Better Kept in the Dark?

Portfolio Disclosure and Agency Problems in Mutual Funds*

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Initial version: August 2014 This Version: August 2015

Abstract

We study the effects of a mandated increase in disclosure in a setting where managerial responses are particularly observable: mutual funds. We conjecture that mandating portfolio disclosure can harm some mutual fund investors. Portfolio disclosure imposes skill re-assessment risks on fund managers which in turn translate into agency costs to investors, especially for funds characterized with high levels of ex-ante managerial skill uncertainty. Using a regulatory change that mandated more frequent portfolio disclosure as a natural experiment, we show that funds with high levels of ex-ante managerial skill uncertainty responded to the regulatory change with an increase in management fees and a decrease in risk taking behavior, relative to funds with low levels of ex-ante managerial skill uncertainty. These actions ultimately get transmitted to fund investors in the form of inferior net performance. Our findings shed new light on the costs of disclosure, as well as providing evidence on disclosure, agency, and governance issues of the investment management industry.

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1. Introduction

Too much disclosure can be costly. Theories in the accounting and finance literature imply that disclosure-induced capital market price pressure can cause managers to take myopic actions to boost short-run profit at the expense of long-run firm value.[2] In particular, Gigler, Kanodia, Sapra, and Venugopalan (2014) show that more frequent disclosure can cause myopic actions to produce quick bottom line results due to impatient shareholders' premature valuation of managerial actions. Initial empirical work provides support to the theoretical implications. For example, Asker, Farre-Mensa, and Ljungqvist (2014) show that public firms, which are subjected to disclosure-induced price pressure, invest significantly less than comparable private firms. Similarly, Gao, Harford, and Li (2014) show that public firms have higher CEO turnover rates and exhibit greater turnover-performance sensitivity than private firms due to investor myopia associated with the public equity market. Using the transition of US firms from annual reporting to quarterly reporting over the period 1950-1970 as a natural experiment, Kraft, Vashishtha, and Venkatachalam (2014) show that increased reporting frequency results in myopic reduction in fixed-asset investments.[3]

We study the issues of disclosure-induced agency costs stemming from managerial skill uncertainty and learning, using a natural experiment of an exogenous shock to disclosure frequency in a simple management setting—the mutual fund industry. Due to its simple management structure, the mutual fund industry provides a clean setting for our study. Although ultimately owned by investors, mutual funds are managed by professional managers. Thus, agency problems that are prevalent in the corporate world can also exist in

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[2] See Narayanan (1985), Stein (1989), Shleifer and Vishny (1990), Bebchuk and Stole (1993), Von Thadden (1995), Holmstrom (1999), and Gigler, Kanodia, Sapra, and Venugopalan (2014), among others.

[3] Relatedly, Ewert and Wagenhofer (2005) show that tightening accounting standards leads to increased managerial incentive to engage in real earnings management. Besides inducing myopic behavior, too much disclosure imposes other (direct and indirect) costs on firms. For example, Bushee and Leuz (2005) examine the impact of the "Eligibility Rule" of 1999, which subjects small firms traded on the OTC Bulletin Board (OTCBB) to the SEC's higher disclosure requirement. They document that the imposition of the disclosure requirements results in significant costs for smaller firms, forcing them off the OTCBB. By revealing valuable information to competitors, too much disclosure can impose proprietary costs on the firm and harm its competitive position (Verrecchia (1983); Hayes and Lundholm (1996)).

the world of mutual funds (e.g. Chevalier and Ellison (1997)). An advantage of studying agency problems in the mutual fund setting is that the characteristics, timing and performance of the investments made by managers are observable to the econometrician. While the setting offers insights into general disclosure and agency issues, using mutual funds also offers an opportunity to increase our limited knowledge of the extent to which agency costs impact the returns to mutual fund investors. Given the sheer size of the industry,[4] even a small effect on individual fund performance could translate into large societal costs. We document that increased portfolio disclosure can give rise to substantial agency costs to mutual fund investors, particularly for funds with high levels of ex-ante managerial skill uncertainty.

Our study is based on a learning framework (e.g., see Murphy (1986))—mutual fund performance depends on its managerial skill, which is initially unknown but gradually learned by investors via some noisy signals such as portfolio disclosure.[5] Portfolio disclosure is particularly useful for evaluating mutual fund managers as it provides skill information beyond alpha based on net asset value.[6] However, investors' posterior re-assessment of a fund's managerial skill from its portfolio disclosure is subjected to factors beyond the

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[4] The U.S. mutual fund industry has $15 trillion in assets under management at the end of year 2013; in comparison, at the same time the total market capitalization of the U.S. stock market stood for $20.7 trillion. (The mutual fund data comes from the Investment Company Institute; the stock market data is based on the market cap of all stocks with share codes 10 and 11 in CRSP.)

[5] Note that there are two types of agency theories: The first is on moral hazard and effort and the second on managerial skill and learning (Murphy (1986)). Our framework is based on the second type of agency theory, as managerial skill arguably matters more than managerial effort in the mutual fund industry.

[6] Carhart (1997), among others, finds very little persistence in abnormal returns based on net asset value. However, studies using disclosed holdings (see, e.g., Daniel, Grinblatt, Titman, and Wermers (1997), Wermers (2000), Kacperczyk and Seru (2007), Kacperczyk, Sialm, and Zheng (2008), and Cremers and Petajisto (2009)) document that portfolio holdings can be useful in identifying a subset of funds that has stock-picking skills. For example, Kacperczyk and Seru (2007) use portfolio holdings to infer whether fund managers use private information in their stock-picking process and document that funds using private information outperform funds using public information by 0.46% per year. The intuition is that when investors are uncertain about a fund's managerial skill ex-ante, short-term fund performance over the quarter may not be informative about how the fund has structured its portfolio for the long term (or over a business cycle, for example), but investors can assess managerial skill by looking at what stocks the fund has picked. On the website of the Financial Industry Regulatory Authority (FINRA), FINRA also suggests that "*You (investors) might want to check the latest quarterly report showing the fund's major investment holdings to see how closely the fund manager is sticking to the strategy described in the prospectus, which is presumably why you invested in the fund.*"

manager's control (i.e. luck; see Nagar (1999) for a theory of disclosure subjecting managers to the risk of investors' posterior skill re-assessment). We use luck broadly such that it includes potentially irrelevant assessment factors like the recent performance of stocks now held, media attention of the companies in the portfolio, how well-known those companies are to retail investors, etc. The higher the investors' ex-ante uncertainty about a fund manager's skill, the larger is the influence of luck on investors' posterior skill re-assessment. Put differently, the variance of posterior skill re-assessment due to portfolio disclosure will be greater when investors start with high ex ante uncertainty. Moreover, the more uncertain investors are about a fund manager's skill ex ante, the more they rely on its portfolio disclosure and the less on their prior perception of managerial skill to evaluate and monitor the fund manager. Thus, portfolio disclosure exposes managers to considerable skill re-assessment risks, particularly for funds with high levels of ex-ante managerial skill uncertainty. These risks translate into more dismissal risk due to holdings-driven flow risk occasioned by luck.

We conjecture that funds with high levels of ex-ante managerial skill uncertainty (henceforth "high-uncertainty funds") opt for low levels of portfolio disclosure, and that mandating a high level of portfolio disclosure imposes substantial agency costs to investors in such funds. Because managers are risk averse (due to their non-diversifiable human capital), anticipating the increased holdings-driven flow and dismissal risks, they demand higher compensation in a competitive managerial labor market. Moreover, they become more myopic than before and reduce their risk-taking behavior (e.g., forgo some risky investment opportunities that have high expected abnormal returns) in order to mitigate the influence of luck in their performance evaluation. These agency-motivated actions by fund managers are ultimately transmitted to investors in the form of reduced net returns.

