TRUST AND DELEGATION

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ABSTRACT

Due to imperfect transparency and costly auditing, trust is an essential component of financial intermediation. In this paper we study a sample of 444 due diligence (DD) reports from a major hedge fund DD firm. A routine feature of due diligence is an assessment of integrity. We find that misrepresentation about past legal and regulatory problems is frequent (21%), as is incorrect or unverifiable representations about other topics (28%). Misrepresentation, the failure to use a major auditing firm, and the use of internal pricing are significantly related to legal and regulatory problems, indices of operational risk. We find that DD reports are typically performed after positive performance and investor inflows. We control for potential bias due to this and other potential conditioning. An operational risk score based on information contained in the DD reports significantly predicts subsequent fund failure and statistical performance characteristics out of sample. Finally we find that observed operational risk characteristics do not appear to moderate fund flow.

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"The positive proposition that increasing the integrity of a firm will contribute to increasing its value is no different in kind from the positive proposition that the net present value investment rule will lead to value creation."-Michael Jensen[1]

In the modern era of fund-based asset management, most investment decisions are delegated to agents whose behavior and character are imperfectly observed and known. Trust is thus an essential feature of the principal-agent relationship in the investment industry and integrity is an important factor in delegated fund management. A variety of institutions have developed to mediate the trust relationship, including regulators, independent auditors and service providers, third-party due diligence firms and informal word-of-mouth networks. Each time a manager "touches" one of these institutions, verifiable information is generated. The consistent or contradictory nature of this information has the potential to enhance or reduce the perceived trustworthiness of the manager.

The issue of trust is particularly important in the hedge fund industry. Many U.S. domiciled hedge funds register with the Securities and Exchange Commission (SEC) on a voluntary basis only. Because they are constrained from marketing to non-qualified investors, the amount of publicly available information available about their performance, strategies, organization, third-party relationships, and personnel is limited to investors who review the fund offering memoranda. Hedge funds, particularly those that use proprietary trading models to generate returns, typically offer less information about their investment process than do other kinds of investment managers such as mutual funds. Although hedge fund data services such as TASS, HFR, and CISDM report such things

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[1] Jensen (2009)

as fund styles, leverage and fees, historical performance, and related advisor entities, they ultimately rely on the funds themselves to voluntarily provide this information, sometimes without verification

In part because the SEC does not allow hedge funds to engage in general solicitation, fund advisors have historically relied on trusted referrals as a prime distribution channel. This reliance on referrals, and the limited transparency with respect to performance and operations, are potential reasons why the Madoff scheme could last so long. Relatively few third party entities had access to performance statistics, information about firm auditors, pricing policies, self-administration and custody. In an environment lacking multiple, comparable sources of information about an agent's credibility, trust is even more important, as are mechanisms to verify trustworthiness.

In this paper, we analyze a comprehensive database of due diligence reports on hedge funds provided by a major investigation firm. Due diligence (DD) firms specialize in gathering and verifying information potentially relevant to operational risk assessment. They are typically retained by clients who are considering an investment in a hedge fund, and who wish to gather more information beyond what is provided by the fund prospectus and by regulatory filings.[2] While the academic literature has widely studied the roles of regulators, auditors and informal reputation within financial markets, research on third-party investigation is comparatively recent. For example, using essentially the same database, Cassar and Gerakos (2008) document correlation between hedge fund internal controls and manager fees, arguing that the extent of operational risk controls is endogenous.

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[2] Typical clients are mainly funds of hedge funds, but also include investment banks, family offices, and other institutions.

The novel feature of the DD reports for our purpose is that they document factual misrepresentations and inconsistencies in statements and materials provided by hedge fund managers. The due diligence database employed in the current study allows us to address some basic questions about trust and credibility in the investment industry.

First, do managers misreport to investigators about operational risk factors? Although, as we shall discuss, the sample of firms subject to due diligence is endogenously determined by such issues as scale, past performance and risk concerns, the basic evidence in the DD records about the rates and nature of informational conflicts is sufficient to give investors serious cause for concern. We focus in particular on misrepresentations related to past regulatory and legal problems, and upon misrepresentations or verification problems relating to performance. The former is pertinent to the potential for future operational events, the latter is important because it is relevant to the reliability of investor returns. We find that both types of misrepresentation are common in the data.

The second question we investigate is whether informational contradictions matter to performance and risk. In particular, we ask whether variables related to honesty explain future reported returns, and also whether they explain the probability of fund failure. This question is complicated by the obvious problem that if managers misrepresent their performance, their reported returns may not be a trustworthy basis for assessing their *ex post* or *ex ante* performance.

Thirdly, we ask how the DD process relates to other institutional filters on operational risk. The most striking result we find is that the failure to use a Big 4

accounting firm is a consistent indicator of factors associated with operational risk, including self-pricing of securities.

Finally, we build a single operational risk score as in Brown *et al*. (2008) to predict fund failure and future performance. This measure maps information that arises in the context of an operational due diligence examination to broadly available information about funds. Out-of-sample tests show that it is strongly related to poor subsequent performance and is also highly predictive of fund failure. A flow-performance analysis using this operations risk score indicates that investors chase past high returns irrespective of operational risk exposure. These results confirm findings of Brown *et al*. (2008) that are based on an analysis of Form ADV filings required of U.S. domiciled funds in 2006. An event study shows that the DD reports are typically issued on high return funds three months after the historical performance has peaked. The DD reports are also issued at the point of highest investor flow into the fund. This pattern is also consistent with the return chasing behavior by institutional hedge fund investors we observe from the flow-performance relation.

In this analysis we address the fact that past performance and past legal or regulatory problems influence which funds receive a DD report. For example, a hedge fund with a stellar historical record might also have a history of regulatory problems which would motivate a fiduciary to more thoroughly vet the manager. In controlling for sample selection we estimate a model that explains the decision to undertake the DD process. This allows us to draw unbiased inferences about performance differentials between problem and non-problem funds. Additionally, the selection model is interesting

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in its own right, as it provides additional insight into the determinants of hedge funds flows.

The remainder of the paper is organized as follows. In the next section we describe the data. In section III we report the determinants of funds selected for due diligence and address the selection bias issue. Section IV presents our results on operational risk analysis, manager integrity, fund performance, and flow-performance relation. We develop a univariate measure of operational risk which we validate on an out-of-sample basis by examining its relationship to subsequent survival, performance and future cash flows into the fund. Section V concludes.

II. Data

Our sample consists of 444 due diligence reports compiled by a third party hedge fund due diligence service provider, HedgeFundDueDiligence.com.[3] These funds are managed by 403 different advisors over the period 2003 to 2008. The DD report information is gathered by the company through several channels: the offering document and marketing materials provided by the manager, on site interviews with the manager, and forms filled out by the manager. They augment this by verifying operational controls, assets under management, and performance with the administrator. Finally, they attempt to verify the authenticity of the audit with the auditor and perform a background check on the management company and its key staff.

A typical DD report spans between 100 to 200 pages with both quantitative and qualitative sections prepared for the clients. Conventional databases such as TASS, HFR,

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[3] The company's website is http://www.hedgefundduediligence.com/

or CISDM usually provide fund level information such as strategy, performance, assets, fees, and leverage, but they do not document the investment and operational process. In contrast, the DD reports reveal how portfolio values are determined, where day-to-day accounting is done, how the DD firm verifies the accuracy of the data provided, and how the governance and control processes are conducted. As a result, DD reports provide a natural platform for us to study operational risk – a major factor in hedge fund failures.[4] By hand collecting data from the DD reports, we create 45 variables for our analysis, although not all data is available for all funds.[5] Data definitions for these variables are reported in Appendix A.

