6-2013

Inferring Reporting-Related Biases in Hedge Fund Databases from Hedge Fund Equity Holdings

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DOI: https://doi.org/10.1287/mnsc.1120.1647

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First Version: March, 2009
This Draft: December, 2010

ABSTRACT

This paper formally analyzes the biases related to self-reporting in the hedge funds databases by matching the quarterly equity holdings of a complete list of 13F-filing hedge fund companies to the union of five major commercial databases of self-reporting hedge funds between 1980 and 2008. Conditional on self-reporting, we find significant evidence of a timing bias in both reporting initiation and termination (delisting): Funds initiate self-reporting after positive abnormal returns which do not persist into the reporting period; while termination of self-reporting is followed by both return deterioration and outflows from the funds. Unconditionally, the propensity to self-report is consistent with the trade-offs between the benefits (e.g., access to prospective investors) and costs (e.g., partial loss of trading secrecy and flexibility in selective marketing). Finally, self-reporting and non-reporting funds do not differ significantly in return performance, reflecting the offsetting factors motivating self-reporting.

[1] Comments and suggestions from Gerald Gay, John Griffin, Bob Hodrick, and seminar and conference participants at Columbia University, CRSP Forum, FMA 2010 Annual Meetings, Tel Aviv University, and the 2nd Annual Conference on Hedge Funds have contributed to this draft. The authors thank Linlin Ma for excellent research assistance.
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Hedge funds are pooled private investment vehicles. Unlike other financial institutions such as banks and mutual funds, they have largely escaped the regulations by raising capital via private placement (under the Securities Act of 1933) and from a limited number of "qualified investors," i.e., accredited institutions and high-net worth individuals (under the Investment Company Act of 1940). Due to their lightly regulated nature, hedge funds are not required to report information about their characteristics, strategies, and performance to any authority or database. As a result, hedge funds are among the least transparent major market participants though according to some estimates by Credit Suisse / Tremont, they managed 1.5 to 2.0 trillion dollars of assets and accounted for about one-third of the equity trading volume in the U.S. during 2007.

The importance of hedge funds has attracted a growing volume of research; and due to the lack of mandatory disclosure, the burgeoning research on hedge funds has mostly relied on commercial hedge fund databases to which hedge funds report voluntarily. Prior research has documented several biases in hedge fund databases including the survivorship bias, backfilling bias, and smoothing bias (e.g., Ackermann, McEnally, and Ravenscraft (1999), Brown, Goetzmann, and Ibbotson (1999), Fung and Hsieh (2000), Liang (2000), Getmanksy, Lo, and Makarov (2004), and Bollen and Pool (2008)). However, the extant literature has not formally addressed the degree of self-reporting bias, arguably one of the most important biases in hedge fund databases. Self-reporting bias is a type of selection bias that results from hedge funds' choices to not report to any database, to initiate reporting at some time, or to discontinue reporting for various reasons, the common ones being liquidation and closed for new investment. Such a bias can potentially affect any study on the performance and risk characteristics of hedge funds but the magnitude or even the direction of the bias is yet unknown. Our paper fills this gap in the hedge fund literature by being the first to assess the extent of self-reporting bias in a comprehensive sample of hedge funds as well as to analyze the determinants of their self-reporting.

A hedge fund's choice to voluntarily report to a commercial database is likely to be non-random. Like all other economic activities, the reporting behavior of hedge funds should be determined by the cost-benefit trade-offs. On the benefit side, listing in a database enhances a fund's exposure to potential investors, which is likely to be more significant for small and medium sized fund companies that desire more publicity but lack the resources for aggressive direct marketing.[5] The main cost of reporting is a partial loss of secrecy and privacy that many hedge funds value.[6] Moreover, keeping the reporting status constitutes a commitment to revealing a fixed set of information at fixed time intervals, depriving a hedge fund of the flexibility in publicizing selective information (such as return performance of a particular period of time) that is most favorable to the fund. Finally, investors attracted to hedge funds through database subscription tend to be more "retail" and short-term. Hedge funds usually value institutional investors whose investing or divesting decisions are not sensitive to short-term performance. Hence, some hedge funds may not want to be exposed to the clientele that are typical of database subscribers.

Even after a fund decides to report to a commercial database, it exercises the discretion on the reporting initiation date and later may choose to exit from the database for both positive and negative reasons. On the positive side, if a hedge fund is closed to new investors due to its success and lack of scalable investment opportunities, then there would be no incentive to attract more capital. On the negative side, embarrassing losses or even the prospect of liquidation could be the reason for a hedge fund to stop reporting.

These scenarios related to the choice of reporting, as well as initiation and discontinuation of reporting indicate a potential selection bias among self-reporting databases. However, the magnitude, or even the direction of the bias, is hard to assess *a priori* (Fung and Hsieh (2000)). This paper is a first

[5] In order to be exempt from the regulations of the 1934 Securities Exchange Act and the 1940 Investment Company Act (and their amendments), a hedge fund cannot advertise to the general public through mass media such as newspapers and TV channels. Moreover, the investors that the fund approaches directly must satisfy the requirement of "qualified investors". Therefore, reporting to a commercial database is often viewed as a cheap way to reach the target investor groups, where the database vendors bear the responsibility of ensuring that only qualified investors have access to their databases.

[6] Though self-reporting hedge funds in general do not reveal holdings information to hedge fund databases, the reported information, such as descriptions of style classification, asset allocation, monthly returns, and leverage/hedging ratios, is often revealing of the funds' investment strategies.

attempt at quantifying the degree of the self-reporting bias in the hedge funds databases by analyzing the quarterly equity holdings of a complete list of hedge fund companies that file the Form 13F to the Securities and Exchange Commission (SEC) between 1980 and 2008. Because of the mandatory nature of the 13F filings,[7] this sample is largely free from the selection bias due to hedge funds' reporting incentives. Among all 13F-filing hedge fund companies, we determine their self-reporting status by matching them to the union of five major hedge fund databases – CISDM, HFR, Eureka, MSCI, and TASS. This represents the most comprehensive database of self-reporting hedge funds that has been used in the literature and hence minimizes the inaccuracy in the classification of funds' self-reporting status.

Upon classifying hedge funds' self-reporting status and imputing returns and other portfolio statistics from the quarter-end holdings of all hedge funds that file 13F forms, we conduct a two-step analysis. First, we analyze the return dynamics around the initial and last reporting dates and the impact of reporting on fund flows for the subsample of self-reporting funds. We then compare the performance and other characteristics of the self-reporting hedge funds to those of the non-reporting ones.

Conditional on self-reporting, we find significant evidence that performance deteriorates both after the initial reporting date and after the reporting termination date. The deterioration amounts to 73 and 24 basis points respectively, using monthly market-adjusted returns. These results indicate two forms of timing bias in returns reported to commercial databases. The first form of timing bias in reporting initiation suggests that hedge funds strategically initiate self-reporting after a run of superior performance; while the second form of timing bias indicates that reporting termination or "delisting" is usually a sign of deterioration. The latter is further supported by the fact that net flows to funds tend to decrease after reporting termination, even after controlling for performance. Good performance prior to initiation of reporting to some extent offsets the poor performance subsequent to termination of reporting, which biases the performance data accessible from the commercial databases toward average performance.

[7] All institutions that have investment discretion over $100 million or more in Section 13(f) securities (mostly publicly traded equity; but also include convertible bonds, and some options) are required to disclose their quarter-end holdings in these securities.

. Unconditionally, we find that young and medium-sized fund companies that employ more diversified and higher-frequency trading strategies (using portfolio turnover rates as proxy) have a stronger incentive to self-report to databases, presumably to publicize their funds and attract potential investors. Given the characteristics of these funds, trading secrecy is less likely to be revealed through voluntary disclosure because of their diversified nature and the high portfolio turnover rates, both of which reduce the costs of reporting. Interestingly, the difference in the return performance, though slightly in favor of the non-reporting funds, is small. Presumably the positive and negative reasons prompting reporting initiation and termination largely offset one another. This is good news for the large body of research on hedge fund performance because the self-reporting bias may not have a material impact when it comes to performance evaluation especially if researchers use a multitude of commercial databases to exhaustively cover the universe of self-reporting hedge funds.

The findings of our paper have implications for the growing research on hedge funds which examines their risk-return characteristics and persistence in their performance.[8] Our study contributes to the earlier work on hedge fund data biases by Ackermann, McEnally, and Ravenscraft (1999), Brown, Goetzmann, and Ibbotson (1999), Fung and Hsieh (2000, 2009), Liang (2000), Malkiel and Saha (2005), and Posthuma and Jelle van der Sluis (2003) among others. Researchers have made progress on addressing the self-reporting bias by using the data on funds of hedge funds (FOFs) (Fung and Hsieh, 2000; Aiken, Clifford, and Ellis, 2010) based on the premise that the returns and holdings of FOFs contain information of non-reporting hedge funds and of hedge funds that terminate reporting. These studies are limited to relative small samples of FOFs and rely on assumptions about randomness of the underlying funds that are selected by the FOFs.

[8] An incomplete list of studies examining hedge fund performance includes Amin and Kat (2003), Agarwal and Naik (2004), Agarwal, Bakshi, and Huij (2009), Agarwal, Daniel, and Naik (2010), Agarwal, Fung, Loon, and Naik (2010), Avramov, Kosowski, Naik, and Teo (2009), Bollen and Whaley (2009), Fung and Hsieh (1997, 2001, 2004), Fung, Hsieh, Naik, and Ramadorai (2008), Getmansky, Lo, and Makarov (2004), Hasanhodzic and Lo (2007), Mitchell and Pulvino (2001), Patton (2009) and those examining persistence in hedge fund performance include Kosowski, Naik, and Teo (2007), Boyson (2008), Jagannathan, Malakhov, and Novikov (2010). For a survey of the hedge fund literature, see Agarwal and Naik (2005).

Our approach avoids the limitations discussed above using a comprehensive sample of hedge funds that are mandatorily required to report their positions in 13F securities to the SEC. Needless to say, this approach has its own limitations as it relies on the quarter-end long-equity positions at the hedge fund company (rather than at the individual fund) level. As such, our estimates should be considered as self-reporting biases in the long-equity component of the portfolios of hedge fund companies. Given that the potential limitations of the different approaches are unlikely to be correlated, findings from alternative approaches could be viewed as complementary in obtaining a more comprehensive picture of the self-reporting biases.

Our paper also determines the performance of funds both before they initiate reporting and after they cease reporting. Timing bias associated with delisting studied in this paper is related to the work by Hodder, Jackwerth, and Kolokolova (2008), who estimate the returns of hedge funds after their disappearance from the databases using data on FOFs that invest in a portfolio of hedge funds, assuming some independence between the component funds' self-reporting status and the FOFs' investment decision. One limitation of their approach is that they need to estimate the holdings of FOFs since this data is not commercially available. Moreover, the validity of their assumption is questionable if the FOFs are more likely to pull out the money from funds before or shortly after they disappear from the databases due to the funds' bad performance. Our approach, in contrast, avoids these limitations by exploiting the mandatory disclosure of equity holdings of hedge fund companies without any estimation of holdings.

In terms of using the hedge fund companies' 13F quarterly equity holdings, our paper is related to Griffin and Xu (2009) who use returns imputed from holdings of hedge funds to infer their overall performance. In addition to having a different sample (1,199 funds versus 306 funds in Griffin and Xu (2009)), the focus of our paper is also different as we relate the analysis of performance to the propensity and effects of voluntary reporting by hedge funds.

Our research contributes to the literature in several ways. It is the first study that uses a comprehensive sample of hedge funds to analyze the biases in hedge fund databases due to self-reporting, including the timing bias and the unconditional selection bias. Our results will offer important

benchmarks and references for hedge fund researchers and investment managers who use such data sources. More generally, the study provides insights into the motivation and consequences of voluntary disclosure by hedge funds, and in the same spirit, by other financial institutions. Finally, it raises interesting questions about the role of hedge fund regulation if voluntary disclosures are deemed inadequate. This is particularly pertinent in view of the ongoing debate regarding the mandatory registration of hedge fund managers and more stringent disclosure rules.

The rest of the paper is organized as follows: Section I details data collection and classification, and provides an overview of the complete sample of 13F filing hedge fund companies. Section II develops hypotheses regarding the various types of data biases based on a discussion of the economics of self-reporting. Section III analyzes the change in performance of self-reporting funds before and after their initial and last reporting dates, as well as the effects of reporting initiation and termination on fund flows. Section IV compares the characteristics and return performance of self-reporting and non-reporting hedge fund companies. Finally, Section V concludes.

I. Data and Overview

A. Collection of Hedge Funds

The key inputs to our analyses are data from two sources. The first is the 13F quarter-end equity holdings data from the Thomson Reuters Ownership Data (formerly the CDA/Spectrum database), available through the Wharton Research Data Services (WRDS). The Form 13F filing, which discloses quarter-end holdings of an institution with a maximum of 45-day delay, is mandatory for all institutions that exercise investment discretion over $100 million of assets in equity and some other publicly traded securities.[9] The second source is a comprehensive self-reported hedge fund database created by the union of five major commercial hedge fund databases: CISDM, Eureka, HFR, MSCI, and TASS (henceforth,

[9] More accurately, institutions are required to disclose all securities that appear on the official list of "Section 13(f) Securities," published by the SEC periodically. This list includes almost all publicly traded equity, some preferred stocks, bonds with convertible features, warrant, and publicly traded call and put options. The Thomson Reuters Ownership database contains only holdings of equity, and does not include other securities. See Aragon and Martin (2009) for an analysis of the original 13F filings for a random sample of 250 hedge fund companies.

the "Union Hedge Fund Database" or simply the "Union Database"). Throughout the paper, we call a hedge fund company that appears in the first database a "13F-filing hedge fund company," and a hedge fund that appears in the second data source a "self-reporting hedge fund."

It is worth noting that the level of reporting is often different between the two data sources. The 13F filings are usually aggregated at the institution level, comparable to the level of management companies or sponsors of hedge funds. The reporting unit in the self-reporting databases is usually at the fund level or at the level of pooled portfolio.[10] Hence, pairing a 13F filing institution to funds in the Union Hedge Fund Databases is often a one-to-multiple match (if a match exists). The matching between the two data sources is facilitated by the fact that the latter database reports the sponsors or management companies of individual funds in most cases.