In contrast, for funds with low levels of ex-ante managerial skill uncertainty (henceforth "low-uncertainty funds") where the manager has presumably established a track record of consistent performance in the past, luck and disclosed holdings play a minor role in investors' posterior skill re-assessment from portfolio disclosure. Consequently, other things equal, such funds are more likely to voluntarily disclose their portfolio holdings. Thus, mandating a high level of portfolio disclosure is unlikely to increase their agency costs because of the relatively low levels of holdings-driven flow and dismissal risks occasioned by luck.

We are able to tease out the causal impact of mandatory mutual fund portfolio disclosure on agency costs using a natural experiment. Prior to 2004, mutual fund managers were required to report the composition of their portfolios to the SEC on a semi-annual basis, although a significant portion of them voluntarily reported on a quarterly basis. In May 2004 the SEC amended the rule and increased the mandatory reporting frequency to quarterly.[7] Consistent with our predictions, we find that high uncertainty funds were significantly less likely to voluntarily disclose their portfolio holdings at a quarterly frequency than their low uncertainty peers prior to the regulatory change.

We next show that mandatory portfolio disclosure increases the risk levels for fund managers that were affected by the regulatory change, that is, the set of managers that were not already reporting on a quarterly frequency prior to 2004 (henceforth: "semi-annual funds"), particularly for the high-uncertainty funds. We show that for the high-uncertainty funds, the sensitivity of fund flows and managerial turnover to portfolio holdings information increases following the regulatory change. This is consistent with theory. After 2004, the disclosed portfolio holdings are more timely than before and hence their informational value is increased, so investors naturally increase their reliance on performance signals derived

[7] See Rule IC-26372 of the SEC on May 10, 2004 at http://www.sec.gov/rules/final/33-8393.htm.

from disclosed portfolio holdings to evaluate fund managers and take monitoring actions, particularly for the high-uncertainty funds. Moreover, the resulting outflows from a potentially negative performance signal may prompt the board to replace the fund management (Khorana (1996)). These monitoring actions by investors and the board constitute the elevated holdings-driven flow and dismissal risks that fund managers face, which in turn lead to the higher agency costs to investors that we document.

Consistent with our conjecture that managers require compensation for bearing the elevated skill re-assessment risks associated with portfolio disclosure, we find that high uncertainty semi-annual funds significantly increase management fees after the regulation relative to low uncertainty funds. Depending on the specification, the incremental increase in annual management fees (relative to net assets under management) is 1.8 to 3.6 basis points.

We further document another channel used by fund managers to mitigate the skill re-assessment risks triggered by increased portfolio disclosure frequency – reduction in risk-taking levels. In order to counterbalance the increased influence of luck in their skill re-assessment (i.e., to counterbalance the increased variance of investors' ex-post skill inference from fund holdings), managers of high-uncertainty funds will choose to deviate less from their benchmark indices and hence will give up some potentially profitable but risky investment opportunities (i.e., deviations from the indices). Indeed, we find that in terms of Active Share (Cremers and Petajisto (2009)), high uncertainty funds bring their portfolios 9-to-10 percentage points closer to their benchmark indices subsequent to the new regulation, relative to low uncertainty funds. Interestingly, we do not find any significant change in window dressing activities for such funds after the regulatory change. Although the incentive for window dressing may increase after the increase in disclosure frequency, higher frequency disclosures are likely harder to manipulate.

We further show that the actions taken by fund managers in response to the disclosures-induced increased skill re-assessment risks ultimately result in lower net returns to investors. Our results point to a significant decrease in the post-regulation net performance of ex-ante high uncertainty funds relative to low uncertainty funds. Specifically, we find an incremental decline of 0.16 to 0.32% per month in risk-adjusted performance.[8] This finding is unlikely to be confounded by other factors since we do not observe a significant difference in stock picking skills between both groups. Our results are robust to various measures of ex-ante skill uncertainty and various (cross-sectional and time-series) placebo tests, where we use mutual funds not subjected to the new regulation (i.e., funds already reporting quarterly before the regulation) or different hypothetical years of imposing the new regulation for the tests.

Agarwal, Mullally, Tang, and Yang (2014) and Parida and Teo (2014) point to another channel via which mandating portfolio disclosure can help others learn the informed trades of mutual funds and may facilitate front-running practices. They show that the effect of this information channel is more pronounced for funds performing better in the pre-regulation period. We find no differences in results when we control for the post-regulation incremental decline in the performance of the best performing funds. Thus, our results are not driven by their findings.

This paper makes several contributions. First, the paper contributes to the literature that studies the role of information disclosure in addressing agency problems of the firm (see Armstrong, Guay, and Weber (2010) and Beyer, Cohen, Lys, and Walther (2010) for

[8] This magnitude of reduction in risk-adjusted performance is large but not surprising, as we document a large reduction in Active Share for high-uncertainty funds relative to low-uncertainty funds following the regulation. Cremers and Petajisto (2009) find that the Active Share measure significantly predicts fund performance, and managers with high Active Share significantly outperform their benchmark indices. Examining 2,650 funds from 1980 to 2003, the authors find that the highest ranking active funds, those with an Active Share of 80% or higher, beat their benchmark indices by 2-2.71% before fees and by 1.49-1.59% after fees. Also note that although we account for systematic risk exposures when calculating net performance (alpha), the reduction in risk taking we find is the reduction in the deviation from the benchmark index. Such deviation is often based on private information and is of idiosyncratic nature. Thus, a reduction in Active Share can still lead to a reduction in (systematic) risk-adjusted net fund performance.

reviews). Many empirical studies suggest that improving information disclosure can help alleviate information asymmetry between insiders and outsiders and hence reduce agency costs of the firm (see, for example, Healy, Palepu, and Sweeney (1999), Leuz and Verrecchia (2000), Sengupta (1998) and Francis, LaFond, Olsson, and Schipper (2004, 2005), LaFond and Watts (2008), Armstrong, Balakrishnan, and Cohen (2012), and Fu, Kraft, and Zhang (2012)). In this paper we employ a natural experiment of a mandatory increase in mutual fund portfolio disclosure and show that mandating information disclosure, instead of reducing agency costs, can cause a substantial increase in agency costs that are eventually born by mutual fund investors.

The study also contributes to the aforementioned literature that studies the costs of too much disclosure. We show that 1) too much disclosure can impose substantial agency costs even in a simple management setting (i.e., the mutual fund industry) and 2) such disclosure-induced agency costs are more pronounced for funds with higher uncertainty. Our findings hence shed new light on the disclosure and agency literature.

Second, we contribute to the literature studying the agency costs of mutual funds. Previous research has focused on agency costs derived from mutual fund tournaments (e.g. Brown, Harlow, and Starks (1996) and Kempf and Ruenzi (2008)), calculation of net asset values (e.g. Zitzewitz 2003), and cross-subsidization (e.g. Gaspar, Massa, Matos (2006) and Bhattacharya, Lee, and Pool (2013)). Edelen, Evans, and Kadlec (2012) demonstrate that greater transparency (disclosure) of operating expenses reduces agency costs as it prevents managers from linking their payments to the commissions they pay to brokers. Our paper differs from these studies in both the type of information disclosed and the effects of disclosure we find on agency costs. We find that disclosure of portfolio holdings exposes fund managers to skill re-assessment risks which steer their behavior towards actions that ultimately harm investors. Thus, we contribute to the literature by showing that portfolio disclosure is a potentially important determinant of agency costs in mutual funds.

Finally, we contribute to the literature that studies the impact of the increased portfolio disclosure frequency in 2004 on fund performance, including, as discussed, Parida and Teo (2011) and Agarwal, Mullally, Tang and Yang (2014). Wang and Verbeek (2013) also point to an increasing return to copy-cat strategies following 2004. All of these papers focus on an information channel that reveals the information content of mutual fund portfolios to outside investors. We contribute to this stream of literature by showing how portfolio disclosure can adversely affect fund performance via another important channel, specifically, the agency channel.