We supplement the information collected by the DD company with data from a combined TASS/CISDM dataset. These two datasets are matched via names and other characteristics. If a fund exists in both CISDM and TASS, we default to the characteristic and return data provided in TASS. As of March 2009, TASS has a total of 12,656 funds and CISDM has 13,171 funds, both live and defunct funds. We are able to match 5,879 TASS funds and CISDM funds, which leaves us a combined hedge fund database of 19,948 unique funds. Our analyses focus on fields that overlap between both datasets. We use the style definitions utilized by Agarwal, Daniel and Naik (2008) for our combined dataset. Using this matched dataset, we then match the DD funds via fund names. If we are able to match a DD fund to our TASS/CISDM merged dataset, we rely on the performance information in the TASS/CISDM database for our performance and flow analyses.

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[4] See Capco (2003). Brown *et al.* (2009) find that a measure of operational risk is more predictive of fund failure than is financial risk.

[5] For example, most onshore hedge funds are limited partnerships, which do not have boards of directors.

In addition to the specific funds that investors requested the DD company to investigate, some advisors also manage other hedge funds besides those in the DD dataset. These funds are listed in the same DD report, along with information indicating if they are offshore, onshore equivalents or part of the master feeder structure of the fund being investigated. In the cases where the "other" funds listed on the DD report are distinct, we also add these funds to our sample when investigating performance and fund death. Since these funds are being operated by the same managers they are arguably exposed to the same operational risks.[6] We present summary statistics for the DD funds in Table I.

<Insert Table I about here>

Of particular interest are variables related to operational issues that were previously unavailable from other hedge fund data sources. One set of variables of interest is the method of pricing securities by the fund. Hedge funds that invest in infrequently traded or illiquid securities cannot rely solely on observed market prices for establishing the portfolio value of the fund. In these cases, managers may supply their own estimates of the hard-to-value security price. This method has obvious potential for operational risk or downright fraud, if employed by an untrustworthy manager.[7] If securities in the fund are priced either entirely or partially by the manager we set the "pricing" variable equal to 0; if priced completely externally it is equal to 1. Another

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[6] These "other" funds may have some operational qualities that do not match the DD fund. We run all performance and flow analyses on the DD funds only and came to similar concludes to those presented in the text.

variable related to pricing is the *NavRestate* variable. This variable indicates whether the net asset value has been restated in the fund's history and is a related indicator of the reliability of the pricing mechanism.

Another group of four variables evaluates the signature controls of the fund. Two variables indicate the number of signatures required to move money from a bank or the prime broker. Generally, the more signatures required to move money from one location to another, the lower the operational risk. However, the number of signatures does not completely capture the security of cash accounts. A two signature requirement, while better than a single signature, may be of little value if both signatures are non-independent. To supplement these signature measures, the DD company also indicates whether money movements are restricted to certain locations. For example, money movements from the prime broker may be limited to only the fund's bank account. The final signature-related variable indicates whether the signature controls are of "institutional quality," meeting the best practice standard for the institutional investment industry. The DD company defines institutional quality as all money movements requiring an internal and independent third party signature.[8]

Two of the due diligence variables address personnel and governance: the number of staff departures from the fund and the number of fund board members who are independent. The first of these relates to the risk involved when a position is vacated and know-how is lost, or continuity in oversight is compromised. Higher personnel turnover taxes the attention of other members of the firm and is a common "red flag" for operational risk. The count of independent board members is a standard governance

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[8] The DD company does note they do not use the term institutional quality to render an opinion about the signature controls, but rather to compare the fund's signature controls against a predefined standard.

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measure that equates independence with disincentive for fraud and lack of conflicts of interest. It has been shown to be a useful variable in studies of the mutual fund industry (see Cremers and Nair (2005)). In a practical sense, in the hedge fund universe, only funds organized offshore tend to have directors.[9] For both employee turnover and independent board members, there is the additional possibility that leaving a fund, or an unwillingness of an independent director to serve on a board is an indication of potential problems.

The DD firm also reports whether the fund is audited by a Big 4 accounting firm. This variable is of particular interest because the fund "inherits" the positive reputation of the firm to the extent that the auditor issues an unqualified opinion with respect to the audited assets and valuation procedures. In the aftermath of the Enron case that brought down a major accounting firm, the risks to the auditor of taking on an untrustworthy client are clearly evident. Thus, this simple variable is expected to carry considerable weight in separating funds with and without significant risk of fraud.[10] Because of this liability, the auditing firm typically pre-screens managers for the potential risk they pose the firm before taking them as a client. This risk analysis continues after the firm is accepted as a client.[11] Because of client confidentiality issue, audit firms are not a public source of information about manager operational risk.[12]

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[9] Only a hand full of onshore funds in our sample has boards of directors. Aragon, Liang, and Park (2009) indicate that most onshore funds are organized as partnership while most offshore funds are organize as open-end investment companies.

[10] Liang (2003) indicates that hedge funds that employed Big 4 auditors tend to be large funds and have less reporting discrepancies.

[11] From one of the DD reports: "… also stated that *OneBig4Auditor* performs extensive Due Diligence prior to accepting a new client."

[12] Auditors were unresponsive to all DD company questions except for the most basic requests for information. Most auditors, especially the 'Big 4' would not discuss any aspect of their audits with the DD company, even going as far in some cases as not to confirm the fund was a client of the company. This was regardless of whether or not the fund gave the auditor permission. In some circumstances, the DD company

One key operational risk variable we use in our analysis is whether or not the fund has had a previous regulatory problem or has been involved in a lawsuit. For a brief period in 2006 most U.S. based hedge funds were required to register with the SEC as investment advisors and file a Form ADV disclosure that provided operational details of the funds, including ownership details, evidence of external and internal conflicts of interest and legal and regulatory problems, along with other information.[13] Brown *et al*. (2008) found that, among other things, problem funds had significantly more conflicts of interest compared to non-problem funds, suggesting that the potential for exploiting customers was associated with past adverse events. Table I shows that that 41% of the funds in our sample have some form of legal or regulatory problem, more than twice the frequency of problems reported in the 2006 Form ADV filings (Brown *et al*., 2008). Of this number, 32% of the funds have been involved in legal disputes as defendants and 15% of funds in the database have past regulatory problems. Firms with problems of this nature would be less inclined to reveal them publicly through registration. Unscrupulous managers might even misrepresent the extent of past problems to customers. Fee-based due diligence service providers seek to capture this kind of misrepresentation through background research and direct interviews with managers.[14]

We use the DD forms to indicate whether managers indeed misrepresent past problems, or their past experiences. The DD firm compared the manager's statement about past legal and regulatory events to third-party records and noted whether the

was able to obtain audits from either the administrator or the fund itself to help verify performance and asset information. However, without auditor verification, the DD company would be unable to verify the authenticity of the audit.

[13] The filing deadline was February 1, 2006, but on June 23, 2006, the U.S. Court of Appeals for the District of Columbia Circuit vacated the rule changes that had required many newly-registered hedge fund managers to register as investment advisers under the Investment Advisers Act.

[14] Currently, a typical DD report costs a client $12.500.

manager's account squared with the independent evidence.[15] These third-party records can come from auditors, administrators, custodian, or prime brokers. A manager who misrepresented his or her background also falls into this category. We further break this indicator down into misrepresentation about lawsuits vs. regulatory problems. We also have an indicator for whether the DD company could not verify other information provided by the manager, for example discrepancies relating to operational issues such as the signatures required for fund transfer. The manager may report that the fund uses one procedure and the bank or broker may report that the fund uses another. The category *Noted Verification Problem* indicates that 42% of the funds in our sample had either a misrepresentation or an inconsistency problem.

To further investigate the trustworthiness of these funds, we break these variables down further in Table II. *Signature Disagreement* indicates that in 16% of the cases, the fund's version of the signature process did not match the version explained by the administrator, while *Pricing Disagreement* indicates that 3.6% of the funds disagreed with the administrator on the process used to price the portfolio. *Switched Vendor* indicates that 11% of the funds switched a major data vendor in the last 3 years, while *Refused DD Question* means that 14% of the funds or the administrator refused to answer DD company questions.

<Insert Table II about here>

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[15] Rather than answer open ended questions, the DD company uses a hard copy form for past legal and regulatory disclosure. The form is signed by the manager and consists of several 'yes/no' questions.

