The Impact of Portfolio Disclosure on Hedge Fund Performance, Fees, and Flows

by

Zhen Shi

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2011 by the
Graduate Supervisory Committee:

Michael Hertzel, Co-Chair
George Aragon, Co-Chair
Jeffrey Coles

ARIZONA STATE UNIVERSITY

May 2011

ABSTRACT

This study investigates the impact of portfolio disclosure on hedge fund performance. Using a regression discontinuity design, I investigate the effect of the disclosure requirements that take effect when an investment company's assets exceed $100 million; when that occurs, a fund is required by the SEC to submit form 13F disclosing its portfolio holdings. Consistent with the argument that portfolio disclosure reveals "trade secrets" and also raises front running costs thus harms the funds that disclose, I find that there is a drop in fund performance (about 4% annually) after a fund begins filing form 13F, as well as an increase in return correlations with other hedge funds in the same investment style. The drop in performance cannot be explained by a change in the assets under management or a mean reversion in returns. Consistent with the idea that funds with illiquid holdings tend to employ sequential trading strategies, which increase the likelihood of being taken advantage of by free riders and front runners, the drop in performance is more dramatic for funds that have more illiquid holdings. In addition, I find that the incentive fees paid to fund managers are 1% higher when portfolio disclosure is required, which supports the hypothesis that investors' monitoring of portfolio holdings disciplines adverse risk-taking by fund managers and allows for higher convexity in the optimal compensation structure. Finally, there is a drop in flows into funds that file 13F, which suggests that hedge fund investors negatively value 13F disclosure. Overall, this study suggests that the cost of portfolio disclosure is economically large. It contributes to the policy debate over what constitutes optimal disclosure.

ACKNOWLEGEMENT

I am grateful to my advisors, George Aragon, Michael Hertzel, and Jeffery Coles, for their guidance, encouragement, patience, and support. I thank my family for always being there for me and for supporting me throughout my Ph.D. study.

TABLE OF CONTENTS

Page

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Determining the extent to which investment portfolios should be publicly disclosed is a basic challenge facing hedge fund industry participants and regulators. Portfolio disclosure is beneficial to the extent that it allows investors to make informed investment allocation decisions and reduces potential agency costs that can arise when managerial actions are more opaque. Portfolio disclosure, however, is costly if it reveals proprietary information and facilitates free-riding activities by others on a fund's profitable investments and trading strategies.[1] In this study, I investigate the effect of the portfolio disclosure requirements that take effect when an investment company's assets exceed $100 million; when that occurs, hedge fund and other institutional managers are required by the SEC to file form 13F reporting their quarterly holdings within 45 days after the end of each quarter. This discontinuous change in disclosure regimes around the $100 million threshold allows for the use of a regression discontinuity approach and the identification of a causal effect of portfolio disclosure on hedge fund performance that is purged of potential endogeneity problems. The identifying assumption is that the function that relates fund size to performance does not have precisely the same jumps as the function that relates fund size to disclosure. This procedure is valid even if unobserved factors that affect performance (such as a fund manager's

[1] Poterba, Shackelford, and Shoven (2004) demonstrate that hypothetical "copycat" funds created by mimicking the portfolio holdings of actively managed mutual funds earn after expense returns that are indistinguishable from the copied funds.

skills) are functionally related to fund size.

Using a complete sample of 4,024 hedge fund managers that report to TASS over the period of February 1977 to February 2010, among which 414 have led Form 13F at least once, I find that fund performance is lower in the disclosure periods than in the non-disclosure periods. The results are robust to five performance measures, including raw returns, market model alpha, Fama-French three-factor alpha, Carhart four-factor alpha, and Fung-Hsieh seven-factor alpha. The cost of performance disclosure is economically large. For example, when measured by the Fama-French three-factor alpha, the performance is 4% lower (annually) during the disclosure periods. I also find that the drop in performance does not occur slowly over time; instead, it occurs in the form of a "sudden" drop in the first year after a fund files its first 13F disclosure. This finding of a 'discontinuous' drop in performance along the time dimension lends strong support to the argument that the decreased performance is due to portfolio disclosure.

Using a regression discontinuity design where samples are narrowed to a small neighborhood around the $100 million threshold, I find that there is a drop in fund performance that occurs in the form of a discontinuous 'jump' and that it cannot be explained by continuous changes in the assets under management when the regulatory regime switches from non-disclosure to disclosure. In addition, I find that there is no such discontinuous drop in performance for funds that also

crossed the $100 million threshold but were not required to file 13F.[2] Furthermore, there is no drop in fund performance when funds crossed other thresholds (e.g., $80 million or $120 million). These results confirm that the drop in performance following disclosure is not due to change in size or mean reversion in returns.

In support of the hypothesis that the decreased performance in the periods of portfolio disclosure is due to free-riding activities by other fund managers, I find that the return correlations between disclosing funds and other hedge funds that are in the same investment style are greater in the disclosure periods than in the non-disclosure periods. This finding supports the idea that other funds take positions more similar to disclosing funds after disclosing funds disclose their portfolio holdings or that incentives to pursue novel strategies diminish following disclosure.

I also investigate the extent to which the liquidity of portfolio holdings affects the cost of disclosure. In general, trades in illiquid securities result in larger price impacts than trades in liquid securities. In order to reduce the transaction cost due to price impact, fund managers tend to employ sequential trading strategies to accumulate or dispose of an illiquid position. However, the longer it takes to accumulate or dispose of a position, the higher the likelihood and greater the cost of being taken advantage of by frontrunners and free riders. Consistent with these observations, I find that the drop in performance is more

[2]The fact that these large funds are not required to file 13F is because they hold non-13(f) securities, short positions, or securities that are less than 10,000 shares or with market value less than $200,000.

dramatic for funds with illiquid holdings.

Disclosure is intended to improve monitoring and reduce agency problems. One of the main agency problems facing hedge fund investors is that managers may take on excessive risk, especially given the prevailing option-like "bonus" incentive fee.[3] Under "bonus" incentive fees, hedge fund managers receive a fixed percentage of fund profit but are not penalized when they incur losses. Thus, hedge fund managers do not suffer any downside risk. Unlike the time series of past fund returns, which provide a very limited view of fund risk, [4] portfolio disclosure allows investors to observe the holdings and assess the risk that they are exposed to. Their monitoring of portfolio holdings may discipline risk taking by fund managers and reduce the convexity of the incentive fees. Consistent with this argument that portfolio disclosure allows higher convexity in the optimal compensation structure, I find that incentive fees are 1% higher in the presence of portfolio disclosure, after controlling for other factors such as assets under management and age of the fund families.

Finally, whether hedge fund investors value 13F portfolio disclosure is still an open question. While investors may prefer more disclosure for the

---

[3]Starks (1987) and Grinblatt and Titman (1989) show in theoretical models that managers have incentives to choose greater risks than the desired risk level by the clients under option like incentive fees. Coles, Daniel, and Naveen (2006) show empirically that higher sensitivity of CEO wealth to stock volatility (vega) implements riskier policy choices. Golec and Starks (2004) find that an exogenous change in incentive fees reduces mutual fund managers' risk taking.

[4]See Stulz (2007) for a discussion on "earthquake" risks that can't be detected from past performance.

[5]See Healy and Palepu (2001) for a review of empirical disclosure literature.

increased transparency it affords, they may prefer less disclosure if it leads to lower fund performance. The value that investors attach to the 13F disclosure can be measured by the fund flows in and out of the funds. I find that flows are lower in the periods of disclosure than in non-disclosure periods. The test for this controls for the change in flows that might be expected in response to other factors, such as changes in past performance (Berk and Green, 2004). My finding suggests that hedge fund investors place a negative value on 13F portfolio disclosure.

This study is related to a broader literature on financial information disclosure.[5] There are several advantages of using hedge funds as a laboratory to examine issues related to disclosure. First, the proprietary cost of disclosure is plausibly more important for hedge fund managers. Hedge funds are relatively unfettered in their ability to use leverage, derivatives, and short sales across several asset classes. This structure might attract talented managers with sophisticated trading strategies. Second, hedge funds often utilize lockup provisions and hold illiquid assets, practices that suggest they are also more likely to use dynamic trading strategies. Disclosure especially undermines the profitability of these strategies. Third, the extent of disclosure, firm performance, and the value investors attach to the disclosure policy can be directly and easily measured in the context of portfolio disclosure. In contrast, the difficulty of measuring the extent of disclosure has constrained research in the area of financial information disclosure (Healy and Palepu, 2001).