The Thomson Reuters Ownership database consists of a list of 5,188 unique 13F-filing institutions for the 1980 -2008 period. We go through the list manually in order to identify whether each filing institution has major hedge fund management business. There is no official definition of a hedge fund. We adopt the generally accepted notion of hedge funds as pooled private investment vehicles that adopt performance-based compensation and that are operated outside of the securities regulation and registration requirements. As such, we classify a 13F-filing institution as a "hedge fund company" if it satisfies one of the following: (i) It matches the name of one or multiple funds from the Union Hedge Fund Database. (ii) It is listed by industry publications (Hedge Fund Group (HFG), Barron's, Alpha Magazine, and Institutional Investors) as one of the top hedge funds. (iii) The company's own website claims itself as a hedge fund management company or lists hedge fund management as a major line of business.[11] (iv) The company is featured by news articles in Factiva as a hedge fund manager/sponsor. (v) Some 13F filer names are those of individuals. In such cases we search the full individual names over the

[10] A fund is usually defined at the level where participating clients combine their investment dollars and purchase/sell pooled portfolio units, rather than individual securities. The unit price is determined by dividing the market value of the pooled portfolio by the number of outstanding units.

[11] Even if a company's website does not formally mention hedge fund management as part of their business, we still classify the company as a hedge fund manager or sponsor if it manages investment vehicles whose descriptions fit our definition of hedge funds. We exclude private equity and venture capital businesses that also have performance-based compensation.

internet (mostly through the filer and co-filer identity information on various types of SEC filings) and classify the name as a hedge fund if the person is the founder, partner, chairman, or other leading personnel of a hedge fund company. Notable examples in this category include Carl Icahn (founder and chairman of the hedge funds Icahn Capital, L.P. and Icahn Partners) and George Soros (founder and chairman of Soros Fund Management, a hedge fund management company).

Applying the above procedure yields 1,199 unique hedge fund companies among all 13F filing institutions. This number is low relative to the universe of hedge fund companies (our Union Database consists of 4,918 hedge fund companies). The difference is due to the minimum requirement of $100 million in equity positions for 13F-filing institutions, which rules out smaller hedge fund companies and most of the hedge fund companies which primarily invest in non-equities. Given that we use the long-equity holdings for our analysis, it is comforting to notice that the largest percentage of our sample funds belong to the "Equity" or "Equity Long/Short" category (38.4%). Other major categories include Event Driven (10.2%), Sectors (5.4%), and Multi-Strategy (5.7%), which are also likely to have substantial equity exposure.

Our sample is restricted to relatively "pure-play" hedge funds (such as Renaissance Technologies and Pershing Square, and investment companies where hedge funds represent their core business, such as D. E. Shaw and the Blackstone Group/Kailix Advisors), and do not include full-service banks whose investment arms engage in hedge funds business (such as Goldman Sachs Asset Management and UBS Dillon Read), nor do we include mutual fund management companies that enter the hedge fund business, a new phenomenon in recent years (Agarwal, Boyson, and Naik (2009), Cici, Gibson, and Moussawi (2010), and Nohel, Wang, and Zheng (2010)). The reason for the exclusion is that the equity holdings of these full-service institutions in their 13F filings may not be informative about the investments of their hedge funds. Our results are qualitatively similar if we include the institutions with major hedge fund business in the list of hedge funds, except their presence will skew the statistics related to portfolio size because they tend to be much larger than the other hedge funds on the list.

Due to our top-down approach, our list of 13F filing hedge funds companies is considerably longer than those used in prior literature. For example, Brunnermeier and Nagel (2004) analyze the role of hedge funds during the late 1990s technology bubble with a sample of 53 hedge fund companies, and Griffin and Xu (2009) examine the portfolio characteristics and performance of 306 hedge fund companies. In both papers, the authors use a one-sided match from published hedge fund lists to the 13F database for the purpose of their research and did not classify hedge funds that fail to make to a major published list or choose not to report to any database. Given that the focus of this paper is to analyze the selection bias, it is particularly important that we adopt the top-down approach to compile a complete list of 13F-filing hedge funds.

Equally important for our research is the composition of a comprehensive sample of self-reporting hedge funds given that a key variable of our analysis is the self-reporting status of a hedge fund. Most of the research in the area of hedge funds has been conducted using one or more of the self-reported databases. For example, Fung and Hsieh (1997) use monthly data from TASS Management and Paradigm LDC, Ackermann et al. (1999) use a combination of HFR and MAR databases, Liang (1999) uses HFR data and Liang (2000) compares the HFR and TASS databases for different biases in the data. More recently, Agarwal, Daniel, and Naik (2009) show that there is limited overlap among four commercial databases, and using one or two of them may result in exclusion of a large number of self-reporting hedge funds. We extend the approach of Agarwal, Daniel, and Naik (2009) by adding one more database (Eureka) to their list of four and use the union of five major databases to minimize the under-classification of the self-reporting status. Using multiple databases also enables us to resolve occasional discrepancies among different databases. Finally, critical importance of using multiple databases is emphasized by Fung and Hsieh (2009) who document that some funds, classified as defunct/graveyard funds by a database because they stopped reporting to this database, may be active and reporting to another database. We minimize such misclassification by using the superset of performance histories of a fund from the five databases.

The Union Hedge Fund Database contains a sample of 11,417 hedge funds, which includes 6,245 equity-oriented hedge funds, over our sample period.[12] Figure 1 plots a Venn diagram that shows the percentages of funds report to each database individually and to all possible combinations of multiple databases. One of the most striking observations from Figure 1 is that 71% of the funds are covered exclusively by only one database with CISDM and MSCI having the maximum (25.8%) and minimum (5.8%) fraction of unique funds.[13] This underscores the importance of using multiple databases in order to achieve a comprehensive coverage of the hedge fund universe.

[Insert Figure 1 here.]

B. Classification of the Self-Reporting Status of Hedge Funds

We next classify the self-reporting status of all the 1,199 hedge fund companies that file 13F by matching them to the Union Database. The classification entails two steps. In the first step, we match by name allowing minor variations. For example, "DKR Capital" from the 13F list is matched to "DKR Capital Inc." in the Union Database. The name-matching produces 645 self-reporting fund companies, or 53.8% of all 13F filing fund companies.

In the next step, we compute the correlation between returns imputed from the 13F quarterly holdings (henceforth, "13F portfolio returns") and returns reported in the Union Database (henceforth, "self-reported returns"). For the former, we compute the monthly returns of a fund company assuming it holds the most recently disclosed quarter-end holdings. For the latter, we compute the average monthly returns of all funds reported in the Union Database that belong to the same fund management company, weighted by their assets under management. 60 pairs (or 9.3% of the 645 self-reporting fund companies)

[12] We take advantage of using multiple databases to fill the missing strategy information if the fund is covered by more than one database. However, despite this exercise, we still have strategy field missing for 483 out of the 11,417 funds in our sample and therefore we cannot determine if these funds are equity-oriented.

[13] A major determinant in the choice of databases to which funds report is the subscriber clientele of the databases (in terms of both characteristics and geography). Most of the funds choose not to report to multiple databases because of the additional cost due to the different requirement imposed by different data vendors on reporting funds, such as the types of data fields, availability of audited financial statements, etc.

turn out to have negative correlations[14], and for 219 pairs, the correlation is not defined due to lack of overlapping periods of data from both data sources. The self-reporting status of these funds is not convincingly established and therefore we exclude them from our main analysis (that is, they are considered neither self-reporting nor non-reporting). As a result, we end up with 366 self-reporting funds and 554 non-reporting funds.

Figure 2 plots the distribution of all 13F-filings and the subset of self-reporting hedge fund companies over the years. Also plotted is the average portfolio size imputed from the 13F quarter-end holdings for both groups of fund companies, expressed in 2008 constant dollars using the Consumer Price Index (CPI) deflator. Figure 2 shows that both the number of 13F filing hedge fund companies and that of self-reporting fund companies have steadily increased over our sample period from 1980 to 2008, with a marked jump in the number of 13F filing hedge fund companies since 2001. Interestingly, the average portfolio size of self-reporting funds was higher than that of the non-reporting funds before 1988, but has been consistently lower than the latter since 1988.

Several forces underlie the changes in the relative size of the reporting and non-reporting funds. First, macro funds, which tend to be large in size, dominated the hedge fund industry prior to the 1990s. The trading strategies of these funds are hard to reverse engineer, implying lower costs of reporting to databases. In contrast, smaller long-equity short funds have become more popular since 1990s. These funds are more sensitive about trading secrecy and hence are less willing to report to databases. Second, there has been a structural change in the hedge fund investor profile in the 1990s. While high net-worth individuals were the predominant investors in the earlier period, institutional investors became the mainstay in the more recent time. This shift can potentially explain why large funds chose to report to commercial databases prior to 1988 to reach out to prospective retail investors but switched to alternative channels afterwards for marketing to institutional investors.

[Insert Figure 2 here.]

[14] Griffin and Xu (2009) report the same percentage number in their sample as 8.5%. They discuss different reasons for correlation being less than one, including some funds within the 13F companies missing from commercial databases and short-term trading being not captured in the 13F database.

Once we identify the self-reporting status of hedge fund companies and the periods during which they report to the Union Database, our analyses almost exclusively rely on the information from 13F filings. As a result, the unit of observation is at the hedge fund management company level, which we will term interchangeably as "hedge funds" for the rest of the paper when there is no danger of confusion.

The main advantage of relying on the 13F data source is that there is little bias associated with selective reporting as long as they meet the minimum hurdle of assets under management ($100 million). Therefore, comparing the portfolio composition and return performance of self-reporting with non-reporting funds could offer an unbiased view of hedge fund performance and shed light on the selection bias introduced by self-reporting. Having said that, it is important to interpret and view our results in light of the limitations of the Thomson Reuters Ownership database. This database only captures the long-equity portfolios of hedge fund companies and masks intra-quarter trading. Hence, we cannot conclude on the reporting-related biases at the aggregate portfolio level or at the individual fund level, given the limitations of our data.

Our research methodology hinges on the proposition that long-equity positions are a substantive portion of the portfolios of equity-oriented hedge funds and that the returns imputed from quarter-end equity long positions are informative about the total returns of these hedge funds. This proposition is also the premise that underlies the earlier work by Brunnermeier and Nagel (2004) and Griffin and Xu (2009). We believe that this proposition is valid on average for several reasons.

First, among the self-reporting fund companies, we find that the average return correlation between their 13F holdings (equity-long positions only, and before fees) and their fund returns reported to hedge fund databases (aggregated at the fund company level and including returns from short positions and non-equity securities, and are net of fees) is 0.54; the median number is slightly higher at 0.57, and the inter-quartile range is 0.34 to 0.77.[15] The correlation is calculated using an average duration of data overlap of 12 years between a fund's appearance in the Union Database and that in the 13F database.

[15] A further investigation reveals that the ten hedge fund companies that exhibit the highest return correlations (ranging from 0.96 to 0.99) all have funds in equity-oriented strategies including long/short equity, equity hedge, event driven, and sector.

Both numbers are comparable to the correlation of 0.55 (mean) and 0.64 (median) reported in Griffin and Xu's (2009) sample.

In addition, two pieces of evidence from hedge fund holdings data underscore the importance of long-equity positions for our sample funds. We obtain the first evidence from retrieving and evaluating the call/put option positions disclosed in the original 13F filings[16] (rather than the data processed by Thomson Reuters). We find that 49% of the hedge fund companies in our sample never reported any option positions during our sample period. The average value of call (put) options as a percentage of the total portfolio for all sample funds is 4.1% (4.0%), indicating limited benefits of including these options for the purpose of our research. The second piece of evidence is provided by Ang, Gorovyy, and van Inwegen (2010). Using a proprietary dataset of funds of hedge funds, the authors report that hedge funds in the equity and event driven strategies (which constitute the great majority of our sample funds) mainly invest in equity and distressed corporate debt, and hence have relatively low leverage.

Second, the contribution of equity positions to the total returns of hedge funds is evident from the equity market betas of hedge funds. Using the monthly Credit Suisse/Tremont hedge fund indices from January 1993 to May 2009,[17] we find that the market beta of the index of all equity-oriented hedge funds is 0.48. Similarly, the average market beta from the four-factor model of the return index of all the self-reporting hedge funds in our sample is 0.40.

Finally, the constant resistance of hedge funds against ownership disclosure, including the 13F filings, implies that the equity positions are critically informative of their investment strategies. Philip Goldstein, an activist hedge fund manager at Bulldog Investors likens his stock holdings to "trade secrets" as much as the protected formula used to make Coke, and condemning the 13F rule for taking the fund's "property without just compensation in violation of the Fifth Amendment to the Constitution."[18] In the wake of the "quant meltdown" in August 2007, 13F filings that publicize equity positions of major quant

[16] Please note that generally only exchange-traded options are required to be disclosed in the Form 13F. Therefore the original 13F filings do not include all potential option positions of institutional investors.
[17] Available from: http://www.hedgeindex.com/hedgeindex/en/default.aspx?cy=USD.
[18] For a more detailed discussion, see Philip Goldstein's interview in September 12, 2006 issue of *Business Week*: http://www.businessweek.com/print/investor/content/sep2006/pi20060913_356291.htm.

hedge funds took much of the blame for inviting "copycats" into the increasingly correlated and crowded strategy space, which eventually contributed to the "death spiral" in the summer of 2007 when many funds employing similar strategies attempted to cut their risks simultaneously in response to their losses (Khandani and Lo (2007)). A recent paper by Agarwal, Jiang, Tang, and Yang (2010) presents large-sample evidence of strategic delays by hedge funds in their 13F disclosure.

C. Overview of Hedge Funds using Quarter-End Equity Holdings Data

Before we compare self-reporting hedge fund companies to non-reporting ones, we take advantage of the complete list of 13F filing hedge funds to report the summary statistics of their equity-portfolio characteristics and the return performance of their long-equity positions. Further, we compare their statistics with those of other categories of 13F-filing institutional investors. Such an analysis represents the most complete overview of the long-equity positions of hedge funds in the literature.

The other categories that we compare hedge funds to include: (1) banks and insurance companies (a combination of type 1 and type 2 institutions by the Thomson classification); (2) mutual fund management companies (type 3 institutions by the Thomson classification); (3) independent investment advisors (type 4 institutions by the Thomson classification, excluding hedge funds classified by us), and (4) others (the type 5 institutions by the Thomson classification, excluding hedge funds classified by us). The Thomson Reuters type code 5 since 1998 is known to be problematic in that the category could include many misclassified institutions that should be assigned with the other type codes (mostly, type code 4). Therefore, we reassign an institution which has type code 5 after 1998 to an earlier code if available and different from 5. The comparison is reported in Table I.