In the wake of the Madoff scandal, verifying performance and existence of assets has taken on greater importance.[16] Surprisingly, nearly 19% of funds' asset information either could not be verified independently (*Assets Disagree*) or the DD firm found a disagreement between the fund's reported assets and evidence from an alternative source (*Can't Verify Assets*). Similar discrepancies (*Performance Disagree*) or verification problems (*Can't Verify Performance*) with respect to reported performance were noted for 14% of DD investigations. The DD firm also found that 20% of managers (*Bad Recall*) interviewed verbally stated incorrect information to the DD company when check against written documentation, including poor recollection about basic levels of assets and performance.[17]

We found it useful to rank managers on how forthcoming they were concerning past problems. We considered three cases. In the first case, managers voluntary disclosed a past problem; however, after further investigation, the DD company found additional legal or regulatory items that should have been disclosed. This occurred in 6% of the cases. We label these "strategic misstatements" in Table II. In the second case, managers disclosed no past problems, but the DD company found they had past legal or regulatory problems. This occurred 9% of the time. We simply label these as misstatements. Finally, if a fund disclosed past problems and the DD company found these were all of the problems with no additional misrepresentations concerning their backgrounds, we labeled these managers "truth-tellers" (23%). A final category is the group of managers who had no past legal or regulatory problems to disclose. It is remarkable that 15% of

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[16] "It's very easy if you want. You must do a third-party check. It's an absolute must," Mr. Madoff said of how one investigates a Ponzi scheme. "It's accounting 101." *Wall Street Journal*, October 31, 2009.

[17] For example, one manager's verbal assets under management figure were over $300 million higher than the actual number.

funds intentionally or unintentionally misstated material facts to the DD company even when they knew that the company was hired to verify this information.

To investigate the relationship between funds' operational properties and past problems, we separate out the problem funds (i.e. those that have experienced legal and regulatory problems) from non problem funds and report mean fund characteristics and differences in means in Table III.

<Insert Table III about here>

We find little difference in the performance of the two groups. Problem funds tend to be larger than non-problem funds, which may be a function of larger funds having more opportunities for lawsuits. This is consistent with Brown *et al*. (2008). We do find non-problem funds have some better operating controls. Non-problem funds more frequently use independent pricing procedures than do problem funds, although problem funds are also more illiquid (measured by longer lockup and redemption periods) and therefore may have to rely on internal pricing. Non-problem funds also have Big 4 auditors more often as well as lower levels of noted verification problems. However, there are few differences in the signature setups between the two groups. The Big 4 auditor variable is particularly interesting in light of the practice of auditors "pre-screening" clients through their own due diligence process. Finally, the problem funds are more likely to switch data vendors, perhaps because irregularities may have been discovered by the previous vendor.

III. Determinants of Fund Selection

Our univariate results indicate that problem funds are more likely to have poorer operational controls while problem funds have similar performance to non-problem funds. However, one confounding aspect in any empirical analysis is the potential for selection bias. Unlike the TASS/CISDM database which comprises thousands of hedge funds, we only have results for 444 funds the DD company examined at the specific request of a potential or current investor in each fund. Previous research, such as Ding, Getmansky, Liang and Wermers (2008), has found investors are more likely to invest in hedge funds that have certain characteristics such as higher historical performance. Investors may also be more likely to request a DD report when they do not trust self-reported measures of historical performance. For these reasons, funds in our DD sample may not represent a random sample of funds from the entire hedge fund universe.

We examine this selection issue in the following manner. Using our combined TASS/CISDM database, we create a list of hedge funds available to be selected each year based on characteristic and performance data ending the previous calendar year. For example, in 2003, any hedge fund alive during the second half of 2002 with the relevant characteristic and performance data is included in our sample. We then label funds selected for a DD report in the following year with a "1" while funds not selected are labeled with a "0". We create a data panel extending from 2003 to 2008, which we then use to run a logistic regression predicting which funds are selected based on their characteristics.

We include prior performance (*Return Mean*), prior risk (*Return Standard Deviation*), return autocorrelation (*Ret Autocorrelation*) size (*Log Assets*), fees and share

restriction measures. We also include a dummy variable indicating whether the fund has a Big 4 auditor as indicated in TASS/CISDM. While we do not have background checks on all funds in TASS/CISDM, we utilize the Big 4 auditor flag to proxy for a lack of past problems, due to indications that the Big 4 auditors screen potential clients. We fit for the case of funds selected for a DD report so positive coefficients indicate a fund with those characteristics is more likely to be chosen for a DD report. We run two models. One model only examines the selection of the DD funds for which we were able to match that DD fund with our combined TASS/CISDM. The other model includes funds that we were unable to match. We used data from the DD reports to populate the necessarily fields for these funds to be included in the selection model. While these funds could not have been selected solely from TASS/CISDM due to their lack of inclusion in those datasets, these funds had to be known by the individuals requesting the DD reports and therefore it seems reasonable to include them in the analysis. We include style and year dummies as well as clustered standard errors by fund. The results are reported in Table IV.

<Insert Table IV about here>

As one would expect, larger funds with better prior performance are more likely to be selected. Larger funds have more clients and higher visibility, which increases the likelihood one would select the fund for a report. As Ding *et al*. (2008) find, funds with superior past performance are more likely to receive attention from potential investors. We also find that funds with Big 4 auditors are less likely to be selected. If it is perceived that problem funds are less likely to have Big 4 auditors, this fact alone may be a

sufficient "red flag" to require the services of a DD company before investing in such a fund. An alternative interpretation is that investors are more comfortable if a fund has a well-known auditor due to their reliance on the auditor's opinion with respect to operational risk. Major fraud cases, such as Bayou and Madoff, involved smaller, unknown auditors. Funds with higher incentive fees and those with a high water mark provision are more likely to be selected, as these variables are likely to reflect manager quality (Brown *et al.* (2008)). The selection model results are consistent whether or not we include the unmatched DD funds. Consistent with prior findings (Agarwal *et al.* (2008), Brown *et al.* (2008) and Ding *et al.* (2008)), these selection results suggest investors chase past returns.

We also examine performance and flows to the DD funds around the DD report date. Each month we compute monthly flow for all funds, which is the difference between this month's assets and last month's assets adjusted for this month's performance divided by the prior month's assets, similar to Sirri and Tufano (1998). We then compute the median of all funds' monthly flows by the number of months that flow occurred from the report date. We do the same for monthly returns. We report median values from two years prior to the report date to two years after the report date with zero being the report month. Figure 1 displays results for monthly returns while Figure 2 displays results for monthly flows.

<Insert Figures 1 and 2 about here>

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Both flows and returns peak slightly before the funds had a DD report. If one were to include a lag from the time that the fund was selected by the investor for a DD report and the report date, investors are selecting funds, on average, exactly at the peak of their performance and investor flows. The two graphs also nicely show how flows lag performance by approximately 6 to 8 months, consistent with the evidence that investors chase past performance.[18]

In additional to the selection bias concerning which funds get selected for the DD reports from the entire hedge fund universe, the DD funds that choose to list in major databases may be significantly different from funds that choose to not report. We compare the DD funds listed in CISDM/TASS and funds that were not listed. Interestingly, there are almost no differences between the two groups. The only significant difference lies in the autocorrelation of returns. All other performance, operating and truthfulness variables are not significantly different. These results, however, are conditional on funds being selected for analysis.[19]

IV. Measuring Operational Risk

A. Relationship between fund problems and operational characteristics

Potential hedge fund investors must decide whether to trust managers with their money. An important question for investors is whether the operational controls of the fund compensate for any potential historical breaches of trust. For example, if managers have a history of legal or regulatory problems then strong operational controls, such as a Big 4 auditor or external pricing, may alleviant investors' concerns. In addition, if a

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[18] It takes from 4-8 weeks from a client's request to the completion of the report by the DD company.
[19] To save space, we do not report the results here, which are available upon request. Cassar and Gerakos (2008) perform a similar comparison and find similar results.

relationship between problems and operational controls exists, then simply having information about the background history of the managers may provide investors with some comfort regarding the funds' operational controls.