This study provides direct evidence that portfolio disclosure harms hedge

fund performance and suggests that the cost of disclosure is economically large. This finding is supported by Aragon, Hertzel, and Shi (2009) and by Agarwal, Jiang, Tang, and Yang's (2009), who demonstrate that hedge fund managers request confidential treatment to delay 13F disclosure of their profitable ideas. This study is also in line with the finding of Ge and Zheng (2006) that past “winner" mutual funds that disclose less frequently outperform those that disclose more frequently.

This study is also the first to analyze the interactions between portfolio disclosure and compensation structure in the investment fund industry. A fund manager's adverse risk-taking incentive is similar to the risk-shifting incentive of an equity holder to expropriate wealth from existing bondholders. My finding that incentive fees are higher in the presence of portfolio disclosure is similar to John, Mehran, and Qian's (2008) finding that the pay-for-performance sensitivity of CEO compensation increases with the intensity of outside monitoring of the firm's risk choice, though their focus is not on the convexity of the compensation.

The remainder of the paper is organized as follows. Section II describes the data. Section III discusses the methodology and empirical results. Section IV concludes.

CHAPTER 2

DATA

Institutional Investment Managers and Form 13F

Since 1978, all institutional investment managers (including hedge fund managers) who exercise investment discretion over $100 million or more have been required by Section 13(f) of the Exchange Act to make quarterly disclosures of portfolio holdings to the SEC on form 13F. Form 13F must be filed with the SEC no later than 45 days after the end of each calendar quarter. The types of securities that are reported on form 13F include exchange-traded and NASDAQ-quoted stocks, equity options and warrants, convertible bonds, and shares of closed-end investment companies. All long positions in such securities with more than 10,000 shares or with a market value exceeding $200,000 are required to be reported. Information reported on form 13F includes the issuers of the securities, the security type, the CUSIP number, the number of shares, and the market value of each security owned. Managers are allowed to report aggregated holdings for different funds managed by the same management company.

Sample Selection

The Lipper/TASS hedge fund database provides monthly fund returns and assets under management, a snapshot of fund characteristics, and the management company/investment advisor voluntarily reported by hedge funds. The TASS hedge fund database reports data beginning in February 1977, and the most recent download covers data to February 2010. At that time there were 13,845 funds, including 5,861 live funds and 7,984 dead funds. A total of 4,024 management

companies/investment advisors are listed in the TASS database and each management company can manage multiple funds.

The Thomson-Reuters Institutional (13f) Holdings dataset provides quarterly holdings by institutional investors that are obligated to file form 13F with the SEC. The Thomson-Reuters dataset starts from the first quarter of 1980, and the most recent downloads cover holdings until the last quarter of 2009. In order to identify investment companies that manage hedge funds, I first compile a list of hedge fund company names using the Company file in the TASS Hedge Fund datasets downloaded in February 2009. This yields a total of 4,024 investment companies that manage hedge funds. I then hand matched these hedge fund company names with company names in the Thomson-Reuters Institutional (13f) Holdings dataset. There are a total of 414 investment companies matched.

Dates on Which Funds Start or Stop Filing Form 13F

The first quarter that a company has fling records in the Thomson (13f) dataset is identified as the quarter that an investment company starts to file form 13F. Similarly, the last quarter that a company has filing records in Thomson (13f) is identified as the quarter that an investment company stops filing form 13F.

Table 1 lists the number of investment companies that began filing form 13F (and were added to the database of 13F filing companies) each year from 1980 to 2009 in column 1 and the number of investment companies that stopped filing form 13F (and were dropped from the 13F list) in column 2. As shown in column 1, the number of investment companies added to the 13F list increased over the first half of the sample period and peaked in year 1999. It stayed roughly stable in the second half of the sample period and dropped in year 2008. Table 2 reports the

distribution of the length of 13F filing periods. The majority of the investment companies have a filing period of between 2 years and 10 years. There are three investment companies that have a filing period of over 20 years.

Table 1. The Number of Companies Added or Dropped from the List of 13F Filing Companies

This table reports the number of investment companies that began filing form 13F (added to the list of 13F Filing companies) each year from 1980 to 2009 in column 1 and the number of investment companies that ceased filing form 13F (and were dropped from the list of 13F companies) in column 2. The first quarter that a company has filing records in the Thomson (13f) dataset is identified as the quarter that an investment company *starts* to file form 13F, excluding the beginning of the Thomson (13f) dataset, which is the first quarter of year 1980. Similarly, the last quarter that a company has filing records in Thomson (13f) is identified as the quarter that an investment company stops filing form 13F, excluding the last date of the Thomson (13f) data download, which is the last quarter of year 2009.

Year	# of Companies That Begin Filing 13F	# of Companies That Cease Filing 13F
1980	1	0
1981	1	0
1982	1	0
1983	1	0
1984	0	0
1985	1	0
1986	0	0
1987	2	0
1991	3	0
1992	1	0
1993	3	0
1994	3	1
1995	5	2
1996	2	0
1997	12	1
1998	17	30
1999	58	6
2000	35	17
2001	12	11
2002	28	10
2003	41	11
2004	28	14
2005	44	18
2006	43	26
2007	43	31
2008	29	50
2009	0	18
Total	414	246

Table 2. The Length of 13F Filing Periods

This table reports the distribution of the length of the 13F filing periods.

Length of 13F Filing Period	# of Investment Companies
1 quarter	24
2 quarters to 1 Year	52
2 to 5 Years	207
6 to 10 Years	101
10 to 15 Years	26
15 to 20 Years	1
>= 20 Years	3
Total	414

CHAPTER 3

EMPIRICAL RESULTS

The Impact of 13F Disclosure on Hedge Fund Performance

Hedge Fund Performance Before and During 13F Portfolio Disclosure

In this section, I use univariate tests to investigate whether portfolio disclosure harms hedge fund performance. Only those fund families that have return data in TASS before and during 13F portfolio disclosure are included in the analysis. The statistical significance of the difference in performance between disclosure and non-disclosure periods is obtained using a paired t-test. As shown in Table 3, hedge fund performance is worse in disclosure periods than in non-disclosure periods. The results are robust to five performance measures including raw returns, market model alpha, Fama-French three-factor alpha, Carhart four-factor alpha, and Fung-Hsieh seven-factor alpha. The differences in performance are both statistically and economically significant. For example, the Fung-Hsieh seven-factor model alpha is 0.399% lower per month (4.788% annually) during the 13F disclosure period.

Risk-Adjusted Performance of Calendar Time Portfolio

I investigate whether a calendar time portfolio which long disclosed funds and short non-disclosed funds earns abnormal risk-adjusted returns. In each month *t*, a fund family is classified as "disclosed" if it files 13F in month *t-1*, otherwise it is classified as "non-disclosed". Only the fund families that file 13F at least once during the sample period are included in the analysis. Table 4 reports raw returns and risk adjusted performance including market model alpha,

Fama-French three-factor alpha, Carhart four-factor alpha, and Fung-Hsieh seven-factor alpha of the calendar time portfolio. As shown in the table, raw returns and alphas obtained from the four risk models are all negative and statistically significant. For example, the alpha based on Fung-Hsieh seven-factor model is -0.283% monthly (3.396% annually). These results suggest that disclosed funds underperformance non-disclosed funds by about 3.4% annually.

Table 3. Hedge Fund Performance Before and During 13F Portfolio Disclosure

This table reports the results of univariate tests on hedge fund performance before and during 13F portfolio disclosure. The statistical significance on the difference in performance is obtained using paired t-tests.