[Insert Table I here.]

Table I shows that hedge fund companies are much smaller in size compared to institutions of other categories where size is calculated as the total value of the quarter-end equity portfolio using reported shares and corresponding quarter-end stock prices reported in CRSP. In particular, the average size of a hedge fund company's long equity portfolio is 16.5% of that of a mutual fund management

company; though the difference in the total assets under management is likely to be smaller because the former may have exposures while mutual funds are more or less constrained to hold long positions in publically traded securities.

Hedge funds also tend to be younger. Because age changes mechanically with the reporting year for the same institution in a panel data, we simply consider the inception year of a filing institution as a proxy for age. The inception year is left-censored at 1980 which is the earliest year that Thomson Reuters has data coverage. The median hedge fund company started 13F filing 19 years after the median bank/insurance company; and the same differences with mutual fund companies and investment advisors are 17 and 7 years, respectively. These differences are all statistically significant at the 1% level.

Three measures point uniformly to the more active nature of hedge funds in portfolio management. First, they are significantly (at the 1% level) less diversified than all other categories as measured by median portfolio Herfindahl index, and the biggest difference is with respect to the mutual funds (0.047 vs. 0.018). The same relation holds using the mean statistic except for the comparison with the "Other" category. Second, hedge funds' portfolio volatility is higher than all other categories using both mean (5.53%) and median (4.93%) standard deviation of monthly returns imputed from quarter-end holdings, and the differences are all significant at the 1% level.

Third, hedge funds' inter-quarter portfolio turnover rates, average (median) of 91.6% (81.5%) annually, is about twice as high as that of mutual funds, investment advisors, and other institutions, and more than three times that of bank and insurance companies, with all differences being significant at the 1% level. Here, the portfolio turnover rate is compounded from the inter-quarter turnover rates[19], calculated as the lesser of purchases and sales, divided by the average portfolio size of the last and the current quarter.[20] Purchases (sales) are calculated as the sum of the products of positive (negative) changes in the

[19] It is possible that some hedge funds may be very high-frequency traders by actively trading within the quarter and therefore may not report any long equity positions at the end of a quarter. However, this will only result in our underestimating the actual portfolio turnover rates of such hedge funds.

[20] We follow the practice of Morningstar, the leading mutual fund research company, in defining portfolio turnover rates. It is worth pointing out that our turnover figures for mutual funds are lower than those reported in the

number of shares in the holdings from the previous quarter-end to the current quarter-end, and the average of the stocks prices at the two quarter-ends. The logic of using the *lesser* (rather than the average) of purchases and sales is to free the measure from the impact of net flows. The comparison between hedge funds and mutual funds in terms of portfolio concentration and turnover rates is consistent with Griffin and Xu's (2009) findings using similar measures.

Does hedge funds' more active management bring about superior returns? The answer is not obvious from Table I. We compute monthly excess return for each institution as the difference between the imputed portfolio return and the CRSP value-weighted equity market return. For the former, we assume that in each month, the institution holds the portfolio disclosed at the most recent past quarter-end[21] and calculate the buy-and-hold return for the month. It turns out that all categories have average and median excess returns close to zero.[22] Moreover, hedge funds outperform all the other institutions on average, though only the differences between the average excess returns of hedge funds and those of investment advisors and other institutions are statistically significant. If we use median excess return as the metric, hedge funds outperform all other institutions significantly. When we use one-factor and four-factor alphas as the performance metric, hedge funds seem to underperform other institutions on average, with all pair-wise differences being significant except the difference in one-factor alphas of hedge funds and "Other" institutions.[23] However, the magnitude of the differences is small. The overall evidence suggests that hedge funds do not command superior returns from their long-equity positions on average.[24] We will analyze the performance within the hedge fund group in more detail in the following sections.

Morningstar database because the 13F data does not account for intra-quarter trading, which may significantly contribute to the funds' turnover.

[21] We code the monthly return as missing if the lag between the current month and the last quarter-end when the portfolio information is available exceeds six months.

[22] Given that institutions as a whole hold a majority stake in public equities (the percentage increased from 32% in the beginning to 66% to the end of our sample period), it is not surprising that on average they simply perform at par with the market.

[23] Since we examine the performance of long equity portfolios of institutions, we do not need to use multifactor models augmented by option factors as in Agarwal and Naik (2004) and Fung and Hsieh (2001, 2004).

[24] This does not rule out the possibility that hedge funds may be delivering superior performance on their non-equity component of the portfolios.

II. The Economics of Self-Reporting: Hypothesis Development

After characterizing the sample of all 13F filing hedge fund companies, the natural question to ask is when hedge funds choose to report to commercial hedge fund databases, or whether they ever choose to report at all. Answer to this question will shed light on the systematic differences, if any, between hedge fund information (especially returns) accessible from the commercial databases and information that is hidden. Characterizing such differences is the key to understanding the selection bias in the databases, which has important implications for hedge fund research.

Like other economic activities, the reporting behavior of hedge funds is an outcome of cost-benefit trade-offs. The benefit that is most cited by hedge fund data vendors in marketing their services to hedge funds is that listing in a database enhances a fund's exposure to potential investors, including fund of funds, foundations, banks, endowments, pensions, consultants, and high net worth individuals. Such benefits are likely to be more significant for small- and medium-sized fund companies that desire more publicity but lack the resources for aggressive direct marketing.

The main cost of reporting is a partial loss of secrecy and privacy that some hedge funds value. The SEC's efforts to push for more disclosure by hedge fund companies have faced strong resistance,[25] indicating the industry's general reluctance for or even strong opposition to more transparency. Though self-reporting hedge funds in general do not reveal holdings information to hedge fund databases, the reported information, such as general descriptions of style classification, asset allocation, monthly returns, and leverage/hedging ratios, is often revealing of the funds' investment strategy. For example, proposed "hedge fund replication" strategies that promise to provide low-cost hedge fund exposure are mostly built on the self-reported information (Kat and Palaro (2006)). Moreover, keeping the reporting status constitutes a commitment to revealing a fixed set of information at fixed time intervals. Such a rigid

[25] Such resistance culminated in *Goldstein vs. Securities and Exchange Commission* (details in http://www.seclaw.com/docs/ref/GoldsteinSEC04-1434.pdf) where Phillip Goldstein, the manager of hedge fund Bulldog, challenged an SEC 2004 rule that required most hedge fund advisors to register with the SEC by early 2006. The decision of the Court, made in June 2006, was mostly in favor of Goldstein.

schedule reduces a hedge fund company's flexibility in marketing, such as featuring a subset of information or a chosen period of return performance that is most favorable to the fund.

An additional cost is related to the clientele of database subscribers. Potential long-term investors targeted directly by hedge funds (mostly large institutions, fiduciaries, and some funds-of-funds) are different from those attracted to hedge funds through database subscription, which tend to be more "retail" based and shorter-term, consisting disproportionately of small institutions and individuals. Stulz (2007) mentions that retail investors may require more "hand-holding" subsequent to poor performance. Mutual fund literature also provides some evidence on institutional money being more "sticky" than retail in that the former does not chase short-term performance as much as the latter (James and Karceski (2006), Chen, Goldstein, and Jiang (2009)). Hedge funds usually value long-term investors whose investing or divesting decisions are not sensitive to short-term performance. Hence, some hedge funds may not want to be exposed to the clientele that are typical of database subscribers.

While it is understandable that funds may not desire to appear in commercial databases during periods of poor performance because they do not wish to publicize the embarrassment, it is much less clear whether reporting funds are overall better or worse performers than non-reporting ones. On one hand, the extreme poor performers may be unlikely to appear in a database simply because they do not survive long enough to satisfy the requirement for track records by most data vendors. On the other hand, some successful hedge funds may prefer to voluntarily report as it serves as a strong signal for better transparency and institutional quality. At the same time, the very successful funds can also shun reporting given their low needs for enhanced visibility and possibly full capacity. In addition, Lhabitant (2006) offers one explanation to the general absence of the largest and most successful hedge funds in the commercial databases: these funds might be concerned that communicating performance to a data vendor may lead to inclusion in that data vendor's index, which automatically raises the performance of that index. As a result, these hedge funds' individual performance will appear less differentiated. If these arguments are valid, then both the periods of self-reporting and the sample of reporting funds will be biased toward average performance.

III. Biases Conditional on Self-Reporting: Reporting Initiation and Termination

We start with the first type of selection bias concerning the subsample of self-reporting funds: When do fund companies initiate reporting and when do they terminate? If funds tend to choose reporting initiation after a run of superior performance or to terminate reporting following subpar returns, examining the performance of funds while they appear in the database can contribute to a "timing bias." Until now, the extant literature has not been able to quantify these two forms of timing bias as the performance of funds "before birth" and "after death" (with respect to the databases) is not observable from the commercial databases. Since our return analysis is based on 13F filings, which are not constrained by funds' reporting status to the commercial databases, it allows us to shed light on these two biases, hitherto unexplored in the hedge fund literature.

A. First form of timing bias: Comparison of fund companies before and after the reporting initiation

The Union Hedge Fund Database provides information on the dates when the hedge funds enter the databases. If a fund company reports to multiple constituent sources in the Union Database, we use the earliest date. Among all 13F-filing hedge fund companies, 103 out of the 366 self-reporting funds afford the before-after analysis if we require a minimum of 12 months of return information around the initial reporting date and the existence of such information on both sides of the date. For 77 funds, there is accurate information on the initial reporting dates provided by one commercial database. For rest of the funds, such exact information is not available and all we can observe is the first date of the performance data recorded in the database. Following the practice of the literature (e.g., Ackermann, McEnally, and Ravenscraft (1999)), for such funds we add 24 months to the first performance dates to form the approximate first reporting dates, effectively assuming a typical practice of 24 months' back-filling by reporting funds. This assumption could be problematic as Fung and Hsieh (2009) document periods longer than 24 months between the inception and first reporting dates. Hence, for robustness, we conduct our analyses using both the entire sample and the subsample with accurate information on initial reporting

date. We focus more on the latter results for our discussion that follows. Please note that since we already account for the backfilling bias in our analysis, first form of the timing bias examined here is distinct from the backfilling bias.

For each fund whose reporting date falls within the 1980-2008 period, we compare the return measures (imputed from the 13F holdings) during the 24-month period before reporting to the Union Database and the 24-month period thereafter (or as many months as possible subject to a minimum of 12 months in total on both sides of the reporting initiation month). Results are reported in Table II.

[Insert Table II here.]

Panel A of Table II shows that performance is overall worse after initial reporting compared to the period before, though the difference is not statistically significant. The difference in the average raw monthly return is 52 basis points, or 6 percent on an annualized basis.

Importantly, when we use the subsample of funds for which we have accurate initial reporting dates, we observe from Panel B of Table II that the performance after initial reporting is significantly lower than that before reporting. The average raw returns and measures of risk-adjusted performance (excess returns, CAPM alpha, and four-factor alpha) are lower by 90, 73, 58, and 24 basis points per month respectively, and all except four-factor alpha differences being statistically significant at the 1% level in addition to being economically meaningful. We obtain similar results using the median performance with the corresponding figures being 49, 32, 33, and 19 basis points per month respectively. Finally, a difference-in-difference approach, which computes the difference around the initial reporting date between raw returns of reporting and non-reporting hedge funds also indicate significant deterioration using both the median and mean values.

The results in Panel B are much more significant and coherent, compared to the full-sample results in Panel A, albeit with a smaller sample, indicating that accurate reporting dates are essential to identify the selection bias around reporting initiation for the sample of self-reporting funds, providing support to the arguments in Fung and Hsieh (2009).

The interpretation of this difference is further facilitated by Figure 3. Panels A and B plot the time series of the monthly raw returns and excess returns averaged across the 77 hedge funds (with accurate initial self-reporting dates) from 24 months before the reporting month, to 24 months afterwards. The two dotted horizontal lines marked the time-series averages of the two sub-periods. The figure indicates that funds choose to initiate self-reporting after a run of superior performance, but such performance does not persist in that it mean-reverts to levels at par with the market after reporting initiation.

[Insert Figure 3 here.]

The subsequent normal performance after a run of superior one supports the hypothesis of strategic timing in initiating self-reporting by hedge funds, if they decide to report at some time. Given the customary back-filling practice (that is, hedge funds usually send retrospective return data to commercial databases), our analysis shows that the early periods of reported returns contain an upward bias for inferring the reported funds' normal performance. Hence, the trimming of early-period returns in return analysis as adopted by the literature is justified. However, the different results between Panels A and B of Table II also points to the limitation of the simple 24-month trimming practice as it does not seem to identify the true initial reporting dates, and hence does not completely clear the first type of timing bias in reporting initiation.

B. Hazard Analysis for reporting initiation

To relate the timing bias to other time-varying fund characteristics in addition to return performance, we present the hazard analysis of reporting initiation for the subsample of fund companies with accurate initial reporting date information. In the language of hazard analysis, in our case, the "failure" event is the hedge fund's first appearance in the hedge fund Union Database. Thus, the hazard rate $h(t)$ is the hedge fund's probability of reporting initiation in a given period *t*, conditional on the fact that it did not initiate reporting in any of the previous periods. We start with a time-varying sample of non-reporting funds. Once a hedge fund has initiated reporting, it exits the sample because the spell has "failed". We estimate our instantaneous hazard model with respect to a set of time-varying explanatory

variables (*X*), such as fund characteristics. That is, the values of these variables are tracked dynamically since the fund's first appearance in the Thomson Reuters database until its first reporting date to the Union Hedge Fund Database (observations of completed spells) or to the end of our sample period (observations of censored spells).

We adopt the semi-parametric Cox proportional hazard model (Cox (1972)) which estimates the relation between the instantaneous hazard rates and the covariates by maximizing a partial-likelihood function. In this model, the hazard rate is assumed to be:

$$h(t) = h(0)e^{X_t'\beta} \tag{1}$$

where *t* is the number of periods since the fund company's first appearance in the Thomson Reuters database. In this setting, a positive coefficient β_k indicates that an increase in the covariate X_k is associated with an increase in the instantaneous probability of hedge funds' initiating reporting to a database during period *t*. We conduct the analysis at the quarterly frequency and results are reported in Table III. Following the norm adopted in hazard analyses and to facilitate interpretation, Table III reports the hazard ratio (also called "exponentiated coefficient") associated with each covariate rather than the raw coefficients β_k where the ratio is defined as: $h(t \mid X_k^{'} = X_k + 1, X_{-k}) / h(t \mid X_k) = e^{\beta_k}$. A hazard ratio that is greater (smaller) than unit indicates a positive (negative) contribution of the covariate to the instantaneous probability of reporting initiation. The z-statistics in the table testifies the significance of raw coefficient (β_k) being different from zero, or of the hazard ratio (e^{β_k}) being different from unit.