To test these propositions, we examine the relationship between past regulatory or legal problems and operational control variables using a logistic model. We control for selection bias by performing the analysis using the two-stage Heckman (1979) model introduced in the previous Section. The *lambda* term represents the inverse Mills ratio obtained from the first stage regression. The second stage logistic model utilizes advisor information to cluster standard errors and also includes style dummies. In this model, positive coefficients indicate a higher likelihood of problems. Results are reported in Table V.

<Insert Table V about here>

We find that funds with legal and regulatory problems have poor operational controls. Problem funds are less likely to have independent pricing. We also find problem funds are more likely to have switched vendors in the last three years. While changing vendors to upgrade the quality of pricing or trade execution is positive for investors, changing vendors may also be a red flag as the fund may have been dropped by the vendor due to data inconsistency. Finally, problem funds are less likely to have a Big 4 auditor; although this result is consistent with Big 4 auditors avoiding funds with legal or regulatory issues. This evidence is consistent with Brown *et al*. (2008) who find that operational risk (measured by the probability of having problems) is positively associated

with conflict of interest and concentrated ownership problems. We would expect that having a Big 4 auditor and independent pricing would be negatively associated with conflicts of interest. One potential drawback of using background information on managers is the reliability of this information, especially if it is self-reported. Indeed, we find approximately 20% of funds have managers who misrepresented past problems or their background information. 10% of funds would have been classified as non-problem funds based on the information disclosed voluntarily to the DD company and through any precompiled due diligence questionnaires, but were found to be problem funds after background checks by the DD company. In results not reported here we find that not having a Big 4 auditor is strongly correlated with the probability that the fund misrepresents material facts to the DD company[20]. This relationship may again by due to the Big 4 auditor's prescreening clients. Those who misstate material facts are less likely to have Big 4 auditors.

B. Canonical Correlation Analysis

The incidence of legal and regulatory problems is only one aspect of operational risk. The DD forms can run over several hundred pages and contain a large number of variables. Brown *et al.* (2008) show that it is possible to define a univariate measure of operational risk (ω-Score). The ω-Score is a linear combination of operational characteristics that maximally correlates with factors shown to contribute to fund failure. In order to apply this method to the DD database, we first identify a set of TASS variables that have been related to fund death in previous literature (Liang, 2000; Brown, Goetzmann, and Park, 2001). As a result, the following variables are chosen: average

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[20] To save space, we do not report the results here, which are available upon request.

monthly returns from the previous year, monthly standard deviation and the first-order autocorrelation from the previous year, size at the beginning of the period, fund age, fees, leverage, lockup provision, and advanced notice period. Next, we form a linear combination of these TASS variables that maximally correlate to the set of the DD variables we have considered[21]. The maximum correlation between the two linear combinations is 0.48. Finally, the resulted linear combination of the DD variables provides the desired single operational risk measure which we refer to as the ω-Score. Note that it is more advantageous to build the ω-Score directly from operational control variables in the DD reports than indirectly from performance and risk information from TASS.[22]

<Insert Table VI about here>

Table VI indicates that funds with better past performance have lower operational risk; funds with smoothed returns (lower standard deviation and autocorrelation) display higher operational risk; younger and smaller funds suffer from higher operational risk; high quality managers (signaled by higher management and incentive fees as well as the use of leverage) are associated with lower operational risk. Finally, funds with longer lockup and redemption notice periods in general invest in illiquid assets so the managers

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[21] To address sample selection concerns we first orthogonalize these variables with respect to the inverse Mills ratio computed in the first stage of the Heckman selection model we estimate.
[22] Brown *et al.* (2008) construct the ω-Score from TASS data instead of the ADV information as the full ADV data is no longer available to the general public after 2006. On the other hand, investors' can purchase DD reports and access much better information.

will have more discretion in smoothing returns or pricing the portfolio, hence higher operational risk.[23]

In terms of the DD variables, the variables internal accounting, misstatements, the interaction of the use of industrial quality signature procedures (Sign IQ) and internal accounting, are all positively related to operational risk. In contrast, the use of Big 4 auditor and external pricing significantly reduces the operational risk. As we note above, the use of a Big 4 auditor may serve as a certification role. A fund with poor operational controls might be less willing or able to retain a major auditing firm.

C. Does Operational Risk Predict Fund Failure?

Thus far, we have established a relationship between operational risk and past regulatory and legal problems and have found relationships between operational risk variables and fund performance. While managers with low quality operational procedures may be able to smooth performance, ultimately this behavior may have little long-term effect on the performance outcome for investors. However, if a manager is committing a serious breach of fiduciary duty which causes fund closure, this could lead to substantial loss or inconvenience. In addition, artificially high performance could attract more flows from other investors, allowing such things as performance smoothing or allowing fraudulent Ponzi schemes to continue over long periods.

<Insert Table VII about here>

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[23] Cassar and Gerkos (2009) find similar results that funds using less independent pricing sources and funds with greater manager discretion in pricing portfolios are more likely to smooth returns.

In Table VII, we examine the relationship between fund "death" and operational risk variables and other fund characteristics to determine whether operational risk affects the probability of fund death. For our purpose, fund death is defined as the cessation of the fund reporting to the database[24]. We run a Cox proportional hazards model controlling for right-censoring. As with the other models, we include the Heckman *lambda* to control for selection bias.

Our results indicate that funds with higher operational risk are more likely to fail. Brown *et al.* (2009) argue that operational risk is more predictive of fund failure than is financial risk (measured as the log of prior standard deviation). Indeed, in our sample return standard deviation is *inversely* related to fund failure. This is consistent with the view that firms which engage in return smoothing behavior are most likely to fail. The global financial crisis was a difficult time for all funds. The probability of fund failure increased during this period regardless of operational or financial risk characteristics, as indicated by the fixed effect for the crisis defined as the period between August 2007 and June 2009.

D. Operational Risk and Subsequent Fund Performance

Results in the prior section find a relationship between operational risk and problems, which is similar to previous results found by Brown *et al.* (2008, 2009) on hedge fund operational risk. While those studies examined the relationship between operational risk and potential conflicts of interest, the collected due diligence data

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[24] The TASS database distinguishes between funds that are liquidated or otherwise no longer in operation from those that simply stop reporting. We use this information to define "death". In the subsample of firms covered only by CISDM we use only the last reported return date as the date of death.

provides the opportunity to examine other potential operational risks for investors. In light of Ponzi scheme scandals in the hedge fund area, one issue of great interest is whether reported returns fairly represent investor performance. Prior research on hedge fund performance has identified evidence that some hedge fund managers may game their performance.[25]

We examine the performance reported by the hedge funds in our due diligence sample subsequent to the DD report date. For each fund in our sample, we compute the appraisal ratio using the Fung and Hsieh (2004) seven factor model.[26] In Table VIII we regress this performance measure on operational risk and other fund characteristics. As Brown *et al.* (2008) found, operational risk leads to low subsequent returns. We interpret the negative sign on standard deviation and its interaction with operational risk to indicate that funds with abnormally low reported standard deviation may have smoothed prior returns. The (marginal) significance of the inverse Mills ratio tells us that we might question the high returns and low volatility of returns which led to the DD report being commissioned in the first place.

<Insert Table VIII about here>

E. Relationship between Operational Risk and Future Flows

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[25] For example, Bollen and Pool (2009) find a discontinuity in the distribution of hedge fund returns. Getmansky *et al.* (2004) find significant autocorrelation of hedge fund returns while Agarwal *et al.* (2008) find hedge funds' December returns appear artificially high.

[26] We thank David Hsieh for making this data available at his website. See http://faculty.fuqua.duke.edu/~dah7/HFData.htm. We also considered the Hsieh and Fung alpha as a measure of performance, with very similar results.