	Before 13F Filing			During 13F Filing			Difference	
	n	mean	sd	n	mean	sd	Paired-t test	
Raw Returns (%)	152	1.098****	0.779	152	0.529****	0.886	-0.569	****
Market Model								
Alpha (%)	152	0.654****	0.730	152	0.261****	0.777	-0.393	****
Beta-Market	152	0.299****	0.430	152	0.393****	0.450	0.093	***
Adj R-squared	152	0.202	0.226	152	0.272	0.250	0.070	***
Fama-French 3 Factor Model								
Alpha (%)	152	0.594****	0.697	152	0.215***	0.838	-0.379	****
Beta-Market	152	0.285****	0.426	152	0.388****	0.421	0.103	***
Beta-SMB	152	0.206****	0.272	152	0.115****	0.325	-0.091	***
Beta-HML	152	0.137****	0.358	152	-0.020	0.446	-0.158	****
R-squared (Adj)	152	0.276	0.248	152	0.340	0.266	0.063	***
Fama-French 4 Factor Model								
Alpha (%)	152	0.561	0.709	152	0.175***	0.812	-0.386	****
Beta-Market	152	0.283****	0.414	152	0.389****	0.430	0.106	***
Beta-SMB	152	0.193****	0.312	152	0.125****	0.327	-0.068	**
Beta-HML	152	0.155****	0.366	152	0.002	0.427	-0.154	****
Beta-Momentum	152	0.030	0.272	152	0.026	0.256	-0.004	
R-squared (Adj)	152	0.306	0.251	152	0.370	0.262	0.064	***
Fung and Hsieh 7 Factor Model								
Alpha (%)	152	0.720	0.792	152	0.321	0.910	-0.399	****
Beta-Bond Trend-Following	152	-0.004	0.061	152	-0.010*	0.069	-0.006	
Beta-Currency Trend-Following	152	0.006	0.050	152	0.007**	0.043	0.002	
Beta-Commodity Trend-Following	152	0.004	0.054	152	0.011**	0.060	0.008	
Beta-S&P 500	152	0.249****	0.433	152	0.291****	0.461	0.042	
Beta-SC-LC	152	0.184****	0.319	152	0.049***	0.185	-0.135	
Beta-10-year Treasury Yield	152	-0.648	4.893	152	-0.086	3.869	1.481	
Beta-Credit Spread	152	-1.567**	8.350	152	-3.043****	6.806	-2.395	
R-squared (Adj)	152	0.244	0.278	152	0.333	0.288	0.089	***

Table 4. Calendar Time Portfolios

This table reports raw and risk-adjusted returns for a calendar time portfolio that longs disclosed funds and shorts non-disclosed funds. In month *t*, a fund family is classified as "disclosed" if it files 13F in month *t-1*, otherwise it is classified as "non-disclosed".

	(1)	(2)	(3)	(4)	(5)
	Raw Return	Market Model	FF-3Factor Model	Carhart 4 Factor Model	Fung-Hsieh 7 Factor Model
Constant	-0.00313**	-0.00330***	-0.00226**	-0.00231**	-0.00283**
	(-2.34)	(-2.74)	(-2.24)	(-2.23)	(-2.12)
Market		0.147****	0.0767***	0.0799**	
		(3.68)	(2.71)	(2.27)	
SMB			-0.00912	-0.0117	
			(-0.29)	(-0.35)	
HML			-0.159****	-0.158****	
			(-4.66)	(-4.56)	
Momentum				0.00624	
				(0.31)	
Bond Trend-Following					0.00335
					(0.48)
Currency Trend-Following					0.00220
					(0.51)
Commodity Trend-Following					0.00324
					(0.49)
S&P 500					0.122***
					(3.24)
SC_LC					-0.000885
					(-0.52)
Credit Spread					-0.741
					(-0.52)
10-year Treasury Yield					-0.0211
					(-0.04)
Observations	108	108	108	108	108
Adjusted R-squared		0.284	0.475	0.471	0.173

Regression Discontinuity (RD) Design

The discontinuous change in the disclosure regime that takes effect when investment companies' assets cross the $100 million threshold allows me to identify an effect of portfolio disclosure on hedge fund performance that is purged of potential endogeneity problems. I employ a regression discontinuity design in which the identifying assumption is that the function that relates fund size to performance does not have precisely the same jumps as the function that relates fund size to disclosure. This procedure is valid even if unobserved factors such as fund manager skill that affect performance are functionally related to fund size. I narrow the sample to a small neighborhood around the $100 million threshold and use model below to detect whether there is a jump in performance when the disclosure requirement changes. Specifically, I keep the fund-year observations that have a lagged fund size greater than $70 million and less than $130 million. The results are robust to various width of the neighborhood such as $90 million to $110 million and $80 million to $120 million.

$$Performance_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma_1 Size_{i,t-1} + \gamma_2 Size^2_{i,t-1} + \varepsilon_{i,t}$$

where $Performance_{i;t}$ is a performance measure for fund family i in year t. $Performance_{i;t}$ is equal to 0 if year t is before investment company i begins filing form 13F, and is equal to 1 if year t is during the period that investment company files form 13F. The coefficient on $Disclosure_{i;t}$ captures whether there is a jump in performance when the disclosure code changes from 0 to 1. Both linear and quadratic terms of lagged assets under management are included in the model to

control for the effect of fund size on fund performance. Using samples only in the small neighborhood of $100 million also allows the results to be less dependent on the model specifications, such as the quadratic relation between size and performance.

As shown in columns (1), (3), (5), (7), and (9) in Panel A of Table 5, the coefficient on $Disclosure_{i;t}$ is negative and statistically significant across all three performance measures. There is a drop in performance that occurs in the form of a discontinuous jump that cannot be explained by continuous changes in assets under management when the regulatory regime switches from non-disclosure to disclosure.

There are also funds in TASS that have crossed the threshold of $100 million but were not required to file 13F because some or all of their assets are not 13(f) securities, are short positions, contain fewer than 10,000 shares, or have a market value of less than $200,000. These non-13F filing funds provide the opportunity for a control test. If the drop in performance is due to 13F disclosure, we should not observe a discontinuous drop in performance for this control group when they cross the $100 million threshold. As shown in columns (2), (4), (6), (8), and (10) in Panel A of Table 5, the coefficient on variable $Disclosure_{i;t}$ is not significantly different from zero, which suggests that there is no drop in performance for funds that crossed the $100 million threshold but did not file 13F disclosure.

I also investigate whether there is a discontinuous drop when funds cross

other thresholds (e.g., $70 million or $130 million). If the drop in performance when funds crossed the $100 million threshold is due to 13F disclosure, we should not observe drops in performance when funds cross other thresholds. As shown in Panel B of Table 5, the coefficient on $Dummy_{i;t}$ is not statistically different from zero when using the threshold of $70 million or $130 million. These results confirm that the drop in performance following disclosure is not due to a change in size or mean reversion in returns.

To address the concern that the yearly performance measure alphas estimated with twelve monthly return observations may not be very reliable due to the limitation of the sample size, I scaled each alpha estimate by its standard error and then run tests identical to those reported in Panels A and B and the results are reported in Panels C and D. By scaling the alpha estimate by its standard error, I give greater weight to the alpha estimates which are relative more precise. As shown in Panel C and Panel D, the results are qualitatively similar.

Table 5. Regression Discontinuity Design

This table reports the results of regression discontinuity (RD) design with samples narrowed to a small neighborhood around the threshold of $100 million ($\delta$ is chosen to represent $30 million). In Panel A, funds that filed 13F during the sample period are included in the analysis in model (1), (3), (5), (7), and (9). $Performance_{i,t}$ is a performance measure for fund family *i* in year *t*. I use five different performance measures in my analysis: raw returns, market model alpha, Fama-French three-factor model alpha, Carhart four-factor model alpha, and Fung-Hsieh seven-factor model alpha. All are calculated using monthly fund returns reported in TASS. $Disclosure_{i,t}$ is equal to 0 if year *t* is before the investment company *i* starts to file form 13F, and is equal to 1 if year *t* is during the period that investment company files form 13F.

$$Performance_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma_1 \cdot Size_{i,t-1} + \gamma_2 \cdot Size_{i,t-1}^2 + \varepsilon_{i,t}$$

Sample: $100 million – δ <= Size $_{i,t-1}$ <= $100 million + δ

Funds that never filed 13F during the sample period are used as a control group for the analysis, and results are reported in model (2), (4), (6), (8), and (10). $Dummy_{i,t}$ is equal to 1 if the size of investment company *i* in year *t-1* is equal or greater than $100 million, and is equal to 0 otherwise.

$$Performance_{i,t} = \alpha + \beta \cdot Dummy_{i,t} + \gamma_1 \cdot Size_{i,t-1} + \gamma_2 \cdot Size_{i,t-1}^2 + \varepsilon_{i,t}$$

$$Dummy_{i,t} = \begin{cases} 1, & if\ Size_{i,t-1} >= \$100\ million \\ 0, & if\ Size_{i,t-1} < \$100\ million \end{cases}$$

Sample: $100 million – δ <= Size $_{i,t-1}$ <= $100 million + δ

In Panel B, other thresholds, including $70 million and $130 million, are chosen for the analysis. Specifically, $Dummy_{i,t}$ is equal to 1 if the size of investment company *i* in year *t-1* is equal or greater than $70 (or $130) million, and is equal to 0 otherwise.

$$Performance_{i,t} = \alpha + \beta \cdot Dummy_{i,t} + \gamma_1 \cdot Size_{i,t-1} + \gamma_2 \cdot Size_{i,t-1}^2 + \varepsilon_{i,t}$$

$$Dummy_{i,t} = \begin{cases} 1, & if\ Size_{i,t-1} >= \$70\ (or\ \$130)\ million \\ 0, & if\ Size_{i,t-1} < \$70\ (or\ \$130)\ million \end{cases}$$

Sample: $70 (or $130 million) – δ <= $Size_{i,t-1}$ <= $70 (or $130 million) + δ

In Panel C, the performance measure - alpha for investment company *i* in year *t* is scaled by the standard error of the alpha estimate. These error-scaled alphas are then used in the regression discontinuity (RD) design that is identical to the tests in Panel A. Similarly, the alphas used in Panel D are scaled by their standard errors and the tests are identical to those in Panel B.