[Insert Table III here]

According to Table III, hedge funds after better performing periods have higher probability of reporting initiation during the current period: hazard ratios associated with performance (lagged) are significantly higher than one. This result supports evidence in Figure 3: hedge fund's performance tends to be abnormally high before reporting initiation. When risk-adjusted measures of performance are considered (columns (2)-(4) in Table III) and market returns are controlled for, the evidence suggests that hedge funds have higher probability of reporting initiation after a period of good market performance.

This result is consistent with the ease in marketing funds when overall market performs well. The coefficient of the market return is insignificant when performance is measured by raw returns because the latter already contains information about market returns.

Table III highlights additional elements in hedge funds' strategic timing in reporting initiation. First, when the proxy for the aggregate flow to hedge fund industry is high, hedge funds have significantly lower probability of reporting initiation. Here we approximate the aggregate flow by the total increase in the equity portfolio value of all 13F-filing hedge funds, netting out the increase due to stock price appreciation. This evidence suggests that a boom in the hedge fund industry provides enough capital to many funds, leading to their lowered needs to enhance exposure to potential investors by reporting initiation.

Second, hedge funds are less likely to initiate reporting during periods of higher portfolio return volatility. Prior literature shows that flows to hedge funds and mutual funds are dampened by return volatility conditional on performance (Ding, Getmansky, Liang, and Wermers (2009), Huang, Wei, and Yan (2007)), indicating that investors tend to discount fund returns when the volatility is also high. Moreover, the Sharpe Ratio is a common performance measure adopted by commercial databases, and this metric is unfavorable to funds with volatile returns. As a result, funds are reluctant to publicize themselves to commercial databases when their returns are volatile.

Finally, hedge funds have higher probability of reporting initiation in their youth stage if they decide to report: the hazard ratios associated with fund age are significantly lower than one. This result is expected as young funds are the most likely to benefit from reporting initiation. The impact of the portfolio concentration (as measured by the average portfolio Herfindahl index) on the reporting initiation is negative and significant at the 10% level. Thus, hedge funds operating more concentrated portfolios are less likely to initiate reporting. This is consistent with the costs of revealing trading secrecy when funds report to databases, an issue that we will discuss in more detail in Section IV.

C. Second form of timing bias: Comparison of fund companies before and after reporting termination

There are 187 funds in our sample that terminated reporting to the Union Database at some point during the 1980-2007 period. For these funds, we are able to analyze the determinants of reporting termination using the same method as we used in Table II for reporting initiation. Moreover, for these funds we have more information about their termination decision due to their reporting status when the decision is made. Results are reported in Table IV.

[Insert Table IV here.]

We observe that the performance after termination of reporting is significantly lower than that before termination. This is not surprising given that most funds exit from commercial databases when their performance starts deteriorating (Ackermann, McEnally, and Ravenscraft (1999), Liang (2000), and Fung and Hsieh (2000, 2002) among others). What is interesting and unique about our analysis here is that we are able to determine the performance of funds after they disappear from the commercial databases. Our analysis is thus analogous to computing the delisting returns for stocks in Shumway (1997) and Shumway and Warther (1999), hence this second form of the timing bias is analogous to a "delisting bias."

Table IV shows that the average monthly raw returns and the three measures of risk-adjusted performance: excess returns, CAPM alpha, and four-factor alpha, are lower by 1.9%, 0.3%, 0.1%, and 0.2% on a monthly basis after the termination of reporting (the first two being significant at the 1% and 5% levels).[26] We obtain similar results for median performance differences with the corresponding figures being 1.5%, 0.2%, 0.03%, and 0.2% per month, with the first and last differences being significant at the 1% level. A graphical illustration of the performance around the reporting termination date is provided in Panels C and D of Figure 3. The message is also similar to what is conveyed by the table.

About 64% of the funds (119 funds) that terminate reporting in our sample provide reasons for termination to the commercial databases. In 112 out of the 119 cases, the given reasons indicate distress (such as liquidation, fund being dormant or data vendor being unable to contact the fund). Other given

[26] The magnitude of excess returns is qualitatively similar to but compares favorably with Hodder, Jackwerth, and Kolokolova's (2008) finding that the average delisted hedge fund held by a sample of fund of hedge funds had a monthly return of -1.86% immediately after it is delisted.

reasons could be positive (such as being closed to new investors) or unclear (such as being merged to another fund) but such cases are rare. When we focus on the subsamples partitioned by stated reasons, we do not find significant differences across the subsamples in the changes in performance after reporting termination, mostly due to the much reduced sample sizes.

In summary, exiting from commercial databases by the reporting funds is overall a sign of deterioration. Interestingly, negative market returns also contribute to higher incidences of report termination—manifested by the higher before-after return gap in raw returns than benchmark-adjusted returns as shown in Table IV. These findings about hedge fund reporting termination are consistent with the patterns associated with stock delisting but with a much milder magnitude, reflecting the fact that fundamental failure is a less dominant reason for hedge fund report termination than for stock delisting. Finally, the combination of good performance prior to reporting initiation (results in the previous section) and poor performance following reporting termination act as offsetting forces that bias the performance tracked by the commercial database toward average.

D. Effects of Self-Reporting on Hedge Fund Flows

D1. Reporting initiation

We discussed in Section II and hypothesize that a primary benefit of reporting to hedge fund databases is enhancing a hedge fund company's exposure to potential clients. If such a motive is justified, then a hedge fund should experience, on average, an increase in flows after the initiation of reporting compared to the counterfactual of not reporting. For all funds that initiate reporting during our sample period, we can isolate the quarterly observations from four quarters before the initial reporting date to four quarters afterwards. We then conduct the following regression at the fund (indexed by *i*)-quarter (indexed by *t*) level:

$$Flow_{i,t} = \sum_{j=-4}^{4} \lambda_j D_{t-j} + \beta Performance_{t-3,t} + \gamma Control_{i,t-1} + \varepsilon_{i,t} \qquad (2)$$

In (2), $Flow_{i,t}$ is calculated as $(Size_{i,t} - Ret_{i,t}*Size_{i,t-1}) / Size_{i,t-1}$, all using disclosed holdings in Form 13F. It measures the change in the value of a fund's equity portfolio due to changes in investment by the funds' investors (and not due to the changes in the stock prices), and is a proxy for the net fund flows. The all-sample average (median) percentage flow to hedge funds companies is 3.6% (1.4%). D_{t-j} are the dummy variables for four quarters before and after the initial reporting date. $Performance_{t-3:t}$ is the monthly average of the performance measure during the past four quarters that end in the current quarter, and $Control_{i,t-1}$ are lagged control variables including portfolio size (in log), fund age (numbers of quarters since first appearance on Thomson Reuters, in log), portfolio turnover rates, and portfolio volatility. Based on the lessons learnt from Table II (discussed in Section III.A), we focus on the subsample of funds with accurate initial reporting dates only. Results are reported in Panel A of Table V.

[Insert Table V here.]

The three columns in Table V Panel A estimate equation (2) using three benchmark-adjusted return performance measures: return in excess of the market, CAPM one-factor alpha, and four-factor alpha. The coefficients on *Performance* tell us that flows are highly responsive (significant at the 1% level) to risk-adjusted returns, regardless of whether we use a simple market benchmark (return in excess of the market) or alphas from one-factor or four-factor models. Our findings are economically significant too. For example, for a one percentage point increase in monthly return in excess of the market (or 12 percentage points during the four quarters when performance is measured), net flows to a fund increase by 2.5% of the total portfolio value (see column 1 of Table V Panel A). This flow pattern is similar to what the literature has documented for mutual funds (e.g., Chevalier and Ellison (1997), Sirri and Tufano (1998)).

Table V shows a small increase in flows during quarters *t+1* and *t+2* using four-factor alphas, where *t* is the initial reporting quarter. However, this increase is transient and does not persist into future quarters, possibly due to a deterioration in performance after reporting initiation, as we show earlier in our paper. When we test for changes in flows over the full window through a formal F-test:

$\sum_{j=0}^{4} \lambda_j - \sum_{j=-4}^{-1} \lambda_j = 0$, we are unable to reject the null of equality. Therefore, reporting to databases does not lead to higher flows over a longer window comparing flows during the year following initiation to those during the year preceding reporting initiation.

It is worth pointing out that we do not observe the counterfactuals—flows that would prevail had the reporting funds chosen not to initiate reporting. It is possible that funds anticipating loss of flows from existing sources would choose to report to databases, and such a decision process biases down the estimate for the incremental flows from exposure through the databases.

D2. Reporting Termination

Lastly, we repeat the analysis used in regression (2) on reporting termination. Results reported in Panel B of Table V show that funds encounter significantly lower net flows (or more outflows) after reporting termination. An F-test of $\sum_{j=0}^{4} \lambda_j - \sum_{j=-4}^{-1} \lambda_j = 0$ is strongly rejected (at the 1% level) in favor of a negative change in net flows across all regression specifications. More specifically, the cumulative net outflows during the quarter of reporting termination and four quarters afterwards amount to 29-34 percent of the lagged portfolio size. This evidence adds further support to a negative delisting bias, i.e., delisting from hedge fund databases is in general a sign of deterioration.

IV. The Unconditional Self-Reporting Bias: Comparing Self-Reporting and Non-Reporting Hedge Funds

As a next step, we move up from the subsample of self-reporting funds to the full sample and ask the question "who report." Our answer relies on the comparison of the pooled sample of 13F-filing hedge fund companies that never appear in the Union Database (there are 554 such non-reporting companies) and those that appear in the database for some time during our sample period (there are 366 such self-reporting companies). To reduce noise, we do not include the 279 fund companies whose reporting status cannot be accurately verified.

A. Comparison of fund characteristics

Table VI reports the comparison of fund companies and portfolio characteristics: portfolio size, portfolio concentration, returns volatility, portfolio turnover rate, and fund company inception year.

[Insert Table VI here.]

In Panel A, we compare the characteristics of never-reporting funds with those of ever-reporting ones using information from all time periods as available on the Thomson Reuters. Panel A of Table VI reveals several patterns regarding the all-time characteristics of self-reporting funds. First, the portfolio size of self-reporting hedge funds are more or less comparable to the non-reporting ones, though the latter has much higher standard deviation. The self-reporting funds are slightly smaller by the mean statistic but somewhat larger by median comparison, indicating that the largest fund companies are under-represented in the set of self-reporting funds. This finding is intuitive as the larger funds are more likely to be the successful ones that are possibly facing decreasing returns to scale and capacity constraints. Such funds may have weaker incentives to report to commercial databases for attracting more capital.

Second, the self-reporting hedge funds have lower portfolio concentration than that of the non-reporting funds as measured by the average portfolio Herfindahl index (average of 0.08 versus 0.11, significant at 1% level). The average monthly return volatilities of the two categories are almost identical, but the self-reporting funds have considerably higher portfolio annualized turnover rates (106%) than that of the non-reporting funds (79%) and the difference is significant at the 1% level. Again these findings conform to the economics of reporting as less concentrated (or more diversified) and higher turnover funds need to worry less about their trading strategies being revealed through self-reporting. Finally, the average inception year (defined as a fund company's first appearance in the Thomson Reuters database) is very similar for both groups, though the median self-reporting fund is two years younger than its non-reporting counterpart.

Table VI Panel A further compares the loadings on common risk factors for self-reporting and non-reporting funds. Interestingly, the equity positions of self-reporting funds have significantly higher exposure to the size (SMB) and book-to-market (HML) factors where the differences in both mean and

median are significant at the 1% level. The difference in the loadings on the market factor follows the same pattern using the median statistic only, and the difference in the loadings on the momentum factor is not significant. To the extent that exposure to common risk factors hardly constitutes trading secrecy, these results support the hypothesis that fund with less conventional trading strategies (i.e., lower factor loadings) are more reluctant to reveal their information to databases.

The two pooled samples compared in Panel A of Table VI are not necessarily directly comparable in that self-reporting and non-reporting fund companies may exist in the Thomson database for different periods and different lengths of time. To refine the comparison, we make the following adjustments: For each self-reporting fund, we crop out the period for which it appears in the Thomson Reuters Ownership database (which may contain periods before, during, and after its reporting to the Union Database). We then find non-reporting fund companies that have 13F data over the same period (or with the maximum overlap). If there are ties in matches, we choose the one that is closest in portfolio size as the self-reporting fund to be the "matching fund." Panel B of Table VI reports the results from such refined comparison.

The comparisons between the two groups regarding the differences in mean and median of turnover rates in Panel B are qualitatively similar to those shown in Panel A, but the magnitudes of the differences are strengthened. Moreover, the differences in the median portfolio concentration are now positive and significant. The portfolio sizes of the paired funds are almost identical, only due to the matching algorithm that is based on this variable. Finally, the matching non-reporting funds are now much older, which is again an artifact of the algorithm which favors matching funds with longer periods of 13F filings.

Please note that the pair-wise comparison analyses reported in Table VI and the hazard analysis (reported in Table III) do not necessarily yield coefficients of the same sign or of similar significance levels. While the former relates the fund characteristics (averaged over the time series) to their propensity to ever report, the latter focuses on how the time-variation in fund characteristics prompt report initiation at certain point of time. For example, the hazard analysis indicates that funds are less likely to initiate

reporting during the period of volatile returns; but reporting funds as a whole do not have less return volatility as compared to non-reporting funds.

B. Comparison of return performance

We next move on to return performance comparison, which underlies the important consequences of the self-reporting-related biases in commercial databases. Such results are reported in Table VII, where Panels A and B adopt the same classification schemes as in the Panels A and B of Table VI.

[Insert Table VII here.]

We observe from Panel A (which uses all-time information as available on Thomson Reuters) that average (median) raw returns of self-reporting funds are significantly higher, at the 1% (5%) level, than those of the non-reporting funds. However, both the magnitude and significance of the differences drop precipitously when the returns are adjusted by the market benchmark (i.e., return in excess of the market), or by the CAPM one-factor or using the four factors (market, size, book-to-market, and momentum) first used in Carhart (1997).