Operational risk characteristics revealed in the DD report indicate a high probability of subsequent fund failure and lower than expected returns. Do investors utilize this information? Some individuals refused to invest with Madoff due to operational concerns. However, others continued to provide money even when they understood his operational deficiencies.[27] Prior research has shown no relationship between investor flows and operational risk disclosed by hedge funds during the brief period of mandatory disclosure by the SEC.[28] However, it was unclear whether investors did not know about the operational risk characteristics of the funds they invested in, or whether they had full information but simply chose to ignore operational risk concerns. While the DD reports are specifically prepared for one investor, the information will clearly be known to one party either interested in investing or already invested in the fund.[29] In addition, the information from the DD report may also filter through third-party channels and become "public" information to the investment community.[30]

Do investors incorporate this information about operational risk into the decision to commit funds? To examine this question we focus on the extent to which the measure of operational risk mediates the flow-performance relationship that has been documented for mutual funds and for hedge funds. We follow the procedure of Sirri and Tufano (1998) with the exception that we define prior return ranking and subsequent annual flows relative to the date of the DD report. In other words, for each DD fund, we track back a minimum of nine months and a maximum of twelve months of complete return

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[27] For example, the $17Billion fund (according to the Madoff SEC Form ADV filing) was audited not by a Big 4 firm but rather by David Friehling, a strip mall accountant who has since pleaded guilty to charges stemming from his role in the affair.

[28] See Brown *et al.* (2008).

[29] One investor can represent a large portion of a fund's overall assets. The DD reports give information on funds' largest investors, who on average represent 21% of funds' assets.

[30] In fact, clients and data subscribers are allowed to view other reports for an additional fee.

data for that fund. We then select every fund in the TASS/CISDM universe which has returns during the same time period. We define the ranking of this DD fund with all other funds available in that same time period. In Table IX, we find that flows are strongly and positively related to high past performance. On the other hand, our measure of operational risk does not in any way influence these flows. Our results here reinforce the finding by Brown *et al*. (2008) that operational risk does not mediate the tendency of naïve investors to chase past performance. Consistent with the prior literature (see Ding *et al*. (2008)), the best-performed group attract the most fund flows. Large funds receive low percentage flows, more volatile funds get less flows. Finally, the lambda variable is significant, indicating that DD funds are selected based on large amount of investor flows.

<Insert Table IX about here>

As a final exercise on investor reaction to the DD reports, we investigate the level of flows directed toward the DD funds after the DD reports versus funds with similar size, age and performance in the same style prior to the DD report date. On the one hand, we know investors are interested in these funds; thus the DD funds should have higher levels of flows. However, all DD reports find some level of red flags. Even minor red flags, especially considering the DD reports are being performed on funds that investors are particularly concerned about, may deter investment. We report results comparing flows of the DD funds to the matched funds in Table X.

<Insert Table X about here>

We find that the DD funds do have higher investor flows after the DD reports. Thus, most investors must still feel comfortable enough to invest in these funds, even after reading about funds' operational deficiencies. Investors may use the DD report as one of the screening criteria, together with their own information and connections.

V. Conclusion

Using hand-collected and proprietary data from 444 hedge fund due diligence (DD) reports, we study operational risk, manager integrity, the relation between hedge fund performance and investor flows. Despite the fundamental importance of integrity in the delegated asset management business, we find that incomplete and inaccurate disclosure of important information is not uncommon among a sample of funds selected for research by clients of a major due diligence firm.   The sample selection issues with respect to the database are themselves revealing. The DD reports are commissioned for funds with high past performance, and this performance peaks around the time of the report, consistent with a reversion towards the mean. The same is true for investor flows, albeit with a lag.

Our paper emphasizes the important role of operational due diligence in diversified hedge fund strategies adopted by institutional and individual investors. Misrepresentation of material facts is found to be a leading indicator of poor future returns and fund failure in the longer term. In prior work, Brown *et al.* (2008) had hypothesized an important role for private-sector information providers in the hedge fund

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industry. The current study allows us to study the private-sector mechanism in depth using a key subsample for which information gathering was costly, and was evidently of some value to the investor.

We find that funds with legal or regulatory problems are less trustworthy. We also find that a relationship with a major auditing firm is a sufficient statistic for the tendency to tell the truth. This is particularly important as we find that misrepresentation of pertinent facts is a leading indicator of poor future performance and fund failure. This strongly suggests that the role of the auditing firm is an important one in the market for investment services, especially hedge funds and other service providers that are lightly regulated.

Our sample does not represent the entire hedge fund industry, but rather the relatively small sample which is chosen to receive a due diligence report. These reports are costly and we find that it is the funds with the highest return and positive fund flow which receive these reports, which is consistent with return chasing behavior on the part of institutional investors. It is important to control for the fact that funds with high prior returns are selected for due diligence scrutiny and we do so using a two stage Heckman procedure. We find strong evidence that the operational risk characteristics revealed in the resulting due diligence report are highly correlated with subsequent poor returns and indeed fund failure. However, we do not find evidence that this information influences the flow-performance relationship. This seems to confirm that institutions investing in hedge funds are merely chasing past high returns. Overall, these results emphasize the important role of operational due diligence in diversified hedge fund strategies adopted by institutional investors and high net worth individuals.

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Table I: Basic Statistics

This table reports summary statistics of our sample. Characteristic data concerning fund properties, operations and background issues are hand collected from due diligence (DD) reports while performance data are collected from TASS, CISDM and the DD reports. *N* represents the number of observations, *Mean* is the mean value while *Std. Dev.* is the standard deviation. *Min* and *Max* are the minimum and maximum values respectively. Data definitions are reported in Appendix A.

Performance	N	Mean	Std. Dev.	Min	Max
Avg. Returns	419	1.67	1.18	-1.97	9.73
Return Std. Dev.	417	2.37	1.82	0.01	12.40
Autocorrelation	393	0.15	0.23	-0.55	0.78
Appraisal Ratio	336	1.05	2.33	-0.61	37.49
Fund Properties					
Management fee (%)	441	1.54	0.48	0.00	3.5
Incentive fee (%)	440	19.13	4.50	0.00	50.00
High Water Mark	439	0.97	0.18	0.00	1.00
Redemption period	441	72.25	74.97	1.00	730.00
Lockup period	441	97.01	199.15	0.00	2000.00
Notice period	442	50.36	35.84	1.00	365.00
AUM (Millions of $)	441	380.62	861.55	0.00	8000.00
Operations					
Pricing	443	0.65	0.48	0.00	1.00
Signature: bank	404	1.70	0.71	0.00	4.00
Signature: prime broker	391	1.74	0.73	0.00	5.00
Signature: IQ	438	0.25	0.44	0.00	1.00
Big4Auditor	443	0.63	0.48	0.00	1.00
Money Restrictions	384	0.38	0.48	0.00	1.00
NAV restate	442	0.10	0.30	0.00	1.00
Staff departure	437	0.49	0.95	0.00	7.00
% of board Ind.	338	0.45	0.32	0.00	1.00
Background Issues					
Problem	443	0.41	0.49	0.00	1.00
Lawsuit	443	0.32	0.47	0.00	1.00
Regulatory	443	0.15	0.36	0.00	1.00
Misrepresentation	443	0.21	0.41	0.00	1.00
Inconsistency	443	0.28	0.45	0.00	1.00
Noted Ver Problem	443	0.42	0.49	0.00	1.00

Table II: Univariate Information on Verification Problems

This table provides further univariate information on background issues based on information contained in the DD reports. The *Verification Problem* section provide further detail on *Inconsistencies* reported in Table 1 while the *Noted Misstatements* section provides further information regarding *Misrepresentations*. *N* represents the number of observations, *Mean* is the mean value while *Std. Dev.* is the standard deviation. *Min* and *Max* are the minimum and maximum values respectively. Data definitions are reported in Appendix A.

