-end total net assets (TNA), in millions of dollars. *FTNA* is the fund family's month-end TNA, in millions of dollars. *FundAge* is the number of years the fund exists since inception. *FundFlows* measures the fund's monthly inflow and outflow of assets. *Expense* is the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. *FundTurnover* is the minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month TNA of the fund. We took the logarithmic of *TNA*, *FTNA*, and *FundAge*. All control variables are lagged by one month. Column (3) - (6) replace the dependent variable with the fund's monthly Jensen-$\alpha$, Fama-French-$\alpha$, Carhart-$\alpha$, and objective-adjusted return, respectively. We compute mutual fund monthly Jensen-$\alpha$, Fama-French-$\alpha$, and Carhart-$\alpha$ using each fund's past 36-month raw returns. We compute a mutual fund's objective-adjusted return by subtracting the average benchmark portfolio of other funds' monthly raw return which shares the same investment objective from the fund's monthly raw return. All standard errors are clustered at the fund-level and are shown in parentheses under the estimated coefficients. The number of mutual funds and $R-$squared are presented. The superscripts $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% levels, respectively.

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| Panel A: Small-cap fund | | | | | | |
|---|---|---|---|---|---|---|
| | **Raw** | | **Jensen** | **Fama-French** | **Carhart** | **Objective-adjusted** |
| *Constant* | 0.375*** | 0.609** | -0.170 | -0.020 | -0.037 | -0.071 |
| | (0.044) | (0.287) | (0.223) | (0.201) | (0.181) | (0.203) |
| *Lehman* | 0.120* | 0.261*** | 0.082 | 0.139* | 0.082 | 0.118 |
| | (0.067) | (0.092) | (0.079) | (0.076) | (0.065) | (0.077) |
| *Post* | -0.286*** | | | | | |
| | (0.062) | | | | | |
| *Lehman*Post* | -0.342*** | | | | | |
| | (0.098) | | | | | |
| *Post1* | | -0.540*** | 0.584*** | 0.103 | 0.355*** | 0.175** |
| | | (0.085) | (0.083) | (0.085) | (0.086) | (0.075) |
| *Lehman*Post1* | | -0.523*** | -0.404*** | -0.495*** | -0.203* | -0.450*** |
| | | (0.126) | (0.125) | (0.135) | (0.114) | (0.122) |
| *Post2* | | 2.982*** | -0.160** | -0.297*** | -0.116* | -0.005 |
| | | (0.075) | (0.067) | (0.062) | (0.062) | (0.072) |
| *Lehman*Post2* | | -0.049 | 0.107 | 0.030 | -0.051 | 0.033 |
| | | (0.100) | (0.094) | (0.092) | (0.089) | (0.099) |
| *Post3* | | -0.697*** | 0.264*** | -0.062 | 0.080 | 0.016 |
| | | (0.066) | (0.069) | (0.073) | (0.064) | (0.065) |
| *Lehman*Post3* | | -0.146 | -0.121 | -0.131 | -0.085 | -0.105 |
| | | (0.093) | (0.098) | (0.105) | (0.094) | (0.093) |
| *LOGTNA* | | -0.114*** | -0.035 | 0.016 | -0.002 | -0.029 |
| | | (0.029) | (0.021) | (0.019) | (0.017) | (0.019) |
| *LOGFTNA* | | -0.038* | 0.009 | -0.012 | -0.016 | -0.009 |
| | | (0.021) | (0.018) | (0.015) | (0.014) | (0.017) |
| *LOGFundAge* | | 0.179*** | 0.113** | 0.027 | 0.036 | 0.082* |
| | | (0.057) | (0.051) | (0.044) | (0.039) | (0.042) |
| *FundFlows* | | 0.019*** | 0.000 | 0.001* | 0.002** | 0.002** |
| | | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Turnover* | | 0.000 | 0.000 | -0.000 | -0.000 | -0.000 |
| | | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Expense* | | -0.063 | 0.091 | 0.136** | 0.118** | 0.083 |
| | | (0.091) | (0.071) | (0.063) | (0.059) | (0.066) |
| Number of funds | 162 | 162 | 162 | 162 | 162 | 162 |
| R-squared | 0.001 | 0.031 | 0.008 | 0.007 | 0.006 | 0.004 |