Panel A. Funds that Did and Did Not File 13F When Crossing the Threshold of $100 Million

	Raw Return		Market Model Alpha		FF 3-Factor Alpha		Carhart 4-Factor Alpha		Fung-Hsieh 7-Factor Alpha	
	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Disclosure	-0.00571	-0.000951	-0.00554**	0.00109	-0.00599**	-0.00124	-0.00616**	-0.00130	-0.00466*	-0.00335
/Dummy	(-1.59)	(-0.70)	(-2.26)	(0.71)	(-2.78)	(-0.62)	(-2.58)	(-0.73)	(-1.81)	(-1.16)
Lagged Size	9.93	9.34	-3.31	3.44	-5.98	0.979	-6.87	0.486	-10.1	3.36
(10^{-10})	(0.56)	(1.51)	(-0.42)	(1.02)	(-0.93)	(0.28)	(-1.02)	(0.13)	(-1.40)	(0.54)
Lagged Size^2	-5.47	-4.68	1.42	-1.85	2.69	-0.129	3.08	0.159	4.49	-1.2
(10^{-18})	(-0.60)	(-1.47)	(0.35)	(-1.03)	(0.83)	(-0.07)	(0.89)	(0.09)	(1.23)	(-0.39)
Constant	-0.0327	-0.0387	0.0250	-0.0128	0.0372	-0.00499	0.0418	-0.00373	0.0597	-0.0166
	(-0.39)	(-1.23)	(0.66)	(-0.78)	(1.21)	(-0.29)	(1.30)	(-0.19)	(1.68)	(-0.53)
Observations	204	796	204	796	204	796	204	796	204	796
R-squared	0.038	0.005	0.041	0.001	0.064	0.004	0.070	0.003	0.026	0.002

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Panel B. Other Thresholds ($70 million and $130 million)

	Raw Return		Market Model Alpha		FF 3-Factor Alpha		Carhart 4-Factor Alpha		Fung-Hsieh 7-Factor Alpha	
	$70 M	$130 M	$70M	$130M	$70M	$130M	$70M	$130M	$70M	$130M
Disclosure	0.0000174	0.00527	0.000401	0.00266	-0.00000908	-0.000747	0.000189	-0.00197	-0.00105	0.00174
/Dummy	(0.01)	(1.25)	(0.33)	(0.92)	(-0.01)	(-0.35)	(0.13)	(-0.88)	(-0.43)	(0.57)
Lagged Size	-3.42	-1.07	-1.66	3.52	-1.56	5.64	-1.62	4.23	-0.697	3.46
(10^{-10})	(-1.23)	(-0.17)	(-1.63)	(0.63)	(-1.30)	(1.03)	(-1.18)	(0.75)	(-0.24)	(0.60)
Lagged Size^2	2.82	-0.0888	1.24	-1.64	1.25	-2.07	1.26	-1.4	0.947	-1.38
(10^{-18})	(1.26)	(-0.04)	(1.36)	(-0.75)	(1.29)	(-0.94)	(1.09)	(-0.62)	(0.42)	(-0.60)
Constant	0.0153**	0.0191	0.00782***	-0.0156	0.00654	-0.0345	0.00603	-0.0280	0.00323	-0.0189
	(2.89)	(0.45)	(3.10)	(-0.45)	(1.57)	(-1.04)	(1.35)	(-0.79)	(0.37)	(-0.51)
Observations	1500	707	1500	707	1500	707	1500	707	1500	707
R-squared	0.002	0.005	0.001	0.003	0.001	0.002	0.001	0.003	0.001	0.002

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Panel C. Funds that Did and Did Not File 13F When Crossing the Threshold of $100 Million (Error-Scaled)

	Raw Return		Market Model Alpha		FF 3-Factor Alpha		Carhart 4-Factor Alpha		Fung-Hsieh 7-Factor Alpha	
	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group	Test Group	Control Group
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Disclosure /Dummy	-1.381**	0.334	-1.281***	0.371*	-1.186***	0.273	-1.236***	0.287	-1.012***	0.129
	(-2.46)	(1.32)	(-3.53)	(1.87)	(-3.57)	(1.04)	(-3.84)	(1.06)	(-3.37)	(0.55)
Lagged Size	-1.94	-10.9	-6.96	-7.93	-11.4	-6.24	-11	-6.76	-3.27	-9.55
(10^{-8})	(-0.14)	(-0.90)	(-0.74)	(-0.93)	(-1.44)	(-1.00)	(-1.58)	(-1.08)	(-0.38)	(-1.12)
Lagged Size^2	1.06	5.63	3.69	3.98	6.02	3.14	5.77	3.39	1.6	4.94
(10^{-16})	(0.14)	(0.84)	(0.77)	(0.84)	(1.53)	(0.90)	(1.62)	(0.95)	(0.38)	(1.14)
Constant	3.174	6.748	4.672	4.615	6.418	3.609	6.295*	3.768	2.823	4.953
	(0.51)	(1.22)	(1.04)	(1.22)	(1.67)	(1.30)	(1.87)	(1.37)	(0.67)	(1.17)
Observations	204	796	204	796	204	796	204	796	204	796
R-squared	0.098	0.003	0.129	0.004	0.132	0.003	0.144	0.003	0.069	0.004

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Panel D. Other Thresholds ($70 million and $130 million) (Error-Scaled)

	Raw Return		Market Model Alpha		FF 3- Factor Alpha		Carhart 4-Factor Alpha		Fung-Hsieh 7-Factor Alpha	
	$70 M	$130 M	$70 M	$130 M	$70 M	$130 M	$70 M	$130 M	$70 M	$130 M
Disclosure	0.390	-0.127	0.386	-0.318	0.335	-0.317	0.296	-0.357	0.228	-0.159
/Dummy	(1.06)	(-0.20)	(1.72)	(-0.77)	(1.61)	(-0.94)	(1.34)	(-0.89)	(0.73)	(-0.45)
Lagged Size	3.95	9.51	1.84	6.2	2.1	5.37	1.88	4.04	3.55	3.31
(10^{-8})	(0.96)	(0.64)	(0.65)	(0.58)	(0.75)	(0.60)	(0.63)	(0.45)	(1.18)	(0.38)
Lagged Size^2	-3.11	-3.18	-1.75	-1.98	-1.92	-1.78	-1.73	-1.21	-2.81	-1.01
(10^{-16})	(-1.00)	(-0.58)	(-0.79)	(-0.50)	(-0.90)	(-0.53)	(-0.79)	(-0.36)	(-1.13)	(-0.29)
Constant	0.0636	-4.816	0.0754	-3.420	-0.179	-3.002	-0.180	-2.335	-0.755	-1.820
	(0.05)	(-0.50)	(0.08)	(-0.49)	(-0.19)	(-0.51)	(-0.17)	(-0.40)	(-0.83)	(-0.33)
Observations	1500	707	1500	707	1500	707	1500	707	1500	707
R-squared	0.003	0.001	0.003	0.001	0.003	0.001	0.002	0.001	0.003	0.001

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

'Discontinuous' Change in Performance When Funds Start to File 13

The univariate tests in Table 3 show that fund performance is poorer in the disclosure periods than in the non-disclosure periods. If the decreased performance is due to portfolio disclosure, the change in fund performance should not occur slowly over time, but in the form of a sudden drop immediately after funds start to file 13F disclosure. In this section, I use the following regression to test whether the change in performance occurs as soon as funds begin filing 13F:

$$Change\ in\ Performance_{i,t} = \alpha + \beta_1 \cdot 1^{st}\ Year_{i,t} + \beta_2 \cdot 2^{nd}\ Year_{i,t} + \beta_3 \cdot 3^{rd}\ Year_{i,t} + \beta_4 \cdot 4^{th}\ Year_{i,t} + \beta_5 \cdot 5^{th+}{}_{i,t} + \gamma_1 \cdot Change\ in\ Size_{i,t} + \gamma_2 \cdot Change\ in\ Size^2_{t-1}$$

Change in Performance$_{i;t}$ is the change in performance of fund family *i* in year *t* from year *t-1*. The variable $1^{st}\ Year_{i;t}$ is equal to 1 if it is the first year in which the fund family *i* starts to file 13F. I also include dummy variables for 2nd, 3rd, and 4th year and for 5th year or later. The control variables include lagged change in linear and quadratic term of assets under management. All TASS funds except funds that report in a currency other than U.S. dollars are included in the analysis, and back-filled data are removed. Fund family and year fixed effects are included in the model and errors are clustered.