The rest of the paper is organized as follows. We introduce the 2004 regulatory change and develop the hypotheses in Section 2; we describe the data and empirical methodology in Sections 3; we present the main empirical results in Section 4; we conduct the robustness checks in Section 5; Section 6 concludes.

2. Institutional Background and Hypothesis Development

Before May 2004, mutual funds were only required by the SEC to file their portfolio holdings twice a year using the semi-annual N-30D form. On May 10, 2004, the SEC enacted a new Rule IC-26372, which requires all mutual funds to disclose their end-of-the-quarter holdings four times a year via form N-CSR at the end of 2^{nd} and 4^{th} fiscal quarters and via form N-Q at the end of the 1^{st} and 3^{rd} fiscal quarters (funds are allowed to file the disclosure forms within 60 days from the end of a quarter). Before the new rule was enacted, mutual funds could also choose to voluntarily disclose their end-of-the-quarter holdings using form N-30B2 at those quarter ends when mandatory portfolio disclosure was not required (i.e., when they were not required to file form N-30D), or they could simply disclose their holdings data to data vendors and not to the SEC. That is, mutual funds, if they liked, could voluntarily disclose their portfolio holdings three times or four times a year before the new regulation. The descriptive statistics of our sample, presented in Table 1, show that 38% of our pre-regulation disclosures were quarterly (i.e. a disclosure in quarter *q-1* followed by a disclosure in quarter *q*). Later, we define our sample of semi-annual funds subjected to the reform as all funds that existed in the end of 2003 and did not disclosure quarterly at least 75% of the time between 1999 and 2003. We thus classify 1,140 funds as funds that were subjected to the reform (i.e. "semi-annual funds") and 413 funds that were not (i.e., "quarterly funds").

The basic intuition of our simple theoretical framework is similar to that in the theory of Nagar (1999). That is, information disclosure triggers shareholders' re-assessment of managerial skill/talent, which in turn imposes uncertainty or risk on the manager. Consider any mutual fund manager with unknown skill level $\mu \sim N(\bar{\mu}, \sigma_\mu^2)$ to investors, with $\bar{\mu}$ being investors' ex-ante (prior) perception of the fund's managerial skill and σ_μ^2 being the fund's ex-ante managerial skill uncertainty to investors. Since the true realization of μ is practically unobservable, the higher the σ_μ^2, the larger the influence of luck on investors' posterior inference of managerial skill (if σ_μ^2 is close to zero, then investors are almost certain about the fund's managerial skill level and hence luck plays little role in their posterior skill inference).

Mutual fund investors use the disclosed information on portfolio holdings to evaluate the fund manager. Let investors derive a signal, s, from the fund's portfolio disclosure (e.g., investors infer the fund's current and expected future risk-adjusted gross performance from its current holdings), based on which they update their prior perception of μ. Denote investors' posterior re-assessment of μ upon receiving the signal, s, as $\hat{\mu} \equiv E(\mu|s)$. Let the derived signal s be noisy with $s = \mu + \varepsilon$, with $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ being the white noise in the signal. We then have

$$\hat{\mu} = E(\mu|s) = E(\mu) + \frac{cov(\mu,s)}{var(s)}\big(s - E(s)\big) = \bar{\mu} + \frac{\sigma_\mu^2}{\sigma_\mu^2+\sigma_\varepsilon^2}(s - \bar{\mu}). \quad (1)$$

From equation (1), it is clear that $\frac{\sigma_\mu^2}{\sigma_\mu^2+\sigma_\varepsilon^2}$ increases in σ_μ^2 but decreases in σ_ε^2. Thus, the higher the ex-ante skill uncertainty (i.e., the larger is σ_μ^2) and/or the less noisy the signal derived from portfolio disclosure (i.e., the smaller is σ_ε^2), the more investors rely on the signal and the less they rely on their prior perception to estimate $\hat{\mu}$, their posterior perception of μ. The variance of investors' posterior skill re-assessment $\hat{\mu}$ is simply

$$var(\hat{\mu}) = \left(\frac{\sigma_\mu^2}{\sigma_\mu^2+\sigma_\varepsilon^2}\right)^2 var(s) = \frac{\sigma_\mu^4}{\sigma_\mu^2+\sigma_\varepsilon^2} \quad (2)$$

Thus, the larger the ex-ante skill uncertainty (i.e., the larger the σ_μ^2) and/or the less noisy the signal (i.e., the smaller the σ_ε^2), the larger the variance of investors' posterior skill inference $\hat{\mu}$. Since investors take monitoring actions (e.g., "vote with their feet") according to their posterior skill re-assessment, a large variance in $\hat{\mu}$ imposes high levels of re-assessment risk on the manager (i.e., flow risk and/or turnover risk). Such risk, stemming from portfolio disclosure, is a manifestation of luck on investors' posterior skill inference.

Since managers are typically risk averse (their human capital is non-diversifiable), funds with ex-ante higher skill uncertainty would opt for lower levels of portfolio disclosure (which results in noisier derived signal with higher σ_ε^2) to counter balance the influence of luck and reduce the variance of investors' posterior skill re-assessment. This, in turn, would reduce the level of skill re-assessment risk imposed on the manager. It is well known that providing two signals (in this case: two disclosure reports) with similar precision (similar σ_ε^2) is equivalent to providing only one signal with higher precision (lower σ_ε^2). Hence, managers with ex-ante higher skill uncertainty would be less likely to voluntarily report in quarterly frequency.[9]

[9] Low levels of disclosure can also be a result of competitive concerns and proprietary costs as modeled by, among others, Verrecchia (1983), Hayes and Lundholm (1996), and Agarwal, Mullally, Tang and Yang (2014).

Hypothesis 1: Other things equal, funds with higher ex-ante managerial skill uncertainty are less likely to disclose their portfolio holdings in quarterly frequency prior to 2004.

The above theoretical framework allows us to derive intuitive testable predictions regarding the effects of the 2004 SEC regulatory change, our natural experiment. After 2004, funds that are subjected to the new regulation (i.e., those that did not voluntarily report in quarterly frequency prior to the regulatory change) are forced to increase their portfolio disclosure frequency, resulting in a reduction in σ_ε^2. More frequent disclosure decreases σ_ε^2 because (1) timelier holdings disclosure has higher information value and (2) more frequent holdings disclosure is more difficult to manipulate. Thus, shareholders will naturally increase their reliance on disclosed portfolio holdings to re-assess fund managerial skills and take monitoring actions, which in turn will impose higher skill re-assessment risk (e.g., holdings-driven flow and turnover risks) to fund managers *especially for funds that have high ex-ante skill uncertainty*. This can be clearly seen from equation (2) since the variance of investors' posterior skill re-assessment, $var(\hat{\mu}) = \frac{\sigma_\mu^4}{\sigma_\mu^2+\sigma_\varepsilon^2}$, rises when σ_ε^2 falls. Moreover, since $\frac{d(var(\hat{\mu}))}{d(\sigma_\varepsilon^2)} = -\frac{\sigma_\mu^4}{(\sigma_\mu^2+\sigma_\varepsilon^2)^2}$, this negative relation between $var(\hat{\mu})$ and σ_ε^2 becomes more pronounced (i.e., larger in magnitude) when σ_μ^2 gets larger because $\frac{\sigma_\mu^4}{(\sigma_\mu^2+\sigma_\varepsilon^2)^2}$ is monotonically increasing in σ_μ^2.