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| Panel B: Non-small-cap fund | | | | | | |
|---|---|---|---|---|---|---|
| | **Raw** | | **Jensen** | **Fama-French** | **Carhart** | **Objective-adjusted** |
| *Constant* | 0.409*** | 0.241** | -0.259*** | -0.154** | -0.237*** | -0.176* |
| | (0.026) | (0.113) | (0.091) | (0.078) | (0.079) | (0.106) |
| *Lehman* | -0.023 | 0.091** | -0.063* | -0.061* | -0.002 | 0.012 |
| | (0.031) | (0.037) | (0.034) | (0.035) | (0.031) | (0.041) |
| *Post* | -0.558*** | | | | | |
| | (0.042) | | | | | |
| *Lehman*Post* | 0.007 | | | | | |
| | (0.049) | | | | | |
| *Post1* | | -0.940*** | 0.138*** | -0.092 | 0.197*** | 0.030 |
| | | (0.051) | (0.047) | (0.056) | (0.050) | (0.062) |
| *Lehman*Post1* | | 0.021 | 0.042 | 0.068 | 0.082 | -0.027 |
| | | (0.060) | (0.055) | (0.066) | (0.057) | (0.072) |
| *Post2* | | 2.556*** | -0.204*** | -0.287*** | -0.103*** | -0.012 |
| | | (0.037) | (0.030) | (0.033) | (0.034) | (0.048) |
| *Lehman*Post2* | | 0.024 | 0.036 | 0.053 | -0.024 | 0.013 |
| | | (0.045) | (0.037) | (0.040) | (0.040) | (0.057) |
| *Post3* | | -0.908*** | -0.040 | -0.178*** | 0.009 | 0.001 |
| | | (0.048) | (0.049) | (0.049) | (0.050) | (0.057) |
| *Lehman*Post3* | | 0.029 | 0.034 | 0.058 | 0.013 | 0.028 |
| | | (0.057) | (0.056) | (0.057) | (0.058) | (0.063) |
| *LOGTNA* | | -0.099*** | -0.046*** | -0.025*** | -0.027*** | -0.037*** |
| | | (0.010) | (0.008) | (0.007) | (0.007) | (0.010) |
| *LOGFTNA* | | -0.018** | 0.034*** | 0.026*** | 0.019*** | 0.021*** |
| | | (0.008) | (0.007) | (0.006) | (0.006) | (0.008) |
| *LOGFundAge* | | 0.142*** | 0.078*** | 0.056*** | 0.051*** | 0.032* |
| | | (0.021) | (0.017) | (0.014) | (0.014) | (0.017) |
| *FundFlows* | | 0.011*** | -0.002 | -0.001 | -0.002** | -0.003 |
| | | (0.003) | (0.002) | (0.001) | (0.001) | (0.002) |
| *Turnover* | | 0.001*** | 0.000*** | 0.000 | 0.000** | -0.000 |
| | | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Expense* | | 0.112*** | 0.145*** | 0.124*** | 0.086*** | 0.102*** |
| | | (0.042) | (0.031) | (0.027) | (0.026) | (0.035) |
| Number of funds | 934 | 930 | 930 | 930 | 930 | 462 |
| R-squared | 0.002 | 0.030 | 0.004 | 0.003 | 0.005 | 0.002 |

Table 5: The channel of the Lehman Brother's bankruptcy impact on mutual funds.

This table presents the estimation results from difference-in-differences (DiD) regressions that analyze the channel of the Lehman Brother's bankruptcy impact on mutual fund performance. The sample period spans between September 2006 and August 2010, with a total of $1,096$ actively managed domestic equity mutual funds. We focus on mutual funds with small brokerage networks and funds that specialize in small-cap stocks. We define a fund to have a small brokerage network if it employs less than four bulge bracket brokerage firms; otherwise the fund is defined as having a large brokerage network. The bulge bracket brokerage firms are Merrill Lynch, Goldman Sachs, Morgan Stanley, J.P. Morgan, Bear Stearns, Citigroup, UBS, Credit Suisse, Deutsche Bank, and Lehman Brothers. We define a fund specializes in small-cap securities if its Lipper classification code is one with either "SCCE", "SCGE", or "SCVE", its Strategic Insight Objective code is "SCG", or its Wiesenberger Objective Code is "SCG". We present the estimation results for Equation (3.2):

$$\begin{aligned} DGTW_{CS,i,t} \quad &= \beta_0 + \beta_1 Lehman_{i,t} + \beta_2 Post1_{i,t} + \beta_3 Lehman_{i,t} * Post1_{i,t} \\ &+\beta_4 Post2_{i,t} + \beta_5 Lehman_{i,t} * Post2_{i,t} \\ &+\beta_6 Post3_{i,t} + \beta_7 Lehman_{i,t} * Post3_{i,t} + \epsilon_{i,t}, \end{aligned}$$