Verification Problems	N	Mean	Std dev	Min	Max
Signature Disagreement	443	16.03%	36. 73%	0	1
Pricing Disagreement	443	3.60%	18.68%	0	1
Bad Recall	443	20.99%	40.77%	0	1
Assets Disagree	443	10.38%	30.54%	0	1
Performance Disagree	442	4.52%	20.81%	0	1
Switched Vendor	443	11.51%	31.95%	0	1
Refused DD question	443	14.00%	34.73%	0	1
Can't Verify Assets	443	8.13%	27.35%	0	1
Can't Verify Performance	443	9.03%	28.69%	0	1
Noted Misstatements	N	Mean	Std dev	Min	Max
Strategic Misstatements	443	6.32%	24.36%	0	1
Misstatements	443	9.26%	29.01%	0	1
Truthteller	443	23.48%	42.43%	0	1
Regulatory Misstatement	443	6.32%	24.36%	0	1
Lawsuit Misstatement	443	17.38%	37.94%	0	1
Legal Misstatement	443	2.26%	14.87%	0	1
Background Misstatement	443	5.87%	23.53%	0	1

Table III: Problem and Non-problem Funds Compared

This table examines univariate differences of *Non-Problem* and *Problem* funds. Data definitions are reported in Appendix A. *Problem* funds are those funds that have either a regulatory issue or a lawsuit discussed on the DD report, while *Non-Problem* funds do not have such disclosures. The number of observations (*N*) and mean value (*Mean*) for both groups is presented. *Diff* is the difference between the two groups, with positive values indicating higher values for the *Non-Problem* group and vice versa. Significance of the difference is assessed using a *t*-test.

	Non-Problem		Problem		
Performance	N	Mean	N	Mean	Diff
Avg. Returns	242	1.65	177	1.70	-0.05
Return Std. Dev.	240	2.29	177	2.47	-0.18
Autocorrelation	227	0.14	166	0.15	-0.01
Appraisal Ratio	198	0.95	138	1.20	-0.25
Fund Properties					
Management fee (%)	258	1.57	183	1.50	0.07
Incentive fee (%)	259	19.19	182	19.05	0.14
High Water Mark	256	0.98	183	0.96	0.02
Redemption period (days)	260	64.41	181	83.51	-19.10*
Lockup period (days)	260	76.77	181	126.08	-49.31*
Notice period (days)	260	47.65	182	54.23	-6.58
AUM (Millions of $)	260	282.12	181	522.11	-239.99*
Operations					
Pricing	260	0.72	183	0.54	0.28**
Signature: IQ	256	0.26	182	0.25	0.01
Big4Auditor	260	0.70	183	0.52	0.18**
Money Restrictions	221	0.40	163	0.34	0.06
NAV restate	259	0.10	183	0.10	0.00
Staff departure	258	0.42	179	0.58	-0.16
% of board Ind.	214	0.47	124	0.43	0.04
Background Issues					
Misrepresentation	260	0.10	183	0.38	-0.28**
Inconsistency	260	0.27	183	0.30	-0.03
Noted Ver Problem	260	0.34	183	0.54	-0.20**
Signature Disagreement	260	0.17	183	0.15	0.02
Pricing Disagreement	260	0.04	183	0.03	0.01
Bad Recall	260	0.20	183	0.22	-0.02
Assets Disagree	260	0.08	183	0.14	-0.06
Performance Disagree	260	0.04	182	0.05	-0.01
Switched Vendor	260	0.07	183	0.18	-0.11**
Refused DD question	260	0.13	183	0.15	-0.02
Can't Verify Assets	260	0.09	183	0.07	0.02
Can't Verify Performance	260	0.09	183	0.09	0.00

**Significant at the 1% level; *Significant at the 5% level

Table IV: Logistic Analysis of Fund Selection

Presented below are results from logistic models analyzing the selection of funds for a DD reports. *Log Assets* is the log of the last assets reported by the fund. *Management Fee* and *Incentive Fee* are the funds' management fee and incentive fee, respectfully. *High Water Mark* and *Leveraged* are one if the fund has a high water mark or uses leverage, respectfully. *Red Notice Period* and *Lockup Period* is the length of notice (in days) needed to request money and the length of time (in months) money is locked into the fund. *Return Mean, Return Std. Dev.* and *Ret Autocorrelation* are the average monthly return, monthly return standard deviation and autocorrelation of monthly returns respectfully. *Big 4 Auditor* is one if the fund has a big 4 auditor. Standard errors are clustered by fund.

	Database Matches		All Funds	
	coefficient	chi-sq	coefficient	chi-sq
Log Assets	0.391	108.07**	0.384	87.86**
Management Fee	0.285	6.97**	0.416	18.82**
Incentive Fee	0.047	14.48**	0.054	21.18**
High Water Mark	0.658	13.15**	0.817	22.14**
Leveraged	0.048	0.13	0.001	0.00
Red Notice Period	0.007	10.07**	0.009	23.07**
Lockup Period	-0.037	12.67**	-0.043	19.14**
Return Mean	0.841	144.55**	0.841	147.40**
Return Std. Dev.	-0.472	93.46**	-0.492	106.87**
Ret Autocorrelation	0.300	1.13	-0.075	0.09
Big 4 Auditor	-0.475	13.62**	-1.041	80.53**
Year Dummies	Y		Y	
Style Dummies	Y		Y	
Clustered by Fund	Y		Y	
Fund Year Observations	26,112		26,203	
Number of Funds	8,999		9,090	
R-Squared	0.26		0.27	

**Significant at the 1% level; *Significant at the 5% level

Table V: Relationship between Problems and Operational Risk Variables

This table reports results of a logistic model investigating the relationship between operational risk variables and problems defined as lawsuits and regulatory issues. The dependent variable is one if the fund has a past legal or regulatory issue and zero otherwise. The logistic model fits the one case; thus, positive values indicate a fund is more likely to have a problem. Models are run with style dummies to control for style effects. Models are run in connection with a two-stage Heckman model, where *Lambda* is the control term. Variables definitions are in Appendix A.

	Model 1		Model 2	
	coefficient	chi-sq	coefficient	chi-sq
Return mean	0.193	0.99	0.041	0.03
Return Std. Dev.	0.033	0.08	0.083	0.40
Return Autocorr	0.032	0.00	-0.139	0.04
Log(assets)	0.093	1.03	0.162	2.05
Fund age	0.032	0.31	0.051	0.59
Management fee	-0.469	2.66	-0.277	0.61
Incentive fee	-0.027	0.85	-0.014	0.17
Lockup period	0.005	0.05	0.014	0.26
Notice period	0.002	0.41	-0.002	0.13
Background Misstatement	0.027	0.00	0.257	0.15
Signature IQ	-0.023	0.00	-0.169	0.19
Pricing	-0.699	6.82**	-0.904	6.91*
Big 4 auditor	-0.825	7.43**	-0.889	5.14*
Perf Ver Issue	-0.119	0.13	0.115	0.08
Bad Recall	-0.066	0.05	-0.480	1.36
Oper Ver Issue	-0.003	0.00	-0.397	1.02
Vendor Switch	1.292	10.31**	1.565	12.42**
Refused DD Question	0.219	0.40	0.450	1.20
# Ind Board			-0.522	1.11
Lambda	0.485	1.23	0.243	0.23
Pseudo R-square	0.21		0.27	
Num Obs.	382		290	

**Significant at the 1% level; *Significant at the 5% level

Table VI: Canonical Correlation between TASS and DD Variables

This table reports the results of a canonical analysis relating operational risk DD data to the observable TASS/CISDM data. The canonical analysis uses the information contained in the DD report to construct a univariate measure of operational risk, or ω-score, using the linear combination implied by the DD canonical variate that is maximally correlated with the set of TASS variables we consider. DD variables definitions are in Appendix A.

TASS/CISDM Variables		DD Variables	
Previous Returns	-0.19**	Misstatements	0.23**
Previous Std. Dev.	-0.18**	SignIQ	0.09
1st Order AC	-0.21**	Big4Auditor	-0.90**
Fund Age	-0.26**	Pricing	-0.39**
Log of Assets	-0.54**	Internal Accounting	0.42**
Management Fee	-0.28**	Misstatements*SignIQ	0.19**
Incentive Fee	-0.24**	Misstatements*Big4Auditor	-0.06
Leverage	-0.50**	Misstatements*Pricing	-0.01
Lockup	0.54**	Misstatements*Internal Accounting	0.40**
Advance Notice	0.25**		
Correlation Between			
TASS and DD Panels	0.48**		

**Significant at the 1% level; *Significant at the 5% level

Table VII: Cox Proportional Hazard Model and *ω*-Score

This table reports results of a Cox proportional hazards model investigating the relationship between operational risk, the *ω*-score variable, volatility, given as the natural logarithm of prior standard deviation, and the length of time to death after the DD report. The dependent variable is the number of years to death after the DD report date. Models are run with style dummies to control for style effects. Models are run in connection with a two-stage Heckman model, where *Lambda* is the inverse Mills ratio. GFC captures the global financial crisis fixed effect between August 2007 to June 2009.