As shown in Panel A Table 6, the coefficients on variable $1^{st}\ Year_{i;t}$ are negative and statistically significant across all five performance measures. For example, the coefficient on variable $1^{st}\ Year_{i;t}$ in model (1) is -0.00523, which suggests that the drop in raw returns in the first year after funds start to file 13F is 0.52% monthly (or 6.3% annually). However, the coefficients on 2nd, 3rd, 4th, and

5^{th+} year dummies are not negatively statistically significant. The results suggest that the decrease in performance occurs in the first year after funds start to file 13F, which supports the argument that the drop in performance is due to 13F disclosure. The coefficient on lagged change in assets under management is negative and statistically significant, which suggests diminishing returns to scale. The coefficient on lagged change in squared size is positive, which suggests that the relation between performance and size is concave. This discontinuous change in performance along the time dimension again lends strong support for the argument that portfolio disclosure harms fund performance. Panel B reports the results where the alpha estimates are scaled by its standard error before being used in the test. As discussed in the previous session, this treatment is to address the concern that the sample size for estimating alpha in each year is limited (12 monthly observations). The results remain unchanged after applying this treatment.

Table 6. Change in Performance When Funds Start to File 13F

This table reports the results of the following regression model:

$$\textit{Change in Performance}_{i,t} = \alpha + \beta_1 \cdot 1^{st}\,\textit{Year}_{i,t} + \beta_2 \cdot 2^{nd}\,\textit{Year}_{i,t} + \beta_3 \cdot 3^{rd}\,\textit{Year}_{i,t} + \beta_4 \cdot 4^{th}\,\textit{Year}_{i,t} + \beta_5 \cdot 5^{th+}{}_{i,t} + \gamma_1 \cdot \textit{Change in Size}_{i,t} + \gamma_2 \cdot \textit{Change in Size}^2_{t-1}$$

Change in Performance$_{i,t}$ is the change in performance of fund family *i* in year *t* from year *t-1*. The variable $1^{st}\,\textit{Year}_{i,t}$ is equal to 1 if it is the first year since fund family *i* start to file 13F. I also include dummy variables for 2nd, 3rd, 4th, and 5th year or later. The control variables include lagged change in linear and quadratic term of assets under management. All investment companies that report to the TASS dataset are included in the analysis. Fund family and year fixed effects are included in the model and errors are clustered. The sample period is from June 1990 to February 2010 after removing the backfilled data.

28

Panel A. Change in Performance When Funds Start to File 13F

	Change in Alpha				
	Raw Return	Market Model	FF3 Factor	Carhart 4 Factor	Fung-Hsieh 7 Factor
	(1)	(2)	(3)	(4)	(5)
1st Year	-0.00492*	-0.00432*	-0.00770***	-0.00818***	-0.00438*
	(-2.02)	(-1.83)	(-3.63)	(-3.63)	(-1.80)
2nd Year	-0.00247	-0.00323	-0.00215	-0.00255	-0.00282
	(-0.75)	(-1.17)	(-0.74)	(-0.69)	(-0.99)
3rd Year	-0.00243	-0.00278	-0.00334	-0.00195	-0.000343
	(-0.87)	(-0.99)	(-0.93)	(-0.38)	(-0.07)
4th Year	-0.00249	-0.00138	-0.00243	-0.00142	-0.000343
	(-0.76)	(-0.52)	(-0.63)	(-0.29)	(-0.05)
5th+ Year	-0.00209	-0.00299	-0.00571	-0.00492	-0.00508
	(-0.65)	(-0.91)	(-1.53)	(-1.19)	(-0.75)
Lag Change in Size	-1.36****	-0.974****	-0.835****	-0.805****	-0.481***
($\times 10^{-11}$)	(-6.16)	(-9.66)	(-7.27)	(-6.69)	(-3.12)
Lag Change in Size^2	7.20****	5.64****	4.89****	4.50****	3.55***
($\times 10^{-22}$)	(6.80)	(8.89)	(5.86)	(5.55)	(4.05)
Constant	0.0217	0.0171	0.00536	0.0221	0.0437
	(1.28)	(0.74)	(0.24)	(1.05)	(1.50)
Observations	5383	5383	5383	5383	5382
R-squared	0.440	0.325	0.267	0.251	0.192

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Panel B. Change in Performance When Funds Start to File 13F (Error Corrected)

	Change in Alpha				
	Raw Return	Market Model	FF3 Factor	Carhart 4 Factor	Fung-Hsieh 7 Factor
	(1)	(2)	(3)	(4)	(5)
1st Year	-0.448*	-0.503**	-0.705***	-0.799****	-0.419*
	(-1.79)	(-2.57)	(-3.71)	(-4.42)	(-2.03)
2nd Year	-0.409	-0.328	-0.344	-0.322	-0.161
	(-1.72)	(-1.39)	(-1.65)	(-1.18)	(-1.04)
3rd Year	0.0638	-0.00522	0.0789	0.143	0.0821
	(0.26)	(-0.02)	(0.35)	(0.43)	(0.50)
4th Year	-0.321	-0.172	-0.210	-0.103	0.0294
	(-0.92)	(-0.56)	(-0.70)	(-0.32)	(0.08)
5th+ Year	-0.335	-0.240	-0.433	-0.418	-0.253
	(-1.27)	(-0.94)	(-1.44)	(-1.33)	(-0.80)
Lag Change in Size	-1.35****	-1.08****	-8.59***	-7.25***	-3.45**
(x 10^{-10})	(-5.56)	(-5.91)	(-3.98)	(-4.05)	(-2.90)
Lag Change in Size^2	7.51****	6.59****	5.21***	4.27***	2.48***
(x 10^{-20})	(5.18)	(5.67)	(3.72)	(3.65)	(3.76)
Constant	1.472	1.294	0.592	1.602	1.541
	(1.07)	(0.84)	(0.41)	(1.14)	(1.03)
Observations	5382	5383	5383	5383	5382
R-squared	0.237	0.241	0.199	0.216	0.140

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

30

Illiquidity and the Impact of Portfolio Disclosure on Performance

The findings in the previous sections suggest that 13F portfolio disclosure leads to lower hedge fund performance. In this section, I examine the hypothesis that the cost of portfolio disclosure should be greater for funds that hold illiquid assets. In general, trades in illiquid securities result in larger price impacts than trades in liquid securities. In order to reduce the transaction cost caused by price impact, fund managers tend to employ sequential trading strategies to accumulate or dispose of an illiquid position. However, the longer it takes to accumulate or dispose of a position, the higher the likelihood and the greater the cost of being taken advantage of by frontrunners and free riders. Consistent with these arguments, I find that the drop in performance is more dramatic for funds with illiquid holdings. I use the following regression model to test whether the cost of disclosure is greater for funds with illiquid holdings:

$$Performance_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma_1 \cdot Illiquidity_i \cdot Disclosure_{i,t} + \gamma_2 \cdot Illiquidity + \beta_1 \cdot \log Size_{i,t-1} + \beta_2 \cdot (\log Size)^2_{i,t-1}$$

$Illiquidity_i$ is the average Amihud (2002) illiquidity measure calculated using the holdings disclosed in form 13F for fund family *i* over all disclosing quarters. The Amihud (2002) illiquidity measure is the average daily illiquidity during the quarter preceding the 13F filing quarter (where daily illiquidity is calculated as the absolute return divided by the dollar trading volume on that day):

$$Illiq_Q = \frac{1}{N} \sum_{T-1}^{N} \frac{|ret_t|}{vol_t \cdot prc_t}$$

where $Illiq_Q$ is quarterly illiquidity, N is the number of days in the quarter, and ret_t, vol_t, and prc_t are the return, trading volume, and the price on day *t*, respectively.

As shown in Table 7, the coefficients on the interaction term between $Illiquidity_i$ and $Disclosure_{i;t}$ are negative across all five models and are statistically significant except in models (1). These results suggest that portfolio disclosure is more costly for funds that have more illiquid holdings.