We therefore expect that funds subjected to the new regulation experience an increase in holdings-driven flow risk ("vote with their feet"), especially for high uncertainty funds. Similarly, we expect that funds subjected to the regulation also experience an increase in holdings-driven managerial turnover risk, particularly for high uncertainty funds. The reason for this is that potential outflows following a negative signal may prompt the board to fire the

However, although considering such proprietary costs will push down the level of disclosure, it will not alter any of the *ceteris paribus* results derived below.

fund management (Khorana (1996)). Facing these increased risks associated with skill re-assessment caused by the mandatory increase in disclosure, fund managers would demand higher compensation in a competitive labor market. *Ceteris paribus*, this increase in compensation should be more pronounced for those funds with higher levels of ex-ante managerial skill uncertainty.

Hypothesis 2: Following the increase in mandatory quarterly disclosure, ceteris paribus, management fees increase for funds with high levels of ex-ante managerial skill uncertainty relative to funds with low levels of ex-ante managerial skill uncertainty.

As investors increase their reliance on disclosed portfolio holdings to evaluate fund managers, the skill re-assessment risk for fund managers increases. Consequently, the expected payoff from managers' risky bets may not be sufficient enough to compensate them for the increased levels of risks, mandated by the increased disclosure frequency. We hence expect these managers to become more myopic, reduce their risk taking (e.g., forgo some investments with high expected (by them) abnormal return that are risky), and move closer to their benchmark indexes subsequent to the new SEC regulation. Funds with high ex-ante levels of skill uncertainty face higher skill re-assessment risk; hence, they should experience a larger reduction in risk-taking relative to a fund with low ex-ante levels of skill uncertainty.

Hypothesis 3: Following the increase in mandatory quarterly disclosure, ceteris paribus, risk taking decreases for funds with high levels of ex-ante managerial skill uncertainty relative to funds with low managerial skill uncertainty.

Ceteris paribus, higher compensation and less risk-taking will in turn drive down the net returns to the mutual fund investors, especially for high uncertainty funds.

Hypothesis 4: Following the increase in mandatory quarterly disclosure, ceteris paribus, net fund performance declines for funds with high levels of ex-ante managerial skill uncertainty relative to funds with low levels of ex-ante managerial skill uncertainty.

3. Data and Empirical Methodology

3.1. Data

We obtain the data used in this study from the CRSP Mutual Fund Database, the Thomson Reuters/CDA equity holdings database, and the CRSP monthly stock files for the 1990-2012 period. The CRSP Mutual Fund Database provides daily fund returns, monthly fund returns and total net assets and annual data on expenses and fees. The daily fund returns and the annual management fee data are available only after 1998. The Thomson Financial/CDA database covers quarterly/semi-annual holdings of mutual funds, as reported to the SEC or voluntarily reported by the funds to data vendors, which we link to the monthly and daily CRSP stock files in order to obtain information on holdings' prices and returns (adjusting for stock splits and other share adjustments). The mutual fund databases are free of survivorship bias and we link them using the MFLINKS tool provided by WRDS.[10]

For a fund to be included in our sample, we require it to have an investment objective code in Thomson Reuters/CDA of growth, aggressive growth, or growth and income. Thus we effectively exclude all balanced, bond, money market, sector, and international funds. We also drop index funds by removing funds that contain in their CRSP-reported fund names the strings "INDEX", "INDE", "INDX", "S&P", or "MSCI". If a fund offers multiple share classes to investors, we aggregate across the different share classes. For total net assets (TNA) under management, we sum the TNAs of the individual shares. To determine a fund's age, we select the age of the oldest share class. For the other fund attributes (returns, expenses, turnovers, etc.), we take the weighted average of the attributes of the individual share classes, where the weights are the lagged TNAs of the individual share classes. We obtain managerial history data from Morningstar Direct.

3.2. Measuring Managerial Skill Uncertainty

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[10] More information on how MFLINKS assigns a unique fund identifier to each fund in the two databases can be found in Wermers (2000).

The tendency of mutual fund investors to chase past fund performance in their capital allocation decisions has been well-documented in the literature (see, for example, Ippolito (1992), Chevalier and Ellison (1997), and Sirri and Tufano (1998)). Therefore, investors' perceptions about fund managerial skill uncertainty are likely to also be based on the information available in fund net returns. The more volatile the past net returns of a fund, the more uncertainty investors perceive about its level of managerial skill. Consequently, we use the decile rank of fund return volatility in order to capture a fund's skill uncertainty, $\textit{Skill Uncertainty}_q$, in any quarter q. Specifically, we use the decile rank of three volatility measures – the standard deviation of past risk-adjusted returns "*StDev(α)*", the standard deviation of past excess returns "$StDev(R\text{-}R^M)$", and the standard deviation of past style-adjusted returns "$StDev(R\text{-}R^{9S})$".

The first $\textit{Skill Uncertainty}_q$ measure we use is based on the decile rank of $StDev(\alpha)_q$, where $StDev(\alpha)_q$ is measured as the standard deviation of the fund's monthly alpha during the past twelve months up to the last month in quarter q. We calculate the fund's alpha in any month m in a two-step procedure. First, we estimate a Carhart (1997) four-factor model using the fund's monthly returns in the previous twelve months (from *m-12* to *m-1*) to obtain the coefficient estimates of $R_M\text{-}R_f$, *SMB*, *HML*, and *MOM*. Then, we use the estimated coefficients to construct an expected return for month m which we subtract from the actual fund return to obtain our alpha estimate in month m. We further define *Uns(α)* as the average decile rank of $StDev(\alpha)_q$ for all quarters the fund existed between 1999 and 2003.

The second $\textit{Skill Uncertainty}_q$ measure is based on the decile rank of $StDev(R\text{-}R^M)_q$, where $StDev(R\text{-}R^M)_q$ is measured as the standard deviation of the fund's excess returns during the past twelve months up to the last month in quarter q. We calculate the fund's excess return in any month m by simply subtracting the CRSP value-weighted return in month m

from the fund's return in that month. We further define *Uns*$(R\text{-}R^M)$ as the average decile rank of *StDev*$(R\text{-}R^M)_q$ for all quarters the fund existed between 1999 and 2003.

The third *Skill Uncertainty*$_q$ measure is based on the decile rank of *StDev*$(R\text{-}R^{9S})_q$, where *StDev*$(R\text{-}R^{9S})_q$ is measured as the standard deviation of the fund's nine-style excess return during the past twelve months up to the last month in quarter *q*. Prior research has extensively studied the nine-style fund allocation employed by Morningstar, one of the leading institutional data providers, on the behavior of mutual fund investors (see, for example, Blake and Morey (2000) and Del Guercio and Tkac (2008)). Morningstar has historically allocated funds on a 3x3 style box, depending on their portfolio tilt towards value vs. growth stocks and small vs. large stocks, and used this fund allocation to benchmark funds. Since we do not observe this historical allocation, we use a factor model to estimate where exactly the fund is positioned on this nine-style box. To calculate the fund's nine-style excess return in any month *m*, we first estimate a Carhart four-factor model over the past twelve months (from *m-12* to *m-1*),[11] and double sort all sample funds (independently) into three portfolios based on their estimated *SMB* scores and into three portfolios base on their estimated *HML* scores, hence allocating each fund to one of the nine-style portfolios. The return in month *m* for each fund's nine-style benchmark portfolio is then defined as the value-weighted return in that month of all funds belonging to the same nine-style portfolio. Nine-style excess returns are then defined as fund returns in excess of their corresponding nine-style benchmark returns. We further define *Uns*$(R\text{-}R^{9S})$ as the average decile rank of *StDev*$(R\text{-}R^{9S})_q$ for all quarters the fund existed between 1999 and 2003.

3.3. Empirical Methodology

We run the following logistic regression model to test Hypothesis 1 that high skill uncertainty funds are less likely to voluntarily disclose their holdings quarterly prior to 2004.