where the dependent variable $DGTW_{CS,i,t}$ measures the fund's characteristics selectivity skills as proposed in Daniel et al. (1997). *Post1* takes the value of 1 in the first year after the Lehman's collapse and 0 otherwise. *Post2* and *Post3* take the value of 1 for the period between September 2009 and February 2010 (6-month period) and March 2010 and August 2010 (6-month period), respectively, and 0 otherwise. We also include the fund characteristics as control variables in the regression analysis. *TNA* represents the fund's month-end total net assets (TNA), in millions of dollars. *FTNA* is the fund family's month-end TNA, in millions of dollars. *FundAge* is the number of years the fund exists since inception. *FundFlows* measures the fund's monthly inflow and outflow of assets. *Expense* is the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. *FundTurnover* is the minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month TNA of the fund. We took the logarithmic of *TNA*, *FTNA*, and *FundAge*. All control variables are lagged by one month. We also replace $DGTW_{CS,i,t}$ with $DGTW_{CT,i,t}$ and $ReturnGap_{i,t}$, respectively. $DGTW_{CT,i,t}$ measures the fund's characteristics timing skills and $ReturnGap_{i,t}$ is the difference between the fund's actual monthly return and buy-and-hold portfolio return as in Kacperczyk et al. (2008). All standard errors are clustered at the fund-level and are shown in parentheses under the estimated coefficients. The number of mutual funds and $R-$squared are presented. The superscripts $*$, $**$, and $***$ indicate significance at the 10%, 5%, and 1% levels, respectively.

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| | Small brokerage network | | | Small-cap funds | | |
|---|---|---|---|---|---|---|
| | **DGTW CS measure** | **DGTW CT measure** | **Return Gap** | **DGTW CS measure** | **DGTW CT measure** | **Return Gap** |
| *Constant* | -0.674*** | -0.036 | 0.779*** | 0.494* | -0.193 | -0.493* |
| | (0.232) | (0.183) | (0.242) | (0.266) | (0.141) | (0.290) |
| *Lehman* | 0.028 | 0.048 | 0.059 | -0.021 | 0.051* | 0.085 |
| | (0.198) | (0.060) | (0.153) | (0.089) | (0.030) | (0.074) |
| *Post1* | 0.364*** | -0.234*** | -0.241*** | 0.453*** | -0.249*** | -0.296*** |
| | (0.072) | (0.050) | (0.055) | (0.086) | (0.060) | (0.069) |
| *Lehman*Post1* | -0.480** | -0.183 | -0.165 | -0.330*** | 0.084 | 0.020 |
| | (0.215) | (0.249) | (0.109) | (0.116) | (0.075) | (0.085) |
| *Post2* | 0.036 | 0.846*** | -0.032 | -0.043 | 0.915*** | 0.108* |
| | (0.049) | (0.052) | (0.053) | (0.070) | (0.062) | (0.063) |
| *Lehman*Post2* | 0.042 | -0.065 | -0.190 | 0.022 | -0.032 | 0.008 |
| | (0.213) | (0.172) | (0.158) | (0.094) | (0.090) | (0.078) |
| *Post3* | -0.145** | -0.134*** | 0.082 | -0.216*** | -0.168*** | 0.092 |
| | (0.065) | (0.033) | (0.053) | (0.073) | (0.032) | (0.066) |
| *Lehman*Post3* | 0.172 | -0.035 | -0.492*** | -0.013 | -0.063 | -0.055 |
| | (0.257) | (0.070) | (0.176) | (0.094) | (0.046) | (0.081) |
| *LOGTNA* | -0.007 | -0.002 | -0.005 | -0.042 | -0.020 | 0.040 |
| | (0.025) | (0.016) | (0.026) | (0.029) | (0.013) | (0.027) |
| *LOGFTNA* | 0.053** | -0.021* | -0.067*** | -0.020 | -0.002 | 0.002 |
| | (0.021) | (0.012) | (0.019) | (0.024) | (0.010) | (0.020) |
| *LOGFundAge* | 0.097** | 0.021 | -0.085* | 0.072 | 0.079* | -0.023 |
| | (0.043) | (0.036) | (0.047) | (0.058) | (0.041) | (0.061) |
| *FundFlows* | -0.002 | 0.003*** | 0.001 | 0.002** | 0.004*** | 0.001 |
| | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Turnover* | -0.000 | 0.000 | 0.000 | -0.000 | -0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) |
| *Expense* | 0.299*** | 0.069 | -0.209** | 0.141 | 0.053 | -0.042 |
| | (0.090) | (0.047) | (0.095) | (0.104) | (0.034) | (0.106) |
| Number of funds | 167 | 167 | 167 | 162 | 162 | 162 |
| R-squared | 0.011 | 0.025 | 0.011 | 0.017 | 0.034 | 0.013 |