The Impact of 13F Disclosure on Correlations of Hedge Fund Returns

If portfolio disclosure reveals trade secrets and facilitates free-riding activities, we should expect to observe an increase in correlations between the returns of fund *i* and the returns of other hedge funds after fund *i* starts to file 13F disclosure. To measure the correlations between the returns of fund *i* and other hedge funds that are in the same investment style in year *t*, I regress the monthly returns of fund *i* on the value-weighted returns in year *t* of all hedge funds that are in the same investment style. The R-squared obtained from this regression describes how much of the return variation for fund *i* can be explained by the index returns for all hedge funds that are in the same investment style and is used as a measure of correlations between the fund *i* and other hedge funds that are in the same investment style.

The regression model in column (1) and (2) of Table 8 is:

$$R^2_{i,t} = \alpha + \beta_1 \cdot Disclosure_{i,t} + \varepsilon_{i,t}$$

Where $Disclosure_{i;t}$ is a dummy variable that is equal to 1 if fund *i* files Form 13F in year *t*, otherwise 0. Advisor fixed effects are included in the models. The

models in column (3) and (4) add control variables including lagged size and lagged quadratic terms of size.

As shown in Table 8, the coefficient on variable $Disclosure_{i;t}$ is positive and statistically significant, which indicates that there is an increase in return correlations between fund *i* and other hedge funds that are in the same investment style after fund *i* starts to file the 13F disclosure. The increase in R_2 is about 3%, which is also economically significant. These results provide strong evidence that there is an increase in return correlations between disclosing funds and other hedge funds when funds start to file 13F. These findings support the argument that portfolio disclosure reveals trade secrets and facilitates free-riding activities.

Table 7. Illiquidity and the Impact of Portfolio Disclosure on Hedge Fund Performance

This table reports the results of the following regression model:

$$Performance_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma_1 \cdot Illiquidity_i \cdot Disclosure_{i,t} + \gamma_2 \cdot Illiquidity + \beta_1 \cdot \log Size_{i,t-1} + \beta_2 \cdot (\log Size)^2_{i,t-1}$$

$Illiquidity_{i,t}$ is the Amihud (2002) illiquidity measure calculated based on the holdings disclosed in 13F. The Amihud (2002) illiquidity measure is calculated as the average daily illiquidity during the quarter preceding the 13F filing quarter (where daily illiquidity is calculated as the absolute return divided by the dollar trading volume on that day):

$$Illiq_Q = \frac{1}{N} \sum_{t=1}^{N} \frac{|ret_t|}{vol_t \cdot prc_t}$$

where $Illiq_Q$ is quarterly illiquidity, N is the number of days in the quarter, ret_t, vol_t, and prc_t are the daily return, trading volume, and the price on day t, respectively.

	Raw	Alpha (Market Model)	Alpha (FF3 Factors)	Alpha (Carhart 4 Factors)	Alpha (FT7 Factors)
	(1)	(2)	(3)	(4)	(5)
Disclosure	-0.0178	-0.0283*	-0.0332**	-0.0270**	-0.0274*
	(-1.01)	(-2.22)	(-2.85)	(-2.51)	(-2.23)
Lagged log Size	-0.00469***	-0.00347	-0.00188	-0.00113	-0.000485
	(-4.07)	(-1.72)	(-0.48)	(-0.32)	(-0.14)
Lagged (log Size)^2	0.000119***	0.0000900	0.0000511	0.0000281	0.0000256
	(4.21)	(1.86)	(0.51)	(0.31)	(0.30)
Disclosure x Illiquidity	-0.000777	-0.00126*	-0.00149**	-0.00119*	-0.00126*
	(-0.97)	(-2.07)	(-2.72)	(-2.34)	(-2.17)
Illiquidity	0.000820	0.000998	0.00122**	0.00104**	0.00108*
	(1.36)	(1.86)	(3.43)	(2.68)	(2.27)
Constant	0.0802***	0.0602**	0.0525	0.0429	0.0379
	(4.02)	(2.55)	(1.38)	(1.28)	(1.00)
Observations	534	534	534	534	534
R-squared	0.182	0.053	0.057	0.060	0.117

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Table 8. The Impact of 13F Disclosure on the Correlations of Hedge Fund Returns

The regression model in the table below is:

$$R^2_{i,t} = \alpha + \beta_1 \cdot Disclosure_{i,t} + \varepsilon_{i,t}$$

where $R^2_{i,t}$ is the R-squared from regressing monthly returns of fund family *i* on the value-weighted returns of hedge funds in the same style in year *t*. $Disclosure_{i,t}$ is a dummy variable which is equal to 1 if fund family *i* files Form 13F in year *t*, otherwise 0. Fund fixed effects are included in the model.

	R-squared			
	(1)	(2)	(3)	(4)
Disclosure	0.0348***	0.0218*	0.0347**	0.0333**
	(2.77)	(1.72)	(2.48)	(2.35)
Lag log Size			-0.0500**	-0.0446**
			(-2.26)	(-2.05)
Lag log Size^2			0.00235****	0.00185***
			(3.66)	(2.93)
Constant	0.419****	0.441****	0.553***	0.914***
	(143.76)	(4.11)	(2.85)	(3.19)
Year Dummy	No	Yes	No	Yes
Observations	13571	13571	11175	11175
R-squared	0.001	0.077	0.014	0.068

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

The Impact of 13F Disclosure on Compensation Schemes

Since portfolio disclosure allows more monitoring of fund activity, it introduces another mechanism to control the agency problem. Though agency theories have rich implications for how monitoring may interact with the fund manager's compensation incentives, the impact of disclosure on optimal compensation is still a rarely explored empirical question in the literature. The typical compensation in the hedge fund industry includes a management fee that is a fixed percentage of assets and an incentive fee that is a percentage of the profit when a fund return is positive or exceeds a "high-water mark". This incentive fee aligns the interest of managers with that of investors. However, such option-like fee structures also provide managers with an incentive to take investment risks that exceed investors' desired risk level. Investors with information about a portfolio's holdings are better able to assess the risk they are exposed to, a circumstance that disciplines risk taking by fund managers. Portfolio disclosure thereby reduces the cost of option-like incentive fees and allows for higher incentive fees in the optimal compensation structure.

Though TASS only provides a snapshot of the fee structure of each reporting fund, the inception date of each fund tells whether the fee structure was set before or during the period that the fund family filed 13F disclosure. Because fund fees are set at the time of the inception of the fund, I compare the fees of the funds launched during the period that their fund families file 13F with the fees of the funds launched before 13F disclosure. In the previous section, the analysis of

the impact of portfolio disclosure on hedge fund performance is conducted at the fund family level. In this section, the analysis is conducted at the fund level.

Summary Statistics on Hedge Fund Compensation Schemes

Table 9 provides summary statistics on hedge fund compensation schemes, including incentive fees, management fees, and whether funds use a high-water mark. Funds of funds are excluded from the sample because their fee structures are different. Funds that launched after their fund family stopped filing form 13F are also excluded. Panel A reports and compares compensation schemes for non-13F filers and 13F filers. Similar to the definition earlier, non-13F filers refers to funds that never filed 13F during the sample period and 13F filers refers to funds that belong to a fund family that filed a 13F at least once. As shown in Panel A of Table 8, the average incentive fee for 13F filers is 18.92% and for non-13F filers is 18.16%. Thus, the incentive fees for 13F filers are 0.76% greater than for non-13F filers, and the difference is statistically significant. The average management fee for both 13F filers and non-13F filers is 1.50%. The percentage of funds that use a high-water mark for 13F filers is 67% and for non-13F filers is 84%. The difference is 17% and is statistically significant. Panel B reports and compares the compensation scheme for funds that launched before their fund families started to file 13F and for funds that launched during the period that their fund families filed 13F. The univariate test shows that funds that launched during the 13F filing have higher incentive fees (0.56%, but not statistically significant) and use a high-water mark more frequently. However, such univariate tests cannot control for

other factors, such as time trends, that might have affected the compensation scheme. I show the results of multivariate tests in the next section.

The Impact of 13F Disclosure on Compensation Schemes

I use the following multivariate regression to capture the effect of disclosure on incentive fees:

$$Incentive\ Fee_i = \alpha + \beta \cdot Disclosure_i + \gamma_1 \cdot FamilyAssets + \gamma_2 \cdot FamilyAge + \varepsilon_i$$

where the dependent variable is incentive fees as a percentage term. The variable $Disclosure_i$ is equal to 1 if the fee structure is set during the period that a fund family files 13F, and is equal to 0 if the fee structure is set in the period before the fund family starts to file 13F. The control variables include the fund family's assets under management and family age (in log form) at the fund's inception date, and a dummy variable that indicates whether the fund family has ever filed a 13F report. Year, fund category, and fund family fixed effects are included in the models and errors are clustered.