The return differences between the mean and median return measures over the matched time period, reported in Table VII Panel B, indicate that self-reporting funds underperform non-reporting funds by 2-8 basis points monthly using the various performance measures, but none of the differences are statistically significant. Interestingly, the differences by percentile values indicate that for lower percentiles (e.g., the 5^{th} percentile), self-reporting funds perform significantly worse (at the 5% and 10% levels) using two of the three benchmark-adjusted return measures, while the pattern does not hold at percentiles above median. Combined evidence indicates that a small fraction of reporting funds has poor performance and may be struggling; while the most successful ones are no more prone to self-reporting.

The only conflicting difference between the results from Panel A and those from Panel B is the relative ranking of raw performance between the two groups of funds: it is significantly positive in favor of the self-reporting funds in the former while negative (but short of significance) in the latter. But such an inconsistency is not observed using any of the benchmark-adjusted returns. Taken together, these

figures indicate timing of hedge fund reporting based on the market condition: hedge funds that were active during years when the overall market performed well were more likely to report to hedge fund databases. This evidence of timing based on market information complements the analysis in Section III regarding timing on individual fund performance.

The overall evidence is consistent with the hypothesis that young and medium-sized fund companies have a stronger incentive to report to databases to publicize their funds and attract potential investors. Moreover, self-reporting funds are more diversified, employ higher-frequency trading strategies (using portfolio Herfindahl index and turnover rates as proxies), and have higher loadings on common factors—presumably trading secrecy is less likely to be revealed through voluntary disclosure or is less important when portfolio involves more stocks, evolves more quickly, and have more exposure to common risk factors. This pattern echoes Agarwal, Jiang, Tang, and Yang's (2010) finding that hedge funds adopting less conventional investment strategies are more likely to resort to confidential 13F filing in order to delay revealing their quarter-end positions. In both cases, funds who value privacy more are more likely to refrain from voluntary disclosures or to seek exemptions from mandatory ones.

Finally, the difference in the return performance, though slightly in favor of the non-reporting funds, is small.[27] This is good news for the existing and ongoing studies on hedge fund performance because the self-reporting bias may not have a material impact when it comes to performance evaluation. In Section II, we hypothesize that the sample of self-reporting funds might be over-represented by funds with average performance. Therefore the selection bias due to self-reporting could be offset by the absence of both the most and least successful funds. Fung and Hsieh (2000) conjectured, with the support of some anecdotal evidence, that the selection bias due to self-reporting is limited because on the one hand "only funds with good performance want to be included in a database," while on the other hand

[27] This result is consistent with Brav, Jiang, Partnoy, and Thomas (2008) who find that hedge funds reporting to two commercial databases perform worse than the non-reporting ones among the sample of activist hedge funds, but the difference is not statistically significant. Their performance measure is different in that they use the abnormal returns of the companies targeted by the activist funds during the event window.

"managers with superior performance did not necessarily participate in vendors' databases." Our results are supportive of their conjecture.

V. Conclusion

This paper presents a comprehensive study that formally analyzes the self-reporting-related biases in hedge fund databases. We show that a union of commercial databases largely eliminates the unconditional bias in performance due to offsetting effects motivating self-reporting. This is good news for the expanding volume of research based on commercial hedge fund databases. Yet our analyses also demonstrate the desirability of merging multiple databases, the systematic differences in the characteristics between reporting and non-reporting funds, as well as significant forms of timing bias corresponding to the deterioration in performance after both reporting initiation and termination (or delisting) among the subsample of reporting funds. These findings can be important in certain contexts. For example, timing bias related to reporting initiation has implications for examining the performance of emerging funds and managers (Aggarwal and Jorion (2010)).

Relatedly, our analyses indicate non-trivial impacts of market-wide returns on fund reporting initiation/termination and fund flows in that both variables are more sensitive to raw returns than to risk-adjusted returns. Such evidence suggests that hedge funds investors chase absolute as well as excess returns, even though market-wide conditions cannot be attributed to skills of fund managers. As a result, hedge funds time their reporting or termination of reporting in response to their own performance as well as to the market-wide conditions.

Taken together, our research provides important references and benchmarks for hedge fund researchers and investment managers who use commercial databases and publicly available information on portfolio holdings of institutions. Our findings shed light on the motivation and consequences of voluntary disclosure by hedge funds. Finally, by comparing databases from mandatory and voluntary sources, our research also contributes to the ongoing debate regarding more stringent disclosure rules for hedge funds.

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Figure 1
Venn Diagram of the Union Hedge Fund Database

The Union Hedge Fund Database contains a sample of 11,417 hedge funds by merging the following databases: CISDM, Eureka, HFR, MSCI, and TASS. This figure shows the percentage of funds covered by each database individually and by all possible combinations of multiple databases.

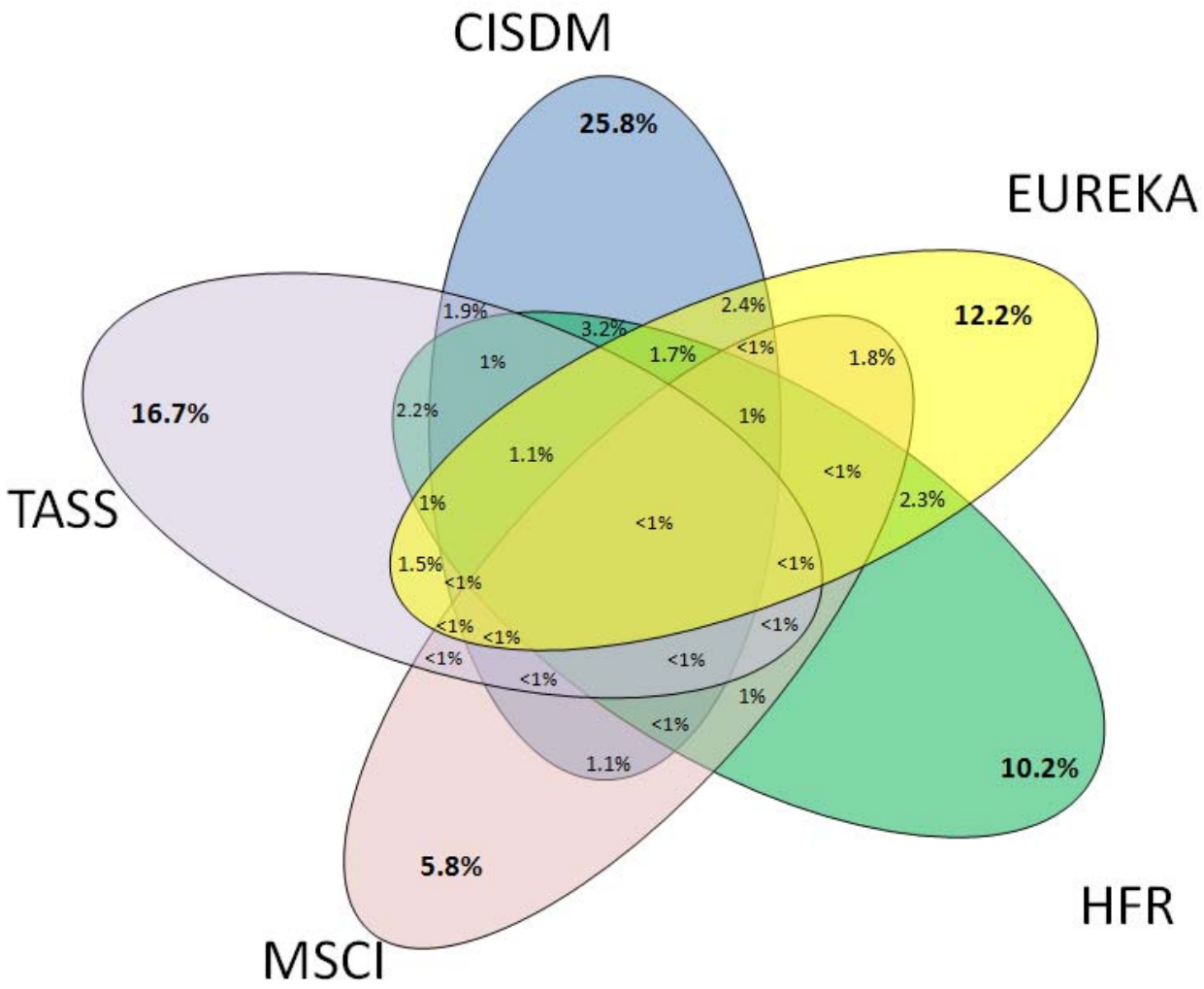


Figure 2

Number of Hedge Funds and Average Portfolio Size

The two solid lines (scale to the left axis) plot the number of 13F-filing hedge funds and the number of self-reporting hedge funds over the period 1980-2008. The two dashed lines (scale to the right axis) plot the average equity portfolio size of self-reporting hedge funds and non-reporting ones. The portfolio size is calculated using the quarter-end holdings disclosed in 13F filings, and is expressed in 2008 constant dollars using the CPI deflator.

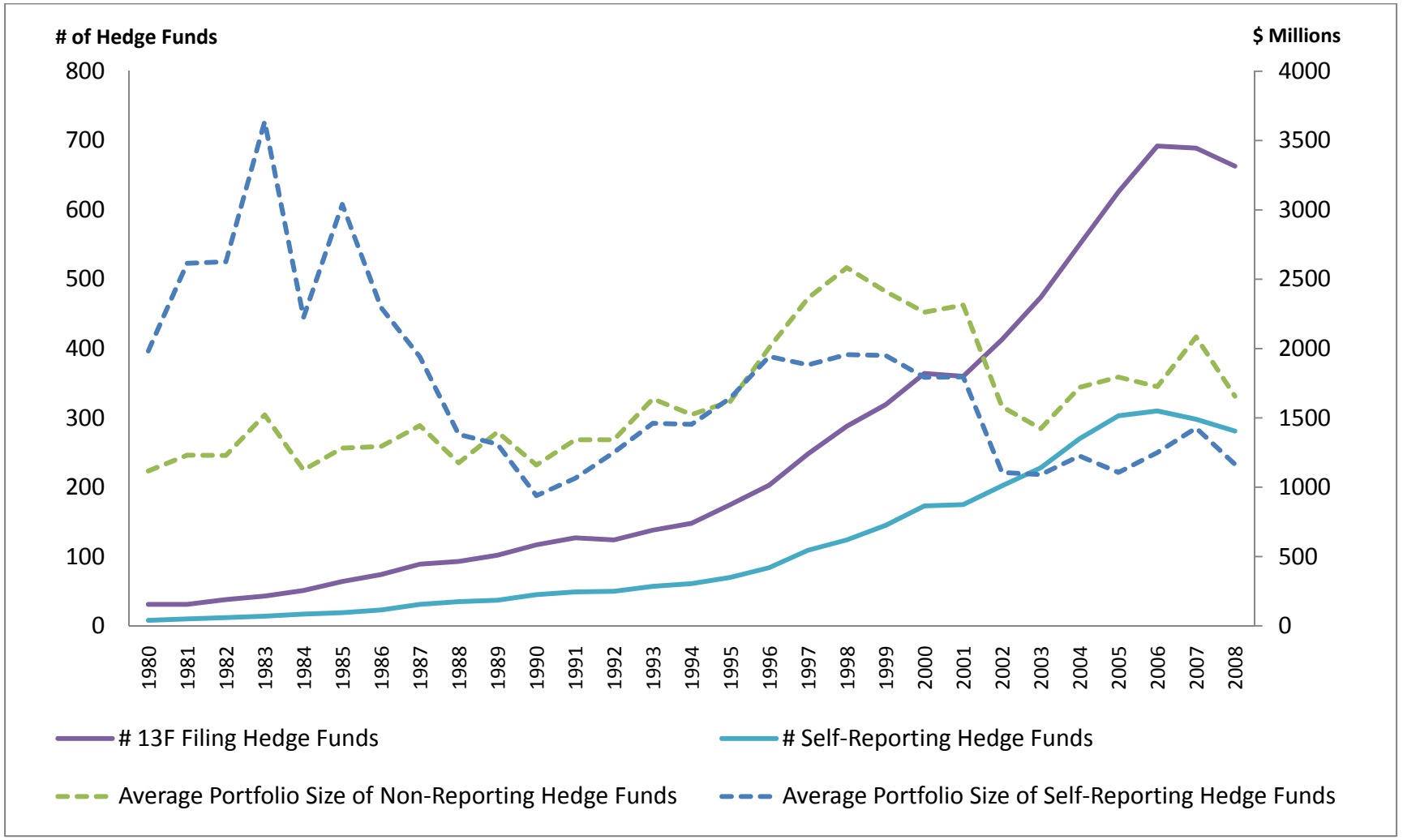
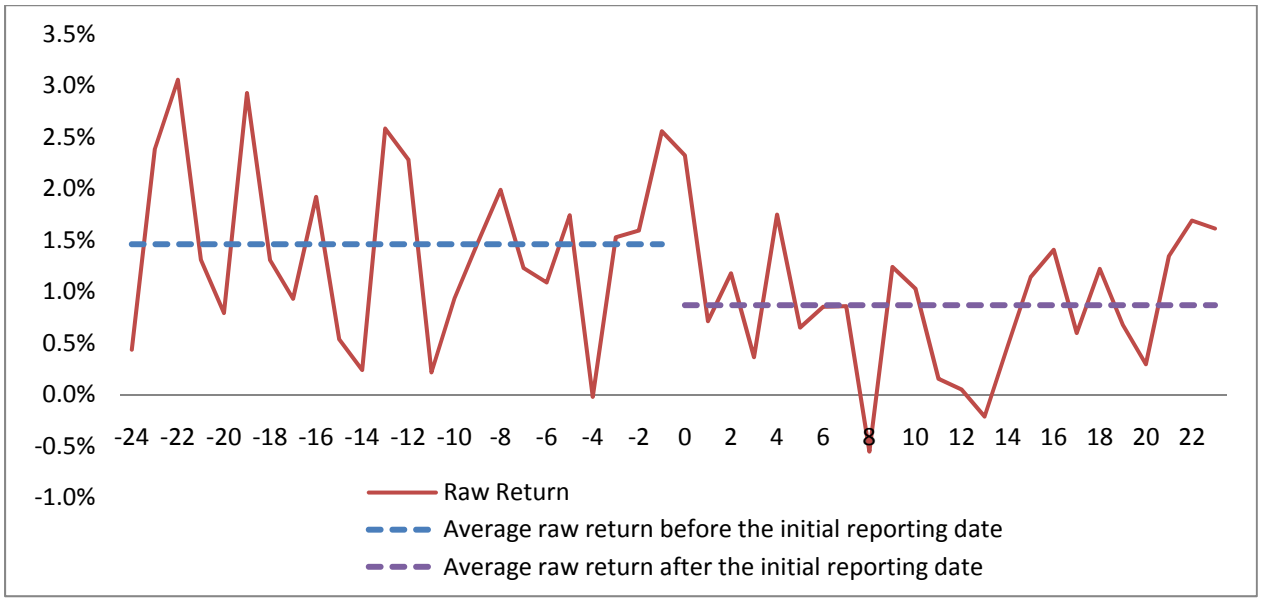