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[11] Our results remain qualitative unchanged if we use 24 months to estimate the factor model.

$$Prob\left(Quarterly_{i,q}=1\right)=\frac{1}{1+exp\left(-X_{i,q-2}\beta\right)}, with$$

$$X_{i,q-2}\beta = \alpha + \beta_1 Skill\ Uncertainty_{i,q-2} + \beta_2 Size_{i,q-2} + \beta_3 Age_{i,q-2} + \beta_4 Alpha^{Y}_{i,q-2} + \beta_5 Expense\ Ratio_{i,q-2} + \beta_6 Turn_{i,q-2} + \beta_7 Load_{i,q-2} + Time\ and/or\ Style\ FEs + \varepsilon_{i,q-2} \quad (3)$$

The dependent variable $Quarterly_{i,q}$ takes the value of one if fund *i* disclosed its holdings in both quarters *q* and *q-1* and takes zero otherwise. $Skill\ Uncertainty_{i,q-2}$ is one of the decile rank of $StDev(\alpha)_{i,q-2}$, $StDev(R\text{-}R_M)_{i,q-2}$, and $StDev(R\text{-}R_{9S})_{i,q-2}$, as defined in the last subsection and measured at the end of quarter *q-2*. $Size_{i,q-2}$ is calculated at the end of quarter *q-2* as the natural logarithm of the fund's TNA (in US$ million). $Age_{i,q-2}$ is calculated at the end of quarter *q-2* as the natural logarithm of the fund's age, measured as the number of months since its inception. $Alpha^{Y}_{i,q-2}$ is estimated at the end of quarter *q-2* from a Carhart's (1997) four-factor model using the last twelve months of monthly returns (up to the quarter-end month) and expressed as a monthly percentage. $Expense\ Ratio_{i,q-2}$ is measured at the end of quarter *q-2* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{i,q-2}$ is calculated at the end of quarter *q-2* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{i,q-2}$ is an indicator taking the value of one if the fund is a load fund and zero otherwise.[12] Depending on the specification, we include time (i.e. year-quarter) and/or style fixed effects. Standard errors are clustered at the fund level throughout our study. The time frame for the test is 1990-2003 and spans all available funds. We expect the coefficient β_1 to be negative and significant.

As discussed in Section 2, we predict that following an increase in mandatory quarterly disclosure, holdings-driven (forced) managerial turnover risk would increase for high

[12] We define load funds as funds with at least one share class with a front-end load and/or a back-end load and/or with 12b-1 fees above 25 basis points. We use the cutoff of 25 basis points since funds with 12b-1 fees higher than 25 basis points are not allowed to market themselves as no-load funds (see, for example, Bergstresser et al. (2010)).

uncertainty funds relative to low uncertainty funds. We use the following logistic model to investigate this prediction.

$$Prob\ (ForcedTurnover_{i,y} = 1) = \frac{1}{1 + exp(-X_{i,y-1}\beta)}, with$$

$$X_{i,y-1}\beta = \alpha + \beta_1 Uncertainty\ Rank_i * Reg * R_{i,y-1}^{DGTW} + \beta_2 Reg * R_{i,y-1}^{DGTW} + \beta_3 Uncertainty\ Rank_i * R_{i,y-1}^{DGTW} + \beta_4 Uncertainty\ Rank_i * Reg + \beta_5 Uncertainty\ Rank_i + \beta_6 R_{i,y-1}^{DGTW} + \beta_7 Size_{i,y-1} + \beta_8 Age_{i,y-1} + \beta_9 Alpha_{i,y-1}^{Y} + \beta_{10} Expense\ Ratio_{i,y-1} + \beta_{11} Turn_{i,y-1} + \beta_{12} Load_{i,y-1} + Time\ and\ Style\ FEs + \varepsilon_{i,y-1} \quad (4)$$

We download the complete managerial history of each fund from Morningstar Direct. Recognizing that managers may leave due to reasons other than bad performance (e.g., star managers continuing their careers in hedge funds), we define as forced turnover only managerial changes following bad performance. Thus, the dependent variable, *ForcedTurnover*$_{i,y}$, takes the value of one if at least half of the fund's managers left their position in year *y*, conditional on the fund being in the lowest quintile of fund alpha in year *y-1*, and takes a value of zero otherwise.[13] Fund alpha in year *t-1* is estimated using Carhart's (1997) four-factor model and monthly fund return data. *Uncertainty Rank*$_i$ is one of *Uns(α)*, *Uns(R-R*^{M}*)*, or *Uns(R-R*^{9S}*)* as defined in Section 3.2. $R_{i,y-1}^{DGTW}$, expressed in percentage points, measures the cumulative DGTW-adjusted return in year *y-1* that can be inferred from the fund's most recently reported fund holdings. The calculation of DGTW-adjusted returns follows Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004).[14] We use $R_{i,y-1}^{DGTW}$ as a proxy for the signal that investors derive from the fund's portfolio disclosure, as

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[13] Our results are weaker but qualitatively similar when we require the fund's performance to be in in the lowest quartile instead of quintile in year *y-1* or if we require at least one manager to be replaced following bad performance in year *y-1*.

[14] The DGTW benchmarks are available via http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm. We thank Russ Wermers for generously sharing the data on his research website.

it reflects the fund's stock-characteristic-adjusted gross performance from its portfolio holdings. *Reg* is an indicator taking the value of zero before the regulatory change in 2004 and one afterwards. The other variables are similarly defined as before. In all specifications we include time (i.e., year) and style fixed effects.[15] The sample covers all funds subjected to the 2004 reform (i.e., the sample of "semi-annual funds" that are forced to increase reporting frequency to quarterly after 2004 and defined in the beginning of Section 2). The time-frame of this test is 1992-2012 where we drop the year 2004, the enactment year of the new regulation. As the theory predicts holdings-driven managerial turnover risk to increase in the post regulation period for high skill uncertainty funds relative to low uncertainty funds, we expect the coefficient β_1 to be negative and statistically significant.

We use the following OLS regression to investigate the prediction that following the increase in mandatory quarterly disclosure, holdings-driven flow risk increases for funds with high skill uncertainty relative to funds with low skill uncertainty.

$$\begin{aligned} Flow_{i,y} = {} & \alpha + \beta_1 Uncertainty\ Rank_i * Reg * R_{i,y-1}^{DGTW} + \beta_2 Reg * R_{i,y-1}^{DGTW} + \\ & \beta_3 Uncertainty\ Rank_i * R_{i,y-1}^{DGTW} + \beta_4 Uncertainty\ Rank_i * Reg + \\ & \beta_5 Uncertainty\ Rank_i + \beta_6 R_{i,y-1}^{DGTW} + \beta_7 Size_{i,y-1} + \beta_8 Age_{i,y-1} + \beta_9 Alpha_{i,y-1}^{Y} + \\ & \beta_{10} Expense\ Ratio_{i,y-1} + \beta_{11} Turn_{i,y-1} + \beta_{12} Load_{i,y-1} + \beta_{13} Flow_{i,y-1} + \\ & Time\ and\ Fund\ FEs + \varepsilon_{i,y-1} \end{aligned} \tag{5}$$

The dependent variable, $Flow_{i,y}$, is fund *i*'s net flow in year *y*, expressed in percentage points. To calculate the yearly fund flows, we first calculate monthly flows as changes in total net assets (TNA) across two months *m*, adjusted for fund returns: $\frac{TNA_{im}-(1+R_m)*TNA_{im-1}}{TNA_{im-1}}$. We then cumulate the 12 monthly flow values to obtain a yearly value. We further control for the past fund flow $Flow_{i,y-1}$ in the regression and include time (i.e., year) and fund fixed effects.

[15] The variable *Reg* does not show up in equations (4) and (5) due to the inclusion of the time fixed effects. Similarly, in the rest of our diff-in-diff(-in-diff) tests we do not report the coefficient of the variable *Reg* whenever we include time-fixed effects in the specifications.