As shown in columns (1) to (5) of Table 10, the coefficients on $Disclosure_i$ are positive and statistically significant. The incentive fees are on average about 1 % higher when a fund family files 13F portfolio disclosure. In unreported tables, I find that there is no change in the management fee or the use of a high-water mark after funds file the 13F disclosure. Overall, these results support the hypothesis that portfolio monitoring reduces risk-taking by fund managers and allows for higher convexity in the optimal compensation structure.

Table 9. Summary Statistics on Hedge Fund Compensation

This table provides summary statistics on hedge fund compensation schemes, including incentive fees, management fees, and whether funds use a high-water mark. Funds of funds and funds that launched after their fund family stopped filing form 13F are excluded from the sample. Panel A reports and compares compensation schemes for non-13F filers and 13F filers. Non-13F filers refer to funds that never filed 13F during the sample period and 13F filers refers to funds that belong to a fund family that filed 13F at least once. Panel B reports and compares the compensation scheme for funds that launched before their fund families started to file 13F and for funds that launched during the period that their fund families filed 13F.

Panel A. Non-13 Filers and 13F Filers

	Non-13F Filers						13F Filers						Difference
	N	Mean	p50	Sd	Min	Max	N	Mean	p50	Sd	Min	Max	13F-Non13F
Incentive Fee (%)	6248	18.16	20	5.89	0	50	450	18.92	20	4.20	0	25	0.76 ***
Management Fee (%)	6254	1.50	1.5	0.66	0	10	450	1.50	1.5	0.61	0	4	0.00
High-Water Mark	6254	0.67	1	0.47	0	1	450	0.84	1	0.37	0	1	0.17 ****
Lockup Dummy	6265	0.25	0	0.43	0	1	451	0.42	0	0.49	0	1	0.17 ****
Family Assets ($ million)	4968	209	0	672	0	20134	405	526	137	1000	0	5775	316 ****
Family Age (month)	6012	33	9	48	1	353	442	59	46	54	1	183	26 ****

Panel B. Before and During 13F Filing

	Launched Before 13F Filing						Launched During 13F Filing						Difference
	N	Mean	p50	Sd	Min	Max	N	Mean	p50	Sd	Min	Max	During-Before
Incentive Fee (%)	208	18.61	20	4.49	0	25	242	19.18	20	3.93	0	25	0.56
Management Fee (%)	208	1.49	1.5	0.66	0	4	242	1.50	1.5	0.56	0	4	0.01
High-Water Mark	208	0.77	1	0.42	0	1	242	0.90	1	0.30	0	1	0.13 ****
Lockup Dummy	208	0.40	0	0.49	0	1	243	0.44	0	0.50	0	1	0.04
Family Assets($ million)	178	390	25	1031	0	5580	227	632	272	963	0	5775	242
Age (month)	202	40	24	46	1	167	240	75	73	55	1	183	35

Table 10. The Impact of 13F Disclosure on Hedge Fund Compensation Schemes

This table reports the results of regressing hedge fund incentive fee on variable $Disclosure_i$ that indicates whether its fund family files 13F disclosure at fund *i*'s inception. Control variables include assets under management and the age of fund family at fund *i*'s inception. Fund's investment style, fund family, and inception year fixed effects are included in the model and errors are clustered.

	Incentive Fees				
	(1)	(2)	(3)	(4)	(5)
Disclosure	1.169*	1.097*	1.164**	1.159**	0.996*
	(1.91)	(1.84)	(2.65)	(2.66)	(1.69)
log Family Assets			-0.00979	-0.152**	0.0457
			(-0.10)	(-2.46)	(0.56)
log Family Age			-0.212**		-0.152
			(-2.41)		(-1.03)
Constant	21.14****	19.17****	-1.574**	-1.475**	14.54****
	(116.69)	(20.80)	(-2.51)	(-2.45)	(12.56)
Fund Style Dummy	No	Yes	Yes	Yes	Yes
Fund Family Dummy	Yes	Yes	No	No	Yes
Inception Year Dummy	Yes	Yes	Yes	Yes	Yes
Observations	6698	6698	5359	5360	5359
R-squared	0.031	0.038	0.069	0.068	0.043

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

The Impact of 13F Disclosure on Fund Flows

Whether hedge fund investors value 13F portfolio disclosure is still an open question. While investors may prefer more disclosure for the increased transparency it affords, they may prefer less disclosure if disclosure hampers the performance of the funds. In addition, it is possible for hedge fund investors to negotiate directly with fund managers to obtain portfolio information privately. The value that investors attach to the 13F disclosure can be measured by the fund flows in and out of the funds, after controlling for other factors that affect flows (e.g., past performance).

Flows for fund family *i* in year *t* are calculated as the changes in assets under management from year end *t-1* to year end t after removing the changes in assets caused by returns in year t and then divided by assets under management at year end *t-1*:

$$Flow_{i,t} = \frac{Assets\ Under\ Management_{i,t} - Assets\ Under\ Management_{i,t-1} \cdot \mathrm{Re}turns_{i,t}}{Assets\ Under\ Management_{i,t-1}}$$

Variable $Flow_{i;t}$ is winsorized at upper 90% to remove the effect of extreme outliers. As shown in Panel A of Table 11, the average flow for non-13F filers is 5.6% per year and for 13F filers is 13.2% per year. The difference is 7.7%, which is statistically significant. The average flow for 13F filers before 13F filing is 36.1% per year and is 2.8% per year during the period of 13F filings. The difference is 33.2%, which is statistically significant. Therefore, the univariate analysis

suggests that fund flows are lower in the disclosure period than in the non-disclosure period.

Since there are factors other than disclosure that can also affect fund flows, I use the following multivariate regression models to examine how fund flows respond to 13F disclosure:

$$Flow_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma \cdot Controls_{i,t-1}$$

The control variables include lagged performance, lagged volatility of fund returns, lagged assets under management in log form, a lockup dummy indicating whether the fund utilizes the lockup provision, and the 13F Filing Funds Dummy variable indicating whether the fund family ever filed 13F in the sample period. As shown in Panel B Table 11, the coefficient on $Disclosure_i$ is negative and statistically significant across all models, which indicates that flows are lower during the disclosure period. For example, model (1) suggests that the flows in the disclosure period are 14% lower per year than in the non-disclosure period. The coefficient on lagged performance is positive, which is consistent with the idea that flow chases past performance (Berk and Green, 2004). The coefficient on past fund volatility is negative, which suggests that hedge fund investors dislike return volatility. Overall, the results indicate that flows are lower in the periods of disclosure than in non-disclosure periods, suggesting that hedge fund investors place a negative value on 13F portfolio disclosure.

Table 11.The Impact of 13F Disclosure on Fund Flows

Panel A of this table reports the summary statistics and univariate tests of flows 1) for the 13F filers and the non-13F filers, and 2) for the 13F filers in the period before they began filing form 13F and in the period during which they filed form 13F.

Panel B reports the results of the panel regression below:

$$Flow_{i,t} = \alpha + \beta \cdot Disclosure_{i,t} + \gamma \cdot Controls_{i,t-1}$$

Where $$Flow_{i,t} = \frac{Assets\ Under\ Management_{i,t} - Assets\ Under\ Management_{i,t-1} \cdot \mathrm{Re}turn_{i,t}}{Assets\ Under\ Management_{i,t-1}}$$

$Flow_{i,t}$ is the flow in or out of investment company *i* during year *t*, defined as the formula above. $Disclosure_{i,t}$ is equal to 1 if investment company *i* files a 13F disclosure in year *t*. Control variables include lagged performance, lagged volatility of fund returns, lagged assets under management in log form, a lockup dummy indicating whether funds utilize lockup provisions, and a *13F Filing Funds Dummy* indicating whether the investment company *i* has ever filed 13F in the sample period. Model (1) to (5) differs in how lagged performance is measured. Year fixed effects are included and errors are clustered at the investment company level.