Figure 3

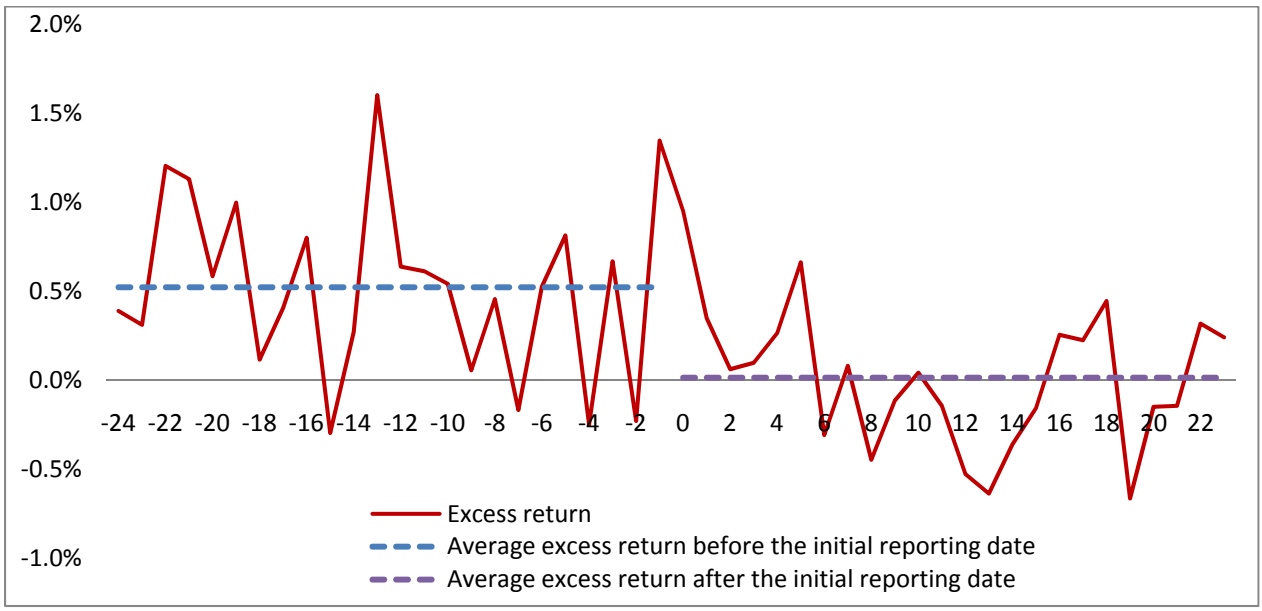
Return Performance around the Initial Reporting Date and the Reporting Termination Date

Panel A shows the time series of monthly raw return for the self-reporting hedge funds from 24 months before the initial reporting date to 24 months afterwards. The imputed portfolio return is constructed by calculating the buy-and-hold return for the month using the most recent past disclosed quarter-end holdings. Panel B shows the time series of monthly excess return for the self-reporting hedge funds from 24 months before the initial reporting date to 24 months afterwards. The excess return is the difference between the imputed portfolio return and the CRSP value-weighted equity market return. Panel C repeats the analyses in Panel A for the reporting termination date. Panel D repeats the analyses in Panel B for the reporting termination date.

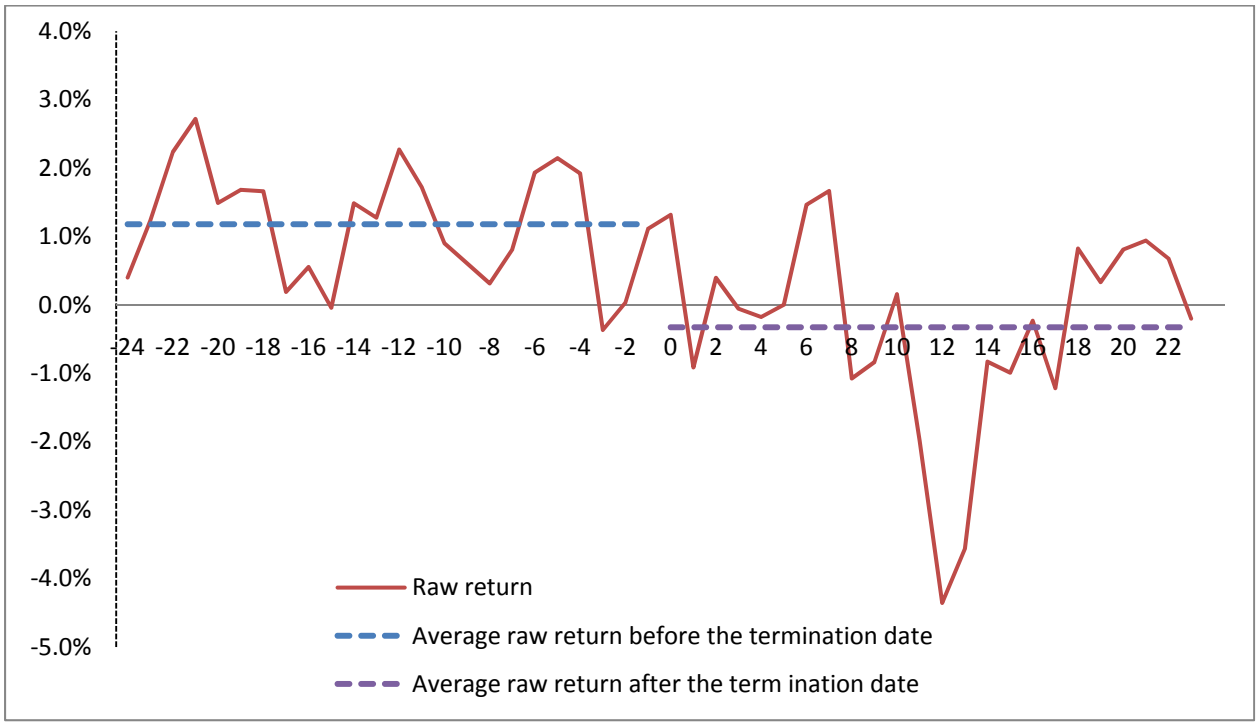
Panel A: Raw Returns around the Initial Reporting Date



Panel B: Excess Returns around the Initial Reporting Date



Panel C: Raw Returns around the Reporting Termination Date



Panel D: Excess Returns around the Reporting Termination Date

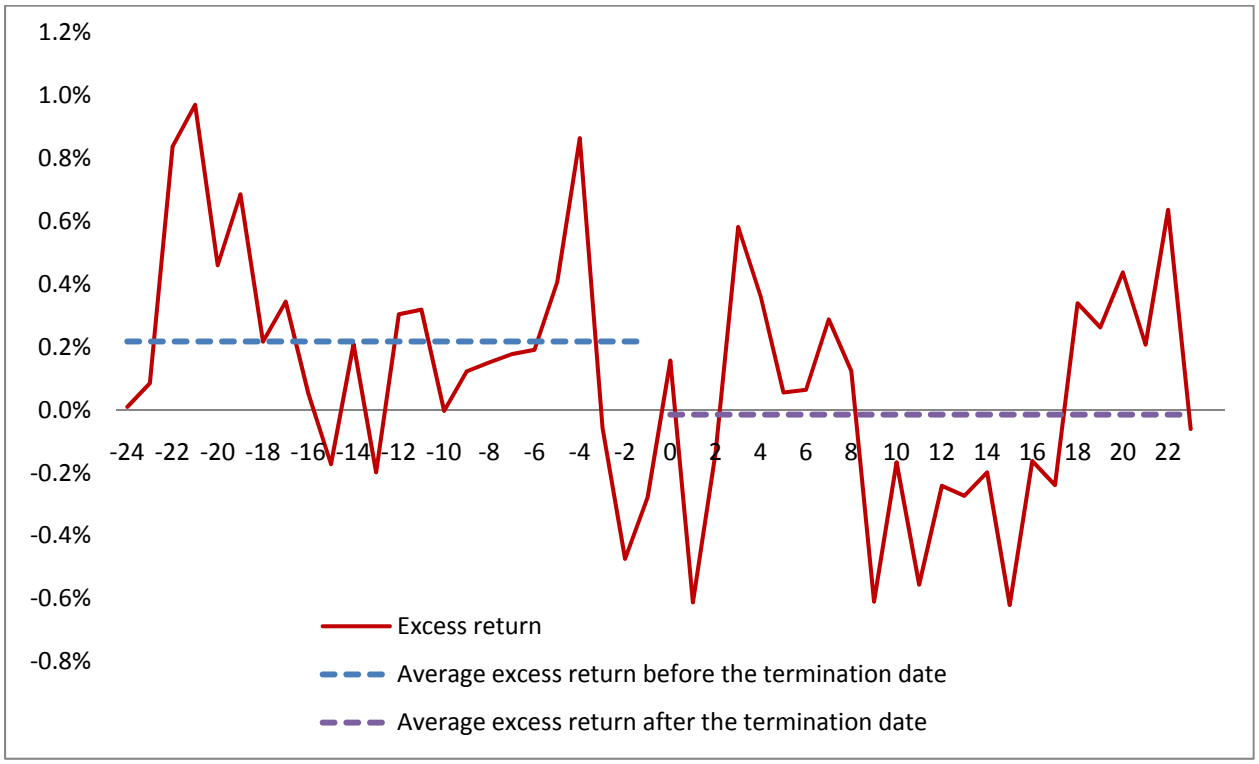


Table I

Comparison of Hedge Funds with Other Categories of 13F-Filling Institutional Investors

The "Hedge fund" category is manually classified (see Section I.A.). The "Bank/insurance" category is a combination of type 1 and type 2 institutions by the classification of Thomson Reuters Ownership Database for 13F filings. The "Mutual fund" category consists of type 3 institutions by Thomson Reuters. The "Investment advisor" category consists of type 4 institutions by Thomson Reuters. The "Other" category includes type 5 institutions by Thomson Reuters (with corrections for coding after 1998). All non-hedge-fund categories exclude classified hedge funds. The portfolio size is calculated as the total value of quarter-end equity portfolio using reported shares and corresponding quarter-end stock prices reported in CRSP. The *Portfolio Herfindahl index* is the Herfindahl index of the disclosed quarter-end equity holdings. The *Monthly return volatility* is the volatility of the imputed portfolio return. The imputed portfolio return is same as defined in Figure 3. The *Annualized portfolio turnover rate* is compounded from the quarterly turnover rates, calculated as the lesser of purchases and sales, divided by the average portfolio size of the last and the current quarter. The *Inception year* is the year of the institution's first appearance in Thomson Reuter (censored at 1980). The *Return in excess of the market* is the same as defined in Figure 3. *One-Factor Alpha* and *Four-Factor Alpha* are the intercepts from CAPM one-factor and Carhart (1997) four-factor models using all available data. *Market Factor*, *SMB Factor*, *HML Factor*, and *Momentum Factor* are estimated factor loadings from Carhart (1997) four-factor model. The t-statistics correspond to the difference between the "Hedge fund" category and other categories. The sample period is 1980-2008. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

	(1) Hedge fund	(2) Bank/insurance	(3) Mutual fund	(4) Investment advisor	(5) Other
Portfolio size ($, million)					
Mean	1041	2609***	6305***	1809***	2431***
t-statistic of the difference	−	−6.58	−5.38	−5.37	−6.76
Median	368	600***	1036***	371	304***
t-statistic of the difference	−	−5.71	−3.71	−0.13	2.97
Portfolio Herfindahl index					
Mean	0.0953	0.0664***	0.0549***	0.0693***	0.1059*
t−statistic of the difference	−	5.23	3.48	4.70	−1.84
Median	0.0465	0.0285***	0.0175***	0.0277***	0.0341***
t-statistic of the difference	−	9.51	14.19	10.77	6.72
Monthly return volatility					
Mean	0.0553	0.0420***	0.0499***	0.0535*	0.0533*
t-statistic of the difference	−	14.28	3.23	1.94	1.96
Median	0.0493	0.0406***	0.0448***	0.0466***	0.0453***
t-statistic of the difference	−	10.02	4.35	2.99	4.02
Annualized portfolio turnover rate					
Mean	0.9162	0.2683***	0.4901***	0.5217***	0.6026***
t-statistic of the difference	−	29.72	13.42	18.40	13.23
Median	0.8149	0.2313***	0.4258***	0.3948***	0.4044***
t-statistic of the difference	−	27.02	11.30	20.19	16.55