The other variables are the same as before. The sample covers all funds subjected to the 2004 reform (i.e. the "semi-annual funds"). The time period of the test is 1992-2012 where we drop year 2004, the enactment year of the new SEC regulation. Since the theory predicts holdings-driven flow risk to increase post the regulation for high skill uncertainty funds relative to low uncertainty funds, we expect the coefficient β_1 to be positive and significant.

To test Hypothesis 2 which states that management fees increase for high uncertainty funds relative to low uncertainty funds following the increase in mandatory quarterly disclosure, we use the following difference-in-differences regression model.

$$ManFee_{i,y} = \alpha + \beta_1 Uncertainty\ Rank_i * Reg + \beta_2 Uncertainty\ Rank_i +$$
$$\beta_3 Reg + \beta_4 Size_{i,y-1} + \beta_5 Age_{i,y-1} + \beta_6 Alpha^Y_{i,y-1} + \beta_7 Expense\ Ratio_{i,y-1} +$$
$$\beta_8 Turn_{i,y-1} + \beta_9 Load_{i,y-1} + \beta_{10} ManFee_{i,y-1} +$$
$$Time\ and/or\ Fund\ and/or\ Style\ FEs + \varepsilon_{i,y-1} \quad (6)$$

$ManFee_y$ is calculated at the end of year y as the fund's most recently reported management fees, expressed in percentages. The other variables are defined as before. We control for the lagged management fees, $ManFee_{y-1}$, and, depending on the specification, we include time and/or style and/or fund fixed effects. The sample covers all funds subjected to the 2004 reform (i.e. the "semi-annual funds"). As management fee data is only available on CRSP after 1998, the time-frame of this test is 1998-2012 where we drop year 2004, the enactment year of the new regulation. According to Hypothesis 2, we expect the coefficient β_1 to be positive and significant.

We further use the following difference-in-differences regression to investigate Hypothesis 3 that risk taking decreases for high uncertainty funds relative to low uncertainty funds subsequent to the increase in mandatory quarterly disclosure.

$$ActiveShare_{i,q} = \alpha + \beta_1 Uncertainty\ Rank_i * Reg_{q-1} + \beta_2 Uncertainty\ Rank_i +$$
$$\beta_3 Reg_{q-1} + \beta_4 ActiveShare_{i,q-1} + \beta_5 Size_{i,q-1} + \beta_6 Age_{i,q-1} + \beta_7 Alpha^Q_{i,q-1} +$$

$$\beta_8 Expense\ Ratio_{i,q-1} + \beta_9 Turn_{i,q-1} + \beta_{10} Load_{i,q-1} + \beta_{11} Alpha^{Y}_{i,q-1} +$$

$$\beta_{12} Flow_{i,q-1} + Time\ and/or\ Fund\ and/or\ Style\ FEs + \varepsilon_{i,q-1} \quad (7)$$

The dependent variable, *ActiveShare*$_q$, measures fund *i*'s Active Share in quarter q. We further control for the lagged active share, *ActiveShare*$_{q-1}$, in the regression. The other right-hand-side variables are the same as those in equation (7) above. We obtain computed Active Share scores from Antti Petajisto's website for the period 1998-2009.[16] Again, the sample covers all funds subjected to the 2004 reform (i.e. the "semi-annual funds"). In our analysis, we drop the year 2004, the enactment year of the new regulation. According to Hypothesis 3, we expect the coefficient β_1 to be negative and statistically significant.

Finally, we use the following difference-in-differences regression model to investigate Hypothesis 4 that net fund performance declines for high uncertainty funds relative to low uncertainty funds subsequent to the increase in mandatory quarterly disclosure.

$$Alpha^{Q}_{i,q} = \alpha + \beta_1 Uncertainty\ Rank_i * Reg_{q-1} + \beta_2 Uncertainty\ Rank_i +$$

$$\beta_3 Reg_{q-1} + \beta_4 Size_{i,q-1} + \beta_5 Age_{i,q-1} + \beta_6 Alpha^{M}_{i,q-1} + \beta_7 Expense\ Ratio_{i,q-1} +$$

$$\beta_8 Turn_{i,q-1} + \beta_9 Load_{i,q-1} + \beta_{10} Alpha^{Y}_{i,q-1} + \beta_{11} Flow_{i,q-1} +$$

$$Time\ and/or\ Fund\ and/or\ Style\ FEs + \varepsilon_{i,q-1} \quad (8)$$

The dependent variable $Alpha^{Q}_{i,q}$ is estimated at the end of each quarter q from Carhart's (1997) four-factor model using the last three-months of fund *i*'s daily returns and the daily risk factors and expressed as a monthly percentage. We use $Alpha^{Q}_{i,q-1}$ and $Alpha^{Y}_{i,q-1}$ to control for the short-term past performance and long-term past performance, respectively. $Alpha^{Q}_{i,q-1}$ is the one-quarter lag of $Alpha^{Q}_{i,q}$. $Alpha^{Y}_{i,q-1}$ is estimated at the end of quarter *q-1* from Carhart's (1997) four-factor model using the last twelve months of monthly returns

[16] Cremers and Petajisto (2009) define Active Share as the fraction of portfolio holdings that differ from the benchmark index holdings, ranging from 0 to 1. For example, an Active Share of 0.7 indicates that 70% of the fund's holdings do not overlap with the index. We thank Antti Petajisto for generously sharing the data via his website http://www.petajisto.net/data.html.

and the monthly risk factors and expressed as a monthly percentage.[17] The other variables are similar to what we use before in the previous regression models. Depending on the specification, we include time (i.e., year-quarter) and/or style and/or fund fixed effects. The sample covers all funds subjected to the 2004 reform (i.e. the "semi-annual funds"). Again due to data availability, the time period of this test is 1998-2012 where we drop year 2004, the enactment year of the new regulation.[18] According to Hypothesis 4, we expect the coefficient β_1 to be negative and significant.

4. Main Empirical Results

4.1. Summary Statistics

Table 1 provides the summary statistics of our sample. In column 1 we present descriptive statistics for the pre-regulation sample, used to test hypothesis 1. This sample spans in total 2,270 funds between 1990 and 2003. We find that the average fund size ($166 million), age (100 months), expenses (1.37% per year) and turnover values (92.69% per year) are consistent with previous studies on the mutual fund industry, such as Wermers (2000). The median size is slightly larger than the mean, while the median age, expenses, and turnover values are lower than the averages. Consistent with the vast body of literature (e.g. Malkiel (1995), Gruber (1996), and Carhart (1997), among others), we find that on average mutual fund alphas are slightly negative over the 1990-2003 period.

In columns 2 and 3 we present the summary statistics for our subsamples of semi-annual and quarterly funds at the end of 2003 for Number of Funds, Size, Age, Expense Ratio, and Turnover and over the 1999-2003 period for Alpha, $StDev(\alpha)_q$, $StDev(R\text{-}R^M)_q$, and $StDev(R\text{-}R^{9S})_q$. A fund must be alive at the end of 2003 to be included in one of these two samples. Quarterly funds are defined as funds that reported at least 75% of time between

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[17] Alphas of the past one quarter and the past one year are standard measures in the literature to control for short-term and long-term past fund performances (e.g., Carhart (1997)). We also use alpha of the past two years as a control and find qualitatively similar results (untabulated).

[18] Daily mutual fund returns are only available on CRSP after 1998.