	Model 1		Model 2	
	coefficient	*t*-stat	coefficient	*t*-stat
Volatility	-9.583	-1.44	-15.303	-2.02*
Omega	0.325	2.01*	0.341	2.04*
Volatility*Omega	-17.162	-2.44*	-16.541	-2.34*
GFC	0.747	3.61**	0.700	3.35**
Directional Traders			-0.789	-2.10*
FOF			-0.578	-1.58
Managed Futures			-0.111	-0.15
Multi-Process			-0.730	-2.36*
Relative Value			-0.391	-1.34
Lambda	-0.036	-0.35	-0.030	-0.29

**Significant at the 1% level; *Significant at the 5% level.

Table VIII: Relationship between Post Appraisal Ratio and Operational Risk Variable ω-Score

This table reports results investigating the relationship between operational risk, the ω-score, and performance after the DD report date. Standard deviation is the monthly return standard deviation up to but not including the report dates. Both DD funds and their related funds are included in the analysis. The fund's appraisal ratio computed using the Fung and Hsieh (2004) seven factor model using returns after the DD report is the dependent variable. Models are run with style dummies to control for style effects. Models are run in connection with a two-stage Heckman model, where *Lambda* is the inverse Mills ratio.

	Model 1		Model 2		Model 3	
	coeff.	*t*-value	coeff.	*t*-value	coeff.	*t*-value
Intercept	-1.161	-5.56**	-1.331	-6.13**	-0.490	-0.99
Omega	-1.359	-6.99**	-1.312	-6.71**	-1.344	-6.84**
Prior Std. Dev.	-0.293	-5.81**	-0.346	-6.14**	-0.343	-5.97**
Omega* Std. Dev.	-0.361	-7.65**	-0.348	-7.35**	-0.352	-7.43**
Directional Traders			-0.017	-0.14	0.004	0.03
FOF			-0.358	-2.43*	-0.347	-2.35*
Managed Futures			0.390	1.35	0.362	1.23
Multi-Process			0.065	0.59	0.097	0.88
Relative Value			-0.099	-0.82	-0.054	-0.44
Log(assets)					-0.047	-1.79
Fund age					-0.005	-0.31
Lambda	0.075	1.91	0.072	1.82	0.083	2.05*
Adj. R-squared	0.31		0.33		0.33	
Num Obs.	317		317		317	

**Significant at the 1% level; *Significant at the 5% level.

Table IX: Relationship between Future Flows and Operational Risk ω-Score

This table reports results with examining investor flows after the DD report. The dependent variable is the fund's flow computed as the percentage change in prior assets over the 12 months after their DD report after controlling for organic growth. Each DD fund's performance is ranked against other funds available at the time of the DD report. Models are run in connection with a two-stage Heckman model, where *Lambda* is the control term.

	Model 1		Model 2	
	coefficient	*t*-stat	coefficient	*t*-stat
Intercept	6.609	3.93**	6.784	3.98**
Low Rank	3.989	1.27	4.272	1.33
Mid Rank	-0.997	-0.60	-1.236	-0.74
High Rank	3.597	2.63**	3.659	2.66**
Omega	-0.098	-0.86	0.018	0.02
Log(assets)	-0.393	-5.02**	-0.403	-5.10**
Prior Std. Dev.	-18.569	-2.77**	-19.182	-2.83**
Low Rank*omega			0.739	0.25
Mid Rank*omega			-1.066	-0.68
High Rank*omega			-0.539	-0.42
Lambda	0.294	2.60**	0.284	2.48*
Adjusted R-squared	0.13		0.13	
Num Obs.	247		247	

**Significant at the 1% level; *Significant at the 5% level.

Table X: Comparison of Flows and Appraisal Ratios after the DD Report

This tables reports results comparing the flows and appraisal ratios of funds selected for DD reports and other matched funds from our combined TASS/CISDM database. Funds for the appraisal ratio results were matched by age, size and prior appraisal ratio. The matching fund was selected as the fund with the lowest total difference across all three variables with prior appraisal ratio receiving twice as much weight. Match funds for the flow results were selected by age, assets and return performance over the prior period. The matching fund was selected as the fund with the lowest total difference across all three variables with prior return performance receiving twice as much weight. Results for all DD funds, problem funds and non-problem funds are reported as well as p-values for the difference.

	DD Funds	Non-DD Matched Funds	Difference	p-value
Flows	1.483	0.632	0.851	0.00
Problem Flows	1.675	0.736	0.939	0.00
Non-Pro Flows	1.277	0.521	0.756	0.00
Appraisal ratio	0.212	0.137	0.074	0.31
Problem funds	0.244	0.183	0.060	0.64
Non-Problem funds	0.181	0.094	0.087	0.22