	(1) Hedge fund	(2) Bank/insurance	(3) Mutual fund	(4) Investment advisor	(5) Other
Inception year					
Mean	1999	1986***	1987***	1994***	2000**
t-statistic of the difference	−	36.56	25.04	14.07	−2.20
Median	2002	1983***	1985***	1995***	2003*
t-statistic of the difference	−	25.98	23.25	16.65	−1.69
Return in excess of the market					
Mean	0.0008	0.0005	0.0007	0.0000**	0.0001*
t-statistic of the difference	−	0.83	0.04	2.26	1.85
Median	0.0011	0.0007***	0.0007**	0.0008**	0.0008*
t-statistic of the difference	−	2.73	2.17	2.39	1.78
One-Factor Alpha					
Mean	−0.0006	0.0002*	0.0016***	0.0006**	−0.0003
t-statistic of the difference	−	−1.66	−3.44	−2.49	−0.62
Median	−0.0002	0.0002	0.0002	0.0001	−0.0002
t-statistic of the difference		−1.42	−1.18	−0.96	0.10
Four-Factor Alpha					
Mean	−0.0020	0.0008***	−0.0003**	−0.0003***	0.0003***
t-statistic of the difference	−	−6.49	−2.27	−3.87	−5.17
Median	−0.0011	0.0004***	−0.0003**	−0.0002***	0.0000***
t-statistic of the difference	−	−6.01	−2.36	−3.60	−4.40
Market Factor					
Mean	1.0917	0.9573***	1.0439***	1.0418***	1.0398***
t-statistic of the difference	−	10.59	2.71	3.96	4.03
Median	1.0553	0.9628***	1.0309**	1.0209***	1.0014***
t-statistic of the difference	−	10.72	2.16	3.90	5.74
SMB Factor					
Mean	0.3344	−0.0780***	0.1600***	0.1448***	0.1267***
t-statistic of the difference	−	22.60	5.43	10.28	11.82
Median	0.2861	−0.1038***	0.0724***	0.0560***	0.0278***
t-statistic of the difference	−	19.18	7.95	11.06	13.14
HML Factor					
Mean	0.0781	−0.0356***	−0.0953***	−0.0477***	0.0344*
t-statistic of the difference	−	5.42	4.12	6.18	1.88
Median	0.0706	−0.0311***	−0.0599***	−0.0275***	0.0251***
t-statistic of the difference	−	7.18	4.29	7.71	2.98
Momentum Factor					
Mean	−0.0126	−0.0156	−0.0044	−0.0048	−0.0087
t-statistic of the difference	−	0.26	−0.40	−0.64	−0.29
Median	−0.0047	−0.0147	0.0050	−0.0084	−0.0121
t-statistic of the difference	−	1.52	−0.93	0.68	1.16
Number of institutions					
	1199	804	204	2007	1801

Table II

Comparison of Return Performance before and after the Initial Reporting Date

This table compares the return measures for fund companies during the 24-month period before the initial reporting date, and during the 24-month period afterwards. *Raw return* is the portfolio return without adjustment. *Excess return* is the portfolio return in excess of the CRSP value-weighted return. *One-Factor Alpha* and *Four-Factor Alpha* are the intercepts from CAPM one-factor and Carhart (1997) four-factor models using all available data. The pooled 48-month period is used to estimate the beta loadings for the one-factor alpha and four-factor alpha. The one-factor alpha and four-factor alpha are coded as missing if there are fewer than 12 observations during the estimation window. The *Difference-in-Difference* is the difference around the initial reporting date between raw returns of reporting and non-reporting hedge funds. Panel A includes the full sample of self-reporting fund companies where the initial reporting dates for some companies are imputed from the first performance dates. Panel B uses only the subsample where such information is accurately recorded. The t-statistics for the differences between the two samples are reported below difference estimates in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

Panel A: Full Sample

	(1) Raw return	(2) Return in excess of the market	(3) One-factor alpha	(4) Four-factor alpha	(5) Difference-in-Difference
Before initial reporting					
5th Percentile	−0.0346	−0.0331	−0.0237	−0.0228	−0.0282
25th Percentile	−0.0013	−0.0041	−0.0038	−0.0043	−0.0063
Median	0.0129	0.0009	0.0018	0.0010	−0.0010
75th Percentile	0.0211	0.0079	0.0073	0.0060	0.0044
95th Percentile	0.0448	0.0290	0.0254	0.0199	0.0275
Mean	0.0115	0.0036	0.0035	0.0021	0.0010
Std. Dev.	0.0299	0.0253	0.0224	0.0175	0.0236
# funds	103	103	102	102	103
After initial reporting					
5th Percentile	−0.0286	−0.0184	−0.0134	−0.0135	−0.0183
25th Percentile	0.0015	−0.0039	−0.0032	−0.0041	−0.0065
Median	0.0084	0.0016	0.0013	0.0005	0.0001
75th Percentile	0.0174	0.0083	0.0072	0.0055	0.0054
95th Percentile	0.0291	0.0173	0.0164	0.0129	0.0170
Mean	0.0063	0.0012	0.0014	0.0003	−0.0010
Std. Dev.	0.0170	0.0118	0.0093	0.0091	0.0114
# funds	103	103	102	102	103

	(1) Raw return	(2) Return in excess of the market	(3) One-factor alpha	(4) Four-factor alpha	(5) Difference-in-Difference
Differences (t-statistics)					
5th Percentile	0.0061	0.0147	0.0103	0.0093	0.0099
	[0.76]	[0.74]	[0.96]	[0.86]	[0.71]
25th Percentile	0.0028	0.0003	0.0007	0.0002	−0.0002
	[0.18]	[0.10]	[0.26]	[−0.06]	[−0.08]
Median	−0.0046	0.0007	−0.0005	−0.0006	0.0010
	[−1.46]	[0.71]	[−0.54]	[−0.37]	[0.57]
75th Percentile	−0.0037*	0.0004	−0.0002	−0.0005	0.0010
	[−1.82]	[0.09]	[−0.27]	[−0.01]	[0.20]
95th Percentile	−0.0157	−0.0118	−0.0090	−0.0070	−0.0105
	[−1.18]	[−0.91]	[−0.85]	[−0.91]	[−1.02]
Mean	−0.0052	−0.0024	−0.0021	−0.0018	−0.0021
	[−1.52]	[−0.88]	[−0.86]	[−0.90]	[−0.80]

Panel B: Subsample of Fund Companies with Accurate Initial Reporting Date Information

	(1) Raw return	(2) Return in excess of the market	(3) One-factor alpha	(4) Four-factor alpha	(5) Difference-in-Difference
Before initial reporting					
5th Percentile	−0.0147	−0.0094	−0.0116	−0.0099	−0.0116
25th Percentile	0.0075	−0.0006	−0.0013	−0.0030	−0.0040
Median	0.0161	0.0033	0.0018	0.0011	0.0012
75th Percentile	0.0238	0.0094	0.0077	0.0048	0.0057
95th Percentile	0.0454	0.0394	0.0255	0.0136	0.0317
Mean	0.0160	0.0059	0.0034	0.0007	0.0024
Std. Dev.	0.0176	0.0141	0.0114	0.0089	0.0118
# funds	77	77	76	76	76
After initial reporting					
5th Percentile	−0.0333	−0.0226	−0.0236	−0.0159	−0.0257
25th Percentile	0.0029	−0.0041	−0.0053	−0.0046	−0.0062
Median	0.0112	0.0001	−0.0014	−0.0008	−0.0014
75th Percentile	0.0174	0.0056	0.0047	0.0035	0.0036
95th Percentile	0.0271	0.0147	0.0119	0.0102	0.0106
Mean	0.0070	−0.0014	−0.0024	−0.0017	−0.0033
Std. Dev.	0.0185	0.0132	0.0135	0.0119	0.0130
# funds	76	76	76	76	76
Differences (t-statistics)					
5th Percentile	−0.0186	−0.0133	−0.0120	−0.0060	−0.0141
	[−1.31]	[−1.21]	[−1.06]	[−0.35]	[−1.27]
25th Percentile	−0.0046	−0.0035**	−0.0040**	−0.0016	−0.0022
	[−1.02]	[−2.36]	[−2.55]	[−1.21]	[−1.20]
Median	−0.0049***	−0.0032**	−0.0033**	−0.0019	−0.0026*
	[−2.88]	[−2.36]	[−2.51]	[−1.33]	[−1.97]
75th Percentile	−0.0064***	−0.0039	−0.0030	−0.0013	−0.0021
	[−3.34]	[−1.56]	[−1.27]	[−1.19]	[−1.36]
95th Percentile	−0.0184*	−0.0248**	−0.0135*	−0.0034	−0.0211**
	[−1.99]	[−2.51]	[−1.74]	[−0.74]	[−2.04]
Mean	−0.0090***	−0.0073***	−0.0058***	−0.0024	−0.0057***
	[−3.09]	[−3.32]	[−2.85]	[−1.42]	[−2.82]

Table III
Hazard Analysis of the Reporting Initiation

This table presents the hazard analysis of reporting initiation for the subsample of fund companies with accurate initial reporting date information using the Cox proportional hazard model. *Raw return* is the portfolio return without adjustment. *Excess return* is the portfolio return in excess of the CRSP value-weighted return. *One-Factor Alpha* and *Four-Factor Alpha* are the intercepts from CAPM one-factor and Carhart (1997) four-factor models using all available data. *Performance*, *Flow*, *Aggregate Flow to Hedge Fund Industry*, and *Market Return* are calculated over [−1, 0] quarters relative to the quarter of reporting initiation. *Portfolio size* (in log), *Turnover*, and *Return volatility* are as defined in Table I. *Manager age* (in log) is the number of years since the fund company's first appearance in Thomson Reuters. Flow is defined as the change in total portfolio value during the current quarter net of the asset value appreciation/depreciation due to returns, scaled by the portfolio value at the end of the previous quarter. Reported coefficients are hazard ratios which are greater (smaller) than unit when the original coefficients are positive (negative). The z-statistics are calculated using the original coefficients (not hazard ratios) and are reported below coefficient estimates in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

Performance Measure	(1) Raw Return	(2) Return in excess of the market	(3) One-factor alpha	(4) Four-factor alpha
Performance	228.13***	190.80***	83.09***	40.60**
	[2.90]	[2.76]	[3.12]	[2.01]
Aggregate Flow to Hedge Fund Industry	0.2509***	0.2517***	0.2619***	0.2659***
	[−4.84]	[−4.85]	[−4.67]	[−4.68]
Portfolio volatility (%)	0.8245***	0.8242***	0.8287***	0.8342***
	[−6.05]	[−6.05]	[−5.89]	[−5.70]
Manager age (log)	0.9243***	0.9238***	0.9236***	0.9216***
	[−3.17]	[−3.19]	[−3.19]	[−3.28]
Portfolio Herfindahl Index	0.1280*	0.1307*	0.1200*	0.1331*
	[−1.74]	[−1.73]	[−1.83]	[−1.78]
Portfolio size (log)	1.0000	1.0000	1.0000	1.0000
	[0.62]	[0.63]	[0.72]	[0.66]
Turnover	0.6650	0.6623	0.6723	0.6975
	[−1.17]	[−1.18]	[−1.14]	[−1.05]
Flow	0.8962	0.8959	0.9183	0.9230
	[−1.14]	[−1.13]	[−0.93]	[−0.90]
Market Return	2.16	475.4**	257.0**	233.0**
	[0.27]	[2.52]	[2.25]	[2.26]
Observations	23618	23618	23618	23619

Table IV
Comparison of Return Performance before and after Reporting Termination

This table presents the same analyses as in Table II except replacing the event with reporting termination. The t-statistics are reported below coefficient estimates in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)
	Raw return	Return in excess of the market	One-factor alpha	Four-factor alpha	Difference-in-Difference
Before reporting termination					
5th Percentile	−0.0068	−0.0143	−0.0143	−0.0102	−0.0157
25th Percentile	0.0081	−0.0008	−0.0021	−0.0022	−0.0033
Median	0.0131	0.0032	0.0016	0.0019	0.0003
75th Percentile	0.0180	0.0078	0.0069	0.0058	0.0051
95th Percentile	0.0288	0.0178	0.0173	0.0151	0.0137
Mean	0.0118	0.0028	0.0018	0.0016	0.0001
Std. Dev.	0.0128	0.0101	0.0101	0.0090	0.0095
# funds	187	187	187	187	187
After reporting termination					
5th Percentile	−0.0562	−0.0290	−0.0216	−0.0188	−0.0264
25th Percentile	−0.0277	−0.0045	−0.0039	−0.0033	−0.0031
Median	−0.0015	0.0014	0.0013	0.0002	0.0007
75th Percentile	0.0120	0.0060	0.0065	0.0045	0.0059
95th Percentile	0.0296	0.0179	0.0177	0.0148	0.0208
Mean	−0.0072	0.0000	0.0006	−0.0001	0.0003
Std. Dev.	0.0262	0.0147	0.0137	0.0118	0.0140
# funds	187	187	187	187	187
Differences (t-statistics)					
5th Percentile	−0.0494***	−0.0147*	−0.0074	−0.0087	−0.0107
	[−4.07]	[−1.92]	[−1.07]	[−1.20]	[−1.22]
25th Percentile	−0.0358***	−0.0037***	−0.0018	−0.0011	0.0002
	[−10.42]	[−3.15]	[−1.57]	[−1.13]	[0.10]
Median	−0.0146***	−0.0018	−0.0003	−0.0018***	0.0004
	[−4.54]	[−1.55]	[−0.81]	[−2.80]	[0.21]
75th Percentile	−0.0061***	−0.0019	−0.0004	−0.0013	0.0008
	[−3.91]	[−1.58]	[−0.41]	[−1.33]	[0.90]
95th Percentile	0.0007	0.0002	0.0004	−0.0003	0.0070
	[0.15]	[0.33]	[0.44]	[−0.08]	[1.56]
Mean	−0.0190***	−0.0028**	−0.0012	−0.0017	0.0002
	[−8.92]	[−2.13]	[−0.98]	[−1.57]	[0.19]

Table V
Flow to Fund Companies before and after the Initial Reporting Date

This table reports the results of multivariate regressions that examine the flow to fund companies before and after the initial reporting date. The dependent variable is the net percentage flow to a fund company in a given quarter, where the flow is defined as the change in total portfolio value during the current quarter net of the asset value appreciation/depreciation due to returns, scaled by the portfolio value at the end of the previous quarter. Panel A reports the estimates of equation (2) in the paper for the subsample of fund companies with accurate initial reporting date information using three benchmark-adjusted *Performance* measures: return in excess of the market, CAPM one-factor alpha, and Carhart (1997) four-factor alpha. *Q+j*, where *j=-4,…, 4,* is the dummy variable for *j* quarters relative to the quarter of initial reporting. *Portfolio size* (in log), *Turnover*, and *Return volatility* are as defined in Table I. *Manager age* (in log) is the number of years since the fund company's first appearance in Thomson Reuters. All covariates lag the dependent variable by one quarter. The F-test reported at the bottom of the table test the null hypothesis that sum of coefficients on Q to Q+4 and the sum of coefficients of Q-4 to Q-1 are equal. The F-test reported at the bottom of the table tests the null hypothesis that sum of coefficients on Q to Q+4 and the sum of coefficients of Q-4 to Q-1 are equal. Panel B presents the same analyses as in Panel A for the full sample except examining the flows to fund companies before and after reporting termination. The t-statistics are reported below coefficient estimates in parentheses. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