1999 and 2003 on a quarterly basis, while all the rest of the funds are classified as semi-annual. Using this identification scheme, we classify 1,140 funds as semi-annual and 413 funds as quarterly. We find descriptive statistics consistent with the studies of Ge and Zheng (2006) and Parida and Teo (2014). Namely, semi-annual funds are smaller (based on the median), slightly younger and have a higher mean (but lower median) expense ratio than quarterly funds. While the distribution of fund size is heavily skewed in both groups, there are some very large semi-annual funds, as revealed by the fact that their mean size is larger than quarterly funds, despite having a significantly smaller median size. The two groups of funds do not demonstrate significant difference in turnover or alpha. Consistent with our conjecture that semi-annual funds have higher ex-ante skill uncertainty, the average $StDev(R\text{-}R^{M})_q$ and average $StDev(R\text{-}R^{9S})_q$ are both significantly higher for semi-annual funds than for quarterly funds.

We also investigate the persistence of our skill uncertainty proxies. We run a separate AR(1) model for each of our three quarterly proxies for skill uncertainty. Using the whole semi-annual sample, the coefficient on the lagged regressor is 0.92 for the AR(1) model on $StDev(\alpha)_q$, 0.93 for the AR(1) model on $StDev(R\text{-}R^{M})_q$, and 0.90 for the AR(1) on $StDev(R\text{-}R^{9S})_q$, all highly statistically different from zero. The coefficients are similar in magnitude when we confine our tests to the pre-2004 period only. Furthermore, we calculate the correlation between the average uncertainty rank for semi-annual funds in the five years prior to 2004 and the five years after 2004. The correlation coefficients are 0.75, 0.81, and 0.79 when we measure skill uncertainty using $StDev(\alpha)_q$, $StDev(R\text{-}R^{M})_q$, and $StDev(R\text{-}R^{9S})_q$, respectively. These results indicate that skill uncertainty is highly persistent and hence our tests are unlikely to be affected by time-varying skill uncertainty.

4.2. Managerial Skill Uncertainty and the Likelihood of Voluntary Quarterly Disclosure

Table 2 presents the results of logistic regressions according to equation (3) that investigate the relation between managerial skill uncertainty and the future likelihood of voluntary quarterly portfolio disclosure. In model (1), the managerial skill uncertainty measure is *StDev(α)* and we include control variables and style fixed effects. We find that *Age* is significantly positively, while *Turn* is significantly negatively, related to the future likelihood of voluntary quarterly disclosure. More importantly, *Skill Uncertainty* is significantly negatively related to the future likelihood of voluntary quarterly disclosure at the 1% level. In terms of economic significance, the results in specification (1) suggest that the future likelihood of voluntary quarterly disclosure for the funds with the highest *Skill Uncertainty* is 5 percentage points lower than that for the funds with the lowest *Skill Uncertainty* (the marginal effect of *StDev(α)* is 0.0056; 0.0056*9=0.05). This is large in magnitude since the unconditional likelihood of voluntary quarterly disclosure is only 38% percent in our sample. In model (2), we further control for time fixed effects and find qualitatively similar results. Models (3)-(6) show that results are also qualitatively similar when we measure *Skill Uncertainty* based on $StDev(R\text{-}R_M)$ or $StDev(R\text{-}R_{9S})$. These results strongly support Hypothesis 1 that high uncertainty funds are less likely to disclose their portfolios in quarterly frequency prior to 2004.

4.3. Changes in Risk Subsequent to the Mandatory Increase in Portfolio Disclosure

We next show that, subsequent to the mandatory increase in portfolio disclosure, holdings-driven (forced) managerial turnover risk and flow risk increase for high uncertainty funds relative to low uncertainty funds. In response, managers in high uncertainty funds, require relatively higher management fees to compensate for the increased risks they are facing. We include only funds that are forced to increase the reporting frequency to quarterly after 2004 in these analyses to ensure that our results are not influenced by self-selection bias.

Table 3 reports the logistic regression results of holdings-driven (forced) managerial turnover risk according to equation (4). In model (1), the skill uncertainty measure is *StDev(α)*. As discussed earlier, our focus is on the coefficient of the three-way-interaction term, $Uncertainty\ Rank_i * Reg * R_{i,y-1}^{DGTW}$, and we include the two-way interaction terms and other control variables as well as time (i.e., year) fixed effects and style fixed effects. As predicted, the coefficient of the three-way-interaction term is significantly negative at the 5% level, confirming an incremental increase in holdings-driven managerial turnover risk after the new SEC regulation for high uncertainty funds relative to low uncertainty funds.[19] Models (2) and (3) show that results are qualitatively similar when we measure managerial skill uncertainty using *StDev(R-R$_M$)* or *StDev(R-R$_{9S}$)*. Table 4 reports the time-and-fund fixed effects OLS regression results on holdings-driven fund flow risk according to equation (5). Again, our focus is on the three-way-interaction term, $Uncertainty\ Rank_i * Reg * R_{i,y-1}^{DGTW}$. The coefficient is positive in all of the three models and is statistically significant in two out of the three models. The results again confirm an incremental increase in holdings-driven flow risk after the new SEC regulation for high uncertainty funds relative to low uncertainty funds.[20]

The results in Tables 3 and 4 are not surprising, as they suggest that the mandatory increase in portfolio disclosure frequency makes investors rely more than before on disclosed portfolio holdings to monitor fund managers, especially for high uncertainty funds.

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[19] In terms of economic significance, the marginal effect suggests an incremental 1.5 percent increase after the new SEC regulation in holdings-driven turnover risk (i.e., the percent rise in forced turnover likelihood for one-standard-deviation *decrease* in $R_{i,y-1}^{DGTW}$, the cumulative DGTW-adjusted return in year *y-1* inferred from the fund's most recently reported fund holdings) for funds in the highest skill uncertainty decile relative to those in the lowest skill uncertainty decile; this is large in magnitude given that the unconditional (forced) turnover rate in our sample is only 4.5 percent.

[20] The effect is also economically significant. For example, model (1) of Table 4 implies an incremental 0.22% percent increase post the new regulation in holdings-driven flow risk (i.e., the percent rise in fund flow for one-standard-deviation increase in $R_{i,y-1}^{DGTW}$) for funds in the highest managerial skill uncertainty decile relative to those in the lowest skill uncertainty decile.

4.4. *Management Fee Changes Subsequent to the Mandatory Increase in Portfolio Disclosure*

Table 5 reports the difference-in-differences regression results on management fees according to equation (6). In models (1), (4), and (7) we control for style fixed effects; in models (2), (5), and (8) we control for style fixed effects and time (i.e., year) fixed effects; and in models (3), (6), and (9) we control for both fund fixed effects and time fixed effects. We find that management fees are higher for larger size funds, no-load funds, funds with higher annual turnover ratio, and funds with higher past management fees. Results are consistent across the nine models for our variable of interest—the coefficient of the difference-in-differences term, $Uncertainty\ Rank_i * Reg$, is positive across all of the nine models and statistically significant in eight out of the nine models. This result confirms an increase in management fees for high uncertainty funds relative to low uncertainty funds after the new SEC regulation, lending strong empirical support to Hypothesis 2. In terms of economic significance, comparing the highest skill uncertainty decile to the lowest skill uncertainty decile, there is an incremental increase in management fees (as a percentage of TNA) of 0.018 to 0.036 percentage points post the new SEC regulation. Given that the average TNA of the semi-annual funds in our sample is $1,890 million, the incremental increase in managerial compensation of the highest skill uncertainty funds relative to the lowest skill uncertainty funds amounts to $0.34 to $0.68 million per year.