Figure 1: Median Returns
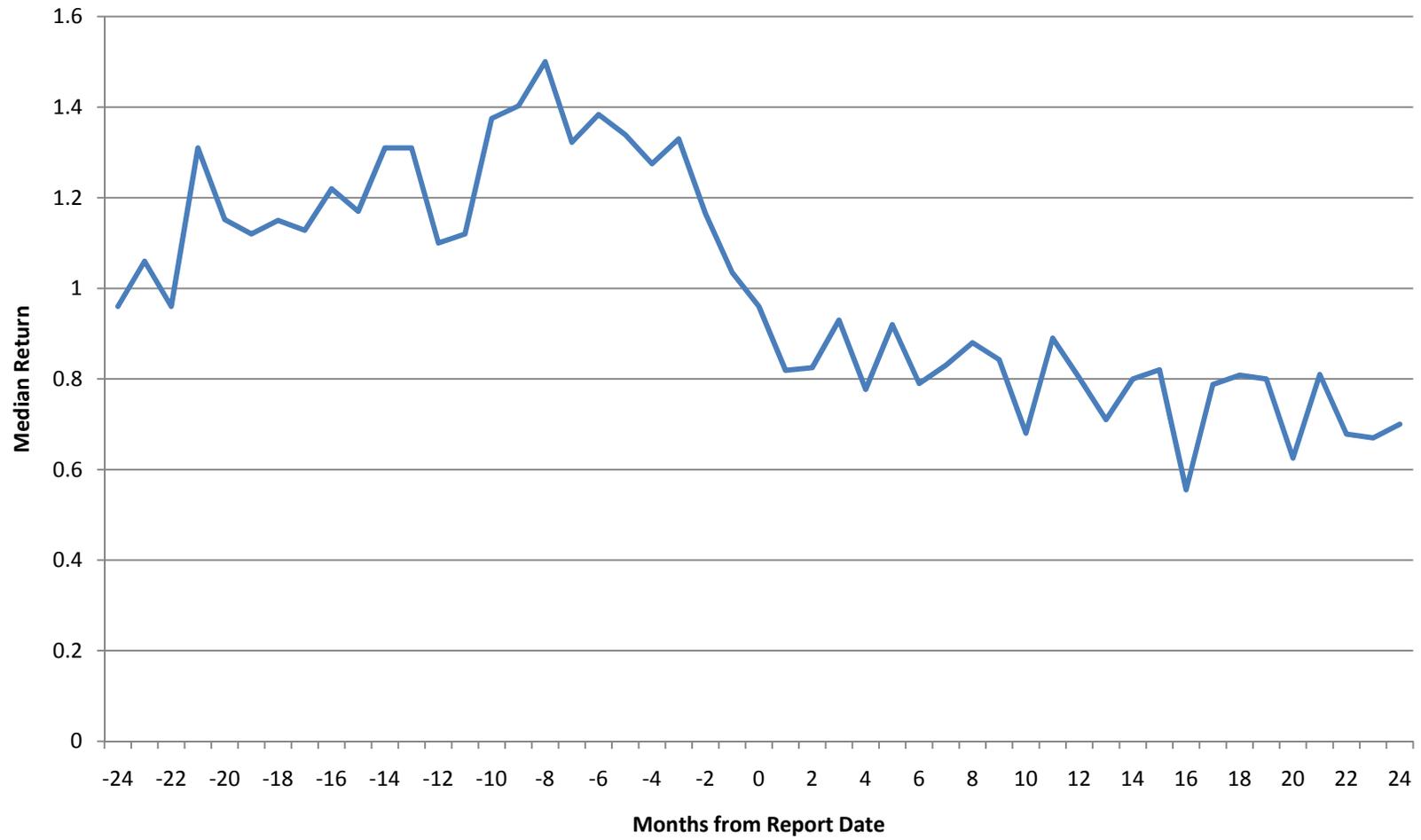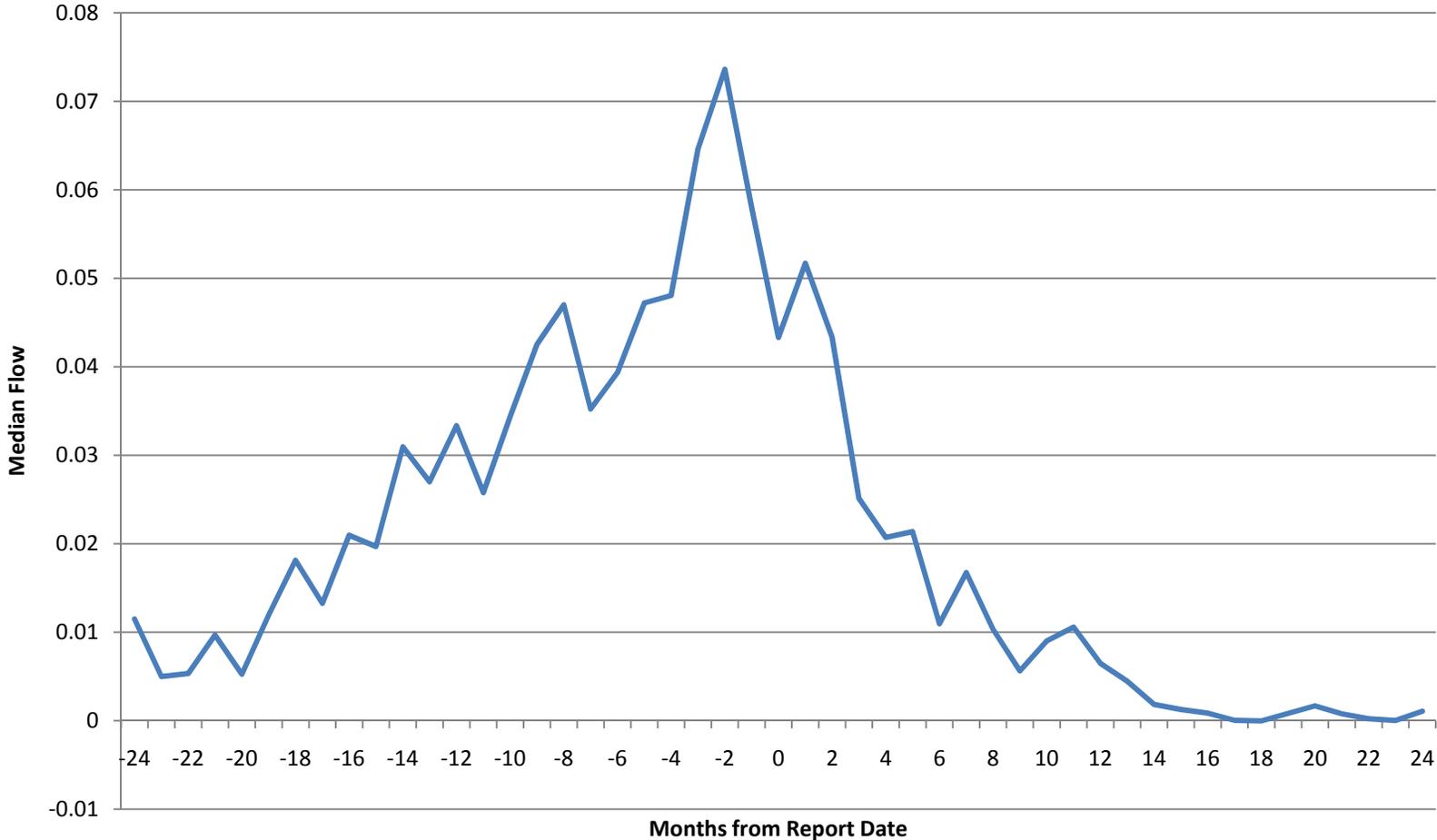
Figure 2: Median Flows

Appendix A: Data Definitions

Data is from a due diligence company. There are 444 funds. All data are hand-collected.

Performance	
Avg. Returns	Average Monthly Return prior to the DD report in percent
Return Std. Dev.	Avg, Return standard deviation prior to the DD report
Autocorrelation	Avg, Return autocorrelation prior to the DD report
Fund Properties	
Management fee (%)	Fund's management fee in percent
Incentive fee (%)	Fund's incentive fee in percent
High Water Mark	1 if the fund has a high water mark and zero otherwise
Redemption period	Number of days between redemption opportunities
Lockup period	Number of days new money is locked into fund
Notice period	Number of days request for a redemption notice
AUM (Millions of $)	Assets under management at DD report time
Log(assets)	Log of assets in US Dollars
Fund age	Age of fund in years
Operations	
Pricing	Priced completely externally = 1, mixed or internal = 0
Signature: IQ	1 if signature controls are institutional quality, zero otherwise
Big4Auditor	1 if fund's auditor is a big 4 auditor, zero otherwise
Money Restrictions	1 if restrictions on where money can be sent from Bank/PB
NAV restate	1 if fund has restated NAV in the past
Staff departure	# of persons that have departed the fund
% of board Ind.	% of board members that are independent
Internal Accounting	1 if fund uses day-to-day internal accounting
Background Issues	
Problem	1 if fund has a lawsuit or regulatory problem, 0 otherwise
Lawsuit	1 if fund has a lawsuit, 0 otherwise
Regulatory	1 if fund has a regulatory issue, 0 otherwise
Misrepresentation	1 if managers failed to disclose past regulatory or legal issue
Noted Ver Problem	1 if DD company had a problem verifying information This includes significant differences between performance/assets and operational rules and failing to disclose prior problems

Misstatement Information	
Strategic Misstatement	Fund voluntarily discloses a problem, but does not disclose all problems.
Misstatement	Fund discloses no problems, but has problems.
Truthteller	Fund discloses all problems.
Regulatory Misstatement	Did not disclose all regulatory infractions
Lawsuit Misstatement	Did not disclose all lawsuits
Legal Misstatement	Did not disclose all legal problems
Background Misstatement	Misrepresented personal background information

Background Issues	
Signature Disagreement	Signature process to move money disagreed between fund and administrator
Pricing Disagreement	Process to price the portfolio disagreed between fund, administrator and/or auditor.
Bad Recall	Fund verbally said something incorrect during DD visit.
Assets Disagree	Asset information disagrees between fund, administrator and/or auditor
Performance Disagree	Performance information disagrees between fund, administrator and/or auditor
Switched Vendor	Fund switched the vendor of a major process in the last three years.
Refused DD Question	Fund and/or administrator refused to answer a DD question
Can't Verify Assets	DD company cannot independently verify asset information
Can't Verify Performance	DD company cannot independently verify performance information
Perf Ver Problem	1 if Assets Disagree, Performance Disagree, Can't Verify Assets or Can't Verify Performance =1
Oper Ver Issue	1 if Signature Disagreement or Pricing Disagreement =1