Panel A: Effects of Reporting Initiation on Flows

	(1)	(2)	(3)
Performance Measure	Return in excess of the market	One-factor alpha	Four-factor alpha
Q-4	0.0854	0.0960	0.1062
	[1.20]	[1.34]	[1.43]
Q-3	−0.0083	0.0033	−0.0526*
	[−0.17]	[0.07]	[−1.71]
Q-2	0.0650	0.0733	0.0209
	[1.16]	[1.29]	[0.48]
Q-1	0.0280	0.0345	0.0363
	[0.51]	[0.63]	[0.61]
Q	0.0387	0.0470	0.0273
	[0.97]	[1.17]	[0.69]
Q+1	0.1282	0.1345	0.1798**
	[1.56]	[1.64]	[2.08]
Q+2	0.0601	0.0683	0.0760*
	[1.40]	[1.60]	[1.75]
Q+3	−0.0034	0.0026	0.0047
	[−0.06]	[0.04]	[0.08]
Q+4	0.0504	0.0515	0.0522
	[0.65]	[0.66]	[0.67]
Performance	2.4853***	0.8716***	0.8689***
	[16.32]	[7.79]	[6.34]

Performance Measure	(1) Return in excess of the market	(2) One-factor alpha	(3) Four-factor alpha
Portfolio size	−0.0281***	−0.0273***	−0.0256***
	[−31.00]	[−30.10]	[−27.94]
Manager age	−0.0077***	−0.0082***	−0.0029
	[−4.69]	[−4.99]	[−1.59]
Turnover	0.0098***	0.0114***	0.0119***
	[3.10]	[3.64]	[3.63]
Portfolio volatility	0.3101***	0.2984***	0.3904***
	[5.23]	[5.03]	[6.27]
Non-Reporting Funds Dummy	−0.0042	−0.0026	−0.0018
	[−0.56]	[−0.34]	[−0.23]
Constant	0.2647***	0.2613***	0.2322***
	[25.61]	[25.21]	[21.94]
N	141090	141089	131544
R-squared	0.016	0.014	0.012
F-test			
Point estimate	0.1002	0.1000	0.1435
F-statistics	1.04	1.04	1.85
p-value	0.3074	0.3075	0.17

Panel B: Effects of Reporting Termination on Flows

	(1)	(2)	(3)
Performance measure	Return in excess of the market	One-factor alpha	Four-factor alpha
Q-4	−0.0106	−0.0063	−0.0354
	[−0.30]	[−0.18]	[−1.20]
Q-3	0.0136	0.0163	0.0268
	[0.34]	[0.41]	[0.65]
Q-2	−0.0079	−0.0055	−0.0236
	[−0.34]	[−0.23]	[−1.07]
Q-1	0.0475	0.0526	0.0520
	[1.05]	[1.16]	[1.17]
Q	−0.0568	−0.0584	−0.0654*
	[−1.52]	[−1.57]	[−1.73]
Q+1	−0.0418	−0.0427	−0.0354
	[−1.00]	[−1.02]	[−0.84]
Q+2	−0.0508	−0.0522	−0.0470
	[−1.41]	[−1.44]	[−1.29]
Q+3	−0.0272	−0.0286	−0.0256
	[−0.69]	[−0.73]	[−0.65]
Q+4	−0.1030***	−0.1050***	−0.1003***
	[−2.78]	[−2.82]	[−2.71]
Performance	2.9684***	1.4168***	1.4327***
	[5.66]	[3.60]	[2.89]
Portfolio size	−0.0602***	−0.0587***	−0.0567***
	[−9.30]	[−9.13]	[−8.84]
Manager age	−0.0160*	−0.0188**	−0.0114
	[−1.80]	[−2.11]	[−1.20]
Annualized portfolio turnover rate	0.0026	0.0031	0.0036
	[0.24]	[0.28]	[0.32]
Portfolio volatility	−0.0131	−0.0453	0.0454
	[−0.05]	[−0.19]	[0.18]
Constant	0.5052***	0.5092***	0.4770***
	[11.45]	[11.59]	[10.68]
N	6301	6301	5934
R-Squared	0.048	0.045	0.041

Performance measure	(1) Return in excess of the market	(2) One-factor alpha	(3) Four-factor alpha
F-test			
Point estimate	−0.3222	−0.3440	−0.2935
F-statistics	8.48	9.56	7.03
p-value	0.0036	0.002	0.008

Table VI
Comparison of Self-Reporting and Non-Reporting Fund Companies

Panel A shows the characteristics of the self-reporting and the non-reporting fund companies. The sample of self-reporting fund companies includes all 13F-filing hedge fund companies that report to the Union Hedge Fund Database (as defined in Figure 1) for some period of time. The sample of non-reporting fund companies includes all 13F-filing hedge fund companies that never report to the Union Hedge Fund Database. The Portfolio *size*, the *Portfolio Herfindahl index*, the *Monthly return volatility*, the *Annualized portfolio turnover rate*, the *Inception year*, and the factor loadings are the same as defined in Table I. The t-statistics correspond to the difference between the self-reporting fund companies and the non-reporting fund companies. The sample period is 1980-2008. Panel B repeats the analyses in Panel A except using a sample of non-reporting fund companies that is matched with the sample of reporting fund companies through the following procedure: For each self-reporting fund, we crop out the period for which it appears in the Thomson Reuters 13F database. We then find non-reporting fund companies that have 13F data over the same period (or with the maximum overlap). If there are ties in matches, we choose the one that is closest in portfolio size as the self-reporting fund to be the "matching fund." Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

Panel A: Comparison of Fund Characteristics

	(1) Self-reporting fund companies	(2) Non-reporting fund companies	(3) Difference	(4) t-statistics of the difference
Portfolio size ($, million)				
Mean	927	1029	−102	−0.76
Median	415	341	74**	2.12
Std. Dev.	1517	2394	−877**	−2.34
Portfolio Herfindahl index				
Mean	0.0798	0.1056	−0.0258***	−3.24
Median	0.0458	0.0480	−0.0022	−0.50
Std. Dev.	0.0922	0.1547	−0.0625***	−4.27
Monthly return volatility				
Mean	0.0557	0.0556	0.0002	0.11
Median	0.0509	0.0474	0.0036**	2.40
Std. Dev.	0.0213	0.0295	−0.0081***	−3.25
Annualized portfolio turnover rate				
Mean	1.0562	0.7937	0.2626***	7.19
Median	0.9909	0.6243	0.3666***	5.72
Std. Dev.	0.5526	0.5946	−0.0420**	−2.03
Inception year				
Mean	1998.7	1999.0	−0.3	−0.60
Median	2000	2002	−2.0**	−2.48
Std. Dev.	6.6	7.8	−1.2***	−3.08
Market Factor				
Mean	1.0940	1.0900	0.0040	0.18
Median	1.0787	1.0373	0.0414***	2.69
Std. Dev.	0.2652	0.3624	−0.0973***	−3.34

	(1) Self-reporting fund companies	(2) Non-reporting fund companies	(3) Difference	(4) t-statistics of the difference
SMB Factor				
Mean	0.3863	0.2980	0.0883**	2.56
Median	0.3416	0.2383	0.1033***	3.63
Std. Dev.	0.3912	0.5335	−0.1423***	−3.95
HML Factor				
Mean	0.1284	0.0428	0.0855***	2.60
Median	0.1140	0.0407	0.0733***	3.05
Std. Dev.	0.4333	0.5821	−0.1489***	−3.81
Momentum Factor				
Mean	−0.0083	−0.0156	0.0074	0.34
Median	−0.0019	−0.0059	0.0039	0.30
Std. Dev.	0.2740	0.3366	−0.0626*	−1.94
Number of institutions				
	366	554	−	−

Panel B: Comparison of Fund Characteristics – Matched Sample

	(1) Self-reporting fund companies	(2) Non-reporting "matching fund companies	(3) Difference	(4) t-statistics of the difference
Portfolio Size				
Mean	927	846	81	0.84
Median	415	394	21	0.49
Std. Dev.	1517	1133	384**	2.09
Portfolio Herfindahl Index				
Mean	0.0798	0.0709	0.0089	1.41
Median	0.0458	0.0377	0.0082***	2.88
Std. Dev.	0.0922	0.0926	−0.0004	−0.02
Volatility				
Mean	0.0557	0.0550	0.0007	0.43
Median	0.0509	0.0479	0.0030	1.58
Std. Dev.	0.0213	0.0214	0.0000	−0.02
Annualized portfolio turnover rate				
Mean	1.0562	0.6484	0.4079***	11.59
Median	0.9909	0.4389	0.5521***	9.77
Std. Dev.	0.5526	0.5002	0.0524**	2.09
Inception year				
Mean	1998.7	1993.5	5.2***	9.91
Median	2000	1995	5.0***	4.78
Std. Dev.	6.6	7.3	−0.7**	−2.16
Market Factor				
Mean	1.0940	1.0674	0.0267	1.48
Median	1.0787	1.0330	0.0457***	3.12
Std. Dev.	0.2652	0.2250	0.0402	1.54
SMB Factor				
Mean	0.3863	0.2949	0.0913***	3.27
Median	0.3416	0.2153	0.1263***	4.46
Std. Dev.	0.3912	0.3875	0.0037	0.13
HML Factor				
Mean	0.1284	−0.0221	0.1504***	4.65
Median	0.1140	0.0113	0.1028***	3.72
Std. Dev.	0.4333	0.3926	0.0406	1.42
Momentum Factor				
Mean	−0.0083	−0.0085	0.0003	0.02
Median	−0.0019	−0.0109	0.0089	0.71
Std. Dev.	0.2740	0.1796	0.0944***	3.95
Number of institutions				
	366	366	–	–

Table VII
Comparison of Self-Reporting and Non-Reporting Matching Fund Companies

Panel A shows the performance measures of the self-reporting fund companies and the non-reporting fund companies. All return performance measures are calculated at the monthly frequency assuming the companies hold their most recently disclosed quarter-end holdings. *Raw return* is the portfolio return without adjustment. *Excess return* is the portfolio return in excess of the CRSP value-weighted return. *One-Factor Alpha* and *Four-Factor Alpha* are the intercepts from CAPM one-factor and Carhart (1997) four-factor models using all available data. Panel B repeats the analyses in Panel A except using a sample of non-reporting fund companies that is matched with the sample of reporting fund companies through the procedure described in Table VI. The t-statistics for the differences are reported. Coefficients marked with ***, **, and * are significant at the 1%, 5%, and 10% level respectively.

Panel A: Comparison of Return Performance

	(1) Raw return	(2) Return in excess of the market	(3) One-Factor Alpha	(4) Four-Factor Alpha
Self-reporting fund companies				
5th Percentile	−0.0178	−0.0139	−0.0096	−0.0105
25th Percentile	−0.0019	−0.0011	−0.0010	−0.0021
Median	0.0047	0.0017	0.0016	0.0009
75th Percentile	0.0095	0.0048	0.0047	0.0038
95th Percentile	0.0164	0.0108	0.0117	0.0086
Mean	0.0025	0.0009	0.0014	0.0005
Std. Dev.	0.0112	0.0082	0.0067	0.0059
# funds	366	366	355	355
Non-reporting fund companies				
5th Percentile	−0.0322	−0.0183	−0.0137	−0.0109
25th Percentile	−0.0073	−0.0025	−0.0018	−0.0021
Median	0.0028	0.0011	0.0009	0.0006
75th Percentile	0.0095	0.0041	0.0039	0.0032
95th Percentile	0.0185	0.0120	0.0124	0.0105
Mean	−0.0006	0.0000	0.0005	0.0003
Std. Dev.	0.0178	0.0107	0.0083	0.0081
# funds	554	554	512	512

	(1) Raw return	(2) Return in excess of the market	(3) One-Factor Alpha	(4) Four-Factor Alpha
Differences (t-statistics)				
5th Percentile	0.0144***	0.0043	0.0041	0.0004
	[3.05]	[1.19]	[1.53]	[0.18]
25th Percentile	0.0054***	0.0015**	0.0008	0.0000
	[4.37]	[2.09]	[1.28]	[−0.03]
Median	0.0019**	0.0007**	0.0007	0.0003
	[2.09]	[2.04]	[1.75] *	[1.20]
75th Percentile	0.0001	0.0007	0.0007	0.0006
	[0.11]	[1.19]	[1.41]	[1.31]
95th Percentile	−0.0021	−0.0011	−0.0007	−0.0018
	[−0.74]	[−0.58]	[−0.42]	[−1.23]
Mean	0.0031***	0.0009	0.0009*	0.0003
	[3.21]	[1.44]	[1.85]	[0.54]

Panel B: Comparison of Return Performance – Matched Sample

	(1) Raw return	(2) Return in excess of the market	(3) One-factor alpha	(4) Four-factor alpha
Self-reporting fund companies				
5th Percentile	−0.0181	−0.0146	−0.0113	−0.0105
25th Percentile	−0.0020	−0.0009	−0.0007	−0.0020
Median	0.0047	0.0018	0.0017	0.0010
75th Percentile	0.0095	0.0048	0.0047	0.0039
95th Percentile	0.0156	0.0108	0.0113	0.0092
Mean	0.0024	0.0009	0.0015	0.0005
Std. Dev.	0.0113	0.0082	0.0067	0.0059
# funds	366	366	355	355
Non-reporting fund companies				
5th Percentile	−0.0134	−0.0091	−0.0088	−0.0069
25th Percentile	−0.0025	−0.0013	−0.0009	−0.0012
Median	0.0045	0.0013	0.0014	0.0008
75th Percentile	0.0091	0.0040	0.0048	0.0032
95th Percentile	0.0174	0.0118	0.0119	0.0098
Mean	0.0032	0.0013	0.0017	0.0011
Std. Dev.	0.0096	0.0065	0.0061	0.0051
# funds	366	366	357	357
Differences (t-statistics)				
5th Percentile	−0.0047*	−0.0055*	−0.0025	−0.0036**
	[−1.66]	[−1.81]	[−1.11]	[−2.21]
25th Percentile	0.0004	0.0004	0.0002	−0.0008**
	[0.40]	[0.68]	[0.35]	[−2.34]
Median	0.0002	0.0005	0.0003	0.0002
	[0.24]	[1.05]	[0.65]	[0.54]
75th Percentile	0.0005	0.0008	−0.0001	0.0007
	[0.66]	[1.38]	[−0.24]	[1.20]
95th Percentile	−0.0018	−0.0009	−0.0007	−0.0006
	[−1.28]	[−0.64]	[−0.46]	[−0.40]
Mean	−0.0008	−0.0004	−0.0002	−0.0005
	[−1.06]	[−0.79]	[−0.37]	[−1.32]