Panel A. Univariate test on Fund Flows

Non-13F Filers				13F Filers				Difference
n	mean	median	sd	n	mean	median	sd	13F-Non13F
2058	0.056	0.017	0.323	296	0.132	0.112	0.284	0.077 ****
Before 13F Filing				During 13F Filing				Difference
n	mean	median	sd	n	mean	median	sd	13F-Non13F
157	0.361	0.36	0.437	285	0.028	-0.01	0.313	-0.332 ****

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

Panel B. The Impact of 13F Disclosure on Fund Flows

	Control variable "Lag Performance" is measured by				
	Raw	Alpha (Market Model)	Alpha (FF3 Factors)	Alpha (Carhart 4 Factors)	Alpha (FT7 Factors)
	(1)	(2)	(3)	(4)	(5)
Disclosure	-0.0998***	-0.0963***	-0.102***	-0.102***	-0.118***
	(-2.74)	(-2.62)	(-2.71)	(-2.71)	(-3.12)
Lag Performance	8.743****	10.09****	5.316****	4.836****	1.120***
	(7.09)	(7.13)	(3.46)	(3.78)	(2.96)
Lag Size	-0.0332****	-0.0323****	-0.0283***	-0.0270***	-0.0249***
	(-3.72)	(-3.65)	(-3.27)	(-3.12)	(-2.89)
Lag Volatility	-2.057***	-2.080***	-1.801**	-1.680**	-1.896**
	(-3.03)	(-2.97)	(-2.31)	(-2.25)	(-2.53)
Fund Family Age	-0.0285****	-0.0275****	-0.0267****	-0.0273****	-0.0284****
	(-5.13)	(-5.04)	(-4.71)	(-4.83)	(-4.91)
Lockup	-0.00620	-0.00818	-0.00404	-0.00186	-0.00175
	(-0.20)	(-0.27)	(-0.13)	(-0.06)	(-0.05)
Constant	1.032****	1.091****	1.048****	1.029****	1.021****
	(5.03)	(5.24)	(4.96)	(4.86)	(4.73)
Observations	1254	1254	1254	1254	1254
R-squared	0.190	0.188	0.155	0.152	0.137

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

CHAPTER 4

CONCLUSIONS

This study contributes to the policy debate over the optimal portfolio disclosure policy by providing direct evidence that portfolio disclosure leads to a decline in hedge fund performance. The cost of portfolio disclosure to hedge fund performance is economically large (4% annually), suggesting that there is a need to improve the current form of mandatory portfolio disclosure. For example, requiring less frequent disclosures or longer delay periods might deter free-riding activities and reduce the costs of portfolio disclosure. Another alternative would be to make hedge fund disclosure reports available only to each fund's investors and to regulatory agencies. In addition, although part of the purpose of mandatory portfolio disclosure is to protect hedge fund investors, it is noteworthy that investment flows drop following disclosure, suggesting that hedge fund investors find disclosure undesirable.

REFERENCES

Agarwal, Vikas, Wei Jiang, Yuehua Tang, and Baozhong Yang, 2009, Do institutional investors have an ace up their sleeves?--Evidence from confidential filings of portfolio holdings. Working paper, Georgia State University and Columbia University.

Angrist, Joshua and Jorn-Steffen Pischke, Mostly Harmless Econometrics, Chapter 6: Getting a Little Jumpy: Regression Discontinuity Designs.

Aragon, George, Michael Hertzel, and Zhen Shi, 2009, Why do hedge funds avoid disclosure? Evidence from confidential 13f filings. Working paper, Arizona State University.

Amihud, Yakov, 2002, Illiquidity and stock returns: cross-section and time-series effects, Journal of Financial Markets 5, 31-56.

Berk, Jonathan and Richard Green, 2004, Mutual fund flows and performance in rational markets, The Journal of Political Economy, 112, 1269-1295.

Coles, Jeffrey, Daveen Daniel, and Lalitha Naveen, 2006, Managerial incentives and risk-taking, Journal of Financial Economics, 79, 431-468.

Frank, Mary M., James M. Poterba, Douglas A. Shackelford, and John B. Shoven, 2004, Copycat funds: Information disclosure regulation and the returns to active management in the mutual fund industry, Journal of Law and Economics 47, 515-541.

Ge, Weili and Lu Zheng, 2006, The frequency of mutual fund portfolio disclosure, Working paper, University of Michigan.

George, Thomas J. and Chuan-Yang Hwang, 2007, Disclosure policies of investment companies, Working paper, University of Houston.

Goleca, Joseph and Laura Starks, 2004, Performance fee contract change and mutual
fund risk, Journal of Financial Economics 73, 93–118.

Healy, Paul M., and Krishna G. Palepu, 2001, Information asymmetry, corporate disclosure, and the capital markets: a review of the empirical disclosure literature, Journal of Accounting and Economics 31, 405-440.

John Kose, Hamid Mehran, and Yiming Qian, 2008, Outside Monitoring and CEO Compensation in the Banking Industry, Working paper, New York University.

Stark, Laura, 1987, Performance incentive fees: an agency theoretic approach, Journal of Financial and Quantitative Analysis, 22, 17-32.

Stulz, René, 2007, Hedge Funds: Past, Present and Future, Working paper, Ohio State University.

Verrecchia, Robert E., 1983, Discretionary disclosure, Journal of Accounting and Economics 5, 365–380.

Wermers, Russ, 2001, The potential effects of more frequent portfolio disclosure on mutual fund performance, Investment Company Institute Perspective, June.

APPENDIX A

Table 11. Probit Analysis on the Likelihood that Firm Files 13F Filing

This table reports the results from a Probit regression that predicts the likelihood of a firm begins to file 13F in the next three years. The dependent variable is equal to one if the firm begins to file 13F in the next three years, otherwise zero. The coefficients, t-statistics (in parenthesis), and the marginal effects (in Italic) for each Probit model are presented.

	(1) Raw	(2) MktModel	(3) FF3Model	(4) Carhart4	(5) Fung-Hsieh7
Historical Performance	3.253	0.577**	1.893****	-1.156	0.0241
	(1.52)	(2.38)	(3.65)	(-1.36)	(0.04)
	0.474	*0.0840***	*0.273****	*-0.169*	*0.00354*
Performance in year t	5.230**	4.626*	2.474	2.856	-0.377
	(2.38)	(1.96)	(1.29)	(1.50)	(-0.30)
	*0.762***	*0.673***	*0.357*	*0.418*	*-0.0555*
Size	0.131****	0.133****	0.134****	0.134****	0.133****
	(6.81)	(6.93)	(7.00)	(7.02)	(6.96)
	*0.0191****	*0.0193****	*0.0193****	*0.0197****	*0.0195****
Historical Volatility	1.148	1.362	1.382	1.140	1.517
	(0.76)	(0.90)	(0.91)	(0.76)	(1.02)
	0.167	*0.198*	*0.199*	*0.167*	*0.223*
Volatility in year t	-1.047	-0.491	-0.226	0.230	-0.231
	(-0.61)	(-0.29)	(-0.14)	(0.14)	(-0.14)
	-0.153	*-0.0715*	*-0.0326*	*0.0336*	*-0.0340*
Age	-0.0209	-0.0200	-0.0186	-0.0208	-0.0212
	(-1.48)	(-1.42)	(-1.32)	(-1.48)	(-1.50)
	-0.00304	*-0.00291*	*-0.00269*	*-0.00304*	*-0.00311*
Lockup	0.157**	0.174**	0.161**	0.172**	0.174**
	(2.19)	(2.44)	(2.24)	(2.40)	(2.44)
	*0.0244***	*0.0273***	*0.0248***	*0.0270***	*0.0275***
Flow in year t	0.165**	0.189***	0.181***	0.200***	0.209****
	(2.57)	(2.99)	(2.86)	(3.17)	(3.34)
	*0.0241****	*0.0275****	*0.0261****	*0.0292****	*0.0307****
Constant	-3.778****	-3.790****	-3.818****	-3.799****	-3.767****
	(-10.57)	(-10.62)	(-10.69)	(-10.66)	(-10.60)
Observation	3725	3725	3725	3725	3723

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.

APPENDIX B

Table 12. The Impact of Portfolio Disclosure on Hedge Fund Risk

This table reports the impact of portfolio disclosure on hedge fund risk. The dependent variable is the risk of fund *i* in year *t*, which is measured by the volatility of the returns of fund *i* in year *t*. $Disclosure_{i,t}$ is equal to 1 if fund *i* filed Form 13F in year *t*, otherwise 0. Control variables include lagged log(size) and squared term of lagged log(size). Year fixed effects are included in the model.

	Fund Risk	Fund Risk
	(1)	(2)
Disclosure	0.000463	-0.000444
	(0.39)	(-0.33)
Lagged logSize		-0.00889**
		(-2.05)
Lagged $(logSize)^2$		0.000263**
		(2.16)
Constant	0.0281****	0.0966**
	(3.40)	(2.52)
Year Dummy	Yes	Yes
Observations	17848	14262
R-squared	0.204	0.201

*, **, ***, and **** denote statistical significance at 10, 5, 1, and 0.1 percent level, respectively.