4.5. *Changes in Risk Taking Subsequent to the Mandatory Increase in Portfolio Disclosure*

Following the new SEC regulation, managers face increased levels of risks, especially those with high ex-ante skill uncertainty. Consequently, the expected gain on managers' stock picks (i.e., the increased compensation through more funds under management as a result of positive performance flow) may not be sufficient to compensate for the increased risk, which provides managers with incentives to reduce risk-taking behavior. Table 6 reports the difference-in-differences regression results on fund risk taking according to equation (7). The dependent variable measures a fund's Active Share in a quarter, a proxy for mutual fund risk taking. As hypothesized, the difference-in-differences term, $Uncertainty\ Rank_i * Reg_{q-1}$, is negative and significant at the 1% level across all of the nine models, suggesting a strong incremental post-regulation reduction in Active Share for high uncertainty funds relative to low uncertainty funds. In terms of economic significance, our results indicate that funds in the highest skill uncertainty decile move 9 to 10% closer to their benchmark index, relative to funds with low skill uncertainty. Thus, there is indeed strong empirical evidence supporting Hypothesis 3's prediction of reducing performance risk by moving closer to benchmarks.

Window dressing is another potential channel that managers may employ to decrease the risks associated with portfolio disclosure. Window dressing refers to the practice of some fund managers to buy or sell certain stocks right before they disclose their holdings to the public, in order to make their portfolios look more favorable in the eyes of the investors. For example, a manager may sell a poorly performing stock just before the disclosure date. To measure window dressing, we use the *RankGap* of Agarwal, Gay, and Ling (2013). The *RankGap* gives a high score to poorly performing funds that hold a disproportionally large share in recent winner stocks.[21] Table A1 reports no incremental change in window-dressing behavior in the post-regulation period for high uncertainty funds relative to low uncertainty funds. Thus, our result suggests that managers do not mask their portfolios in an attempt to combat the risks associated with increased portfolio disclosure.

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[21] $RankGap_q$ is calculated as $(PerformanceRank_q - (WinnerRank_q + LoserRank_q) * 0.5)/200$, where funds are ranked in a descending order in 100 groups according to past performance ($PerformanceRank_q$) and the proportion of winner stocks in their portfolios ($WinnerRank_q$) and in an ascending order in 100 groups according to the proportion of loser stocks in their portfolios ($LoserRank_q$). See Agarwal, Gay, and Ling (2013) for further details.

4.6. Net Fund Performance Changes Subsequent to the Mandatory Increase in Portfolio Disclosure

We next test Hypothesis 4 that high skill uncertainty fund's net performance declines relative to low skill uncertainty funds following the new regulation. Table 7 reports the difference-in-differences regression results according to equation (8). Models (1), (4), and (7) include style fixed effects; models (2), (5), and (8) include style and time (i.e., year-quarter) fixed effects; and models (3), (6), and (9) include fund and time fixed effects. We find that net fund performance as measured by four-factor alpha per month is higher for funds with higher past short-term performance (i.e., higher $Alpha_{i,q-1}^{Q}$) and lower for funds with higher expense ratio or higher annual turnover ratio. More importantly, for our variable of interest, the coefficient of the difference-in-differences term, $Uncertainty\ Rank_i * Reg$, is negative and significant at the 1% level across all of the nine models. In terms of economic significance, comparing the highest managerial skill uncertainty decile to the lowest skill uncertainty decile, there is an incremental decline in net fund performance of 0.16 to 0.32 percentage points per month after the regulation.

In the Appendix B, Table A2 shows that there is no incremental change after the new SEC regulation in stock-picking skills for high uncertainty funds relative to low skill uncertainty funds.[22] Given that we document no changes in stock-picking skills, the decreased net performance differential between high and low uncertainty funds must stem from the increased management fees and decreased risk taking in response to the risks that portfolio disclosure poses.

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[22] We measure stock picking skills using $BAR^{firstbuys}_q$ -- the benchmark adjusted returns in quarter *q* of stocks that funds bought for the first time in quarter *q-1*. Benchmark adjusted returns refers to the [-1,+1] earnings announcement returns in the average [-1,+1] earnings announcement return of stocks with similar book-to-market, size, and momentum. See Baker et al. (2010) for further details on constructing this proxy.

5. Additional Checks

5.1. Placebo Tests

To check the internal validity of our difference-in-differences estimator, we conduct falsification tests following the suggestion in Roberts and Whited (2011). Specifically, we falsely assume that the onset of the new regulation occurs three years before it actually does. In each case, we then re-estimate the difference-in-differences regressions on management fees, net fund performance, and risk taking (Hypotheses 2-4). We drop year 2001 from these regressions. Table A3 in the Appendix reports the results. Panel A shows that the difference-in-differences term is insignificant in the regressions on management fees; Panel B shows that the difference-in-differences term is insignificant in the regressions on net fund performance; and Panel C shows that the difference-in-differences term is much weaker (only marginally significant) in the regressions on risk taking. These results strongly suggest that our earlier findings are most likely due to the treatment effect of the new SEC regulation in 2004, as opposed to some alternative forces (e.g., non-parallel trends prior to the new regulation).

As a further robustness check, we conduct placebo tests on the set of quarterly funds that are not subject to the new SEC regulation since they already voluntarily reported at a quarterly frequency prior to 2004. For this set of funds, Table A4 in the Appendix shows that there is no significant incremental change in management fees, net fund performance or risk taking behavior for high uncertainty funds relative to low uncertainty funds post 2004, further confirming a treatment effect of the 2004 regulatory change on funds subjected to the new regulation.[23]

5.2. Disentangling an information vs. agency channel

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[23] We find a small aggregate downward trend in active share, as in Cremers and Patejisto (2009), but the underlying trend is much smaller than the change found for the funds affected by the regulation.

Agarwal et al. (2014) and Parida and Teo (2014) document another channel through which the increased frequency of mandatory portfolio disclosure can impact mutual funds. We label this channel an "information channel". In Agarwal et al. (2014), market makers learn from the disclosed holdings of informed traders (i.e., informed mutual funds), which limits their ability to take advantage of their informed trades. In Parida and Teo (2014), increased disclosure frequency allows other market participants to more easily front run the trades of mutual funds. Both of these papers suggest that better performing funds are hurt more from the increased disclosure frequency than worse performing funds.

To disentangle the information channel from the agency channel, we first calculate the quarterly quintile rank of $Alpha_{i,q-1}^{Y}$ for all funds in the sample of semi-annual funds between 1999 and 2003. Next, we average those quarterly ranks for every fund across the 1999-2003 period. The variable *Top Fund* takes the value of 1 if the fund was in the top quintile of the average alpha rank and zero otherwise. We next add *Top Fund* and its interaction with the *Reg* dummy to the previous net return analysis. The results are reported in Table A5, where we report evidence in support of both channels. Both interactions of the regulation dummy with Skill Uncertainty and the Top Fund indicator enter with a significant and negative sign. The magnitudes on the *Reg**Top Fund* interaction are about three times as large as the ones on the *Reg**Skill Uncertainty* interaction. However, since *Top Fund* takes value of 0 and 1 and the *Skill Uncertainty* values range between 1 and 10, the effect of the agency channel on fund performance appears to be even larger than the effect of the information channel.

6. Conclusion

In this paper, we predict that (1) mutual funds with higher ex-ante managerial skill uncertainty opt for lower levels of portfolio disclosure, and (2) mandating fund portfolio disclosure can hurt investors via an agency channel because mandatory portfolio disclosure imposes additional skill re-assessment risks on managers which in turn translate into additional agency costs to investors, especially for funds with high levels of ex-ante managerial skill uncertainty.

Using a SEC regulatory change in 2004 that mandated a more frequent portfolio disclosure as a quasi-natural experiment, we show that funds with higher ex-ante managerial skill uncertainty are indeed significantly less likely to voluntarily disclose their portfolios in quarterly frequency prior to the new regulation. We further show that these funds responded to the regulatory change with an increase in management fees and a decrease in risk taking behavior, relative to funds with low ex-ante skill uncertainty. These actions ultimately result in inferior net performance for fund investors. Our findings shed new light on disclosure, agency, and governance issues in general and of the mutual fund industry in particular, a large industry with significant importance for investors and the economy.

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Table 1. Summary Statistics

This table presents descriptive statistics of the sample. In column 1, the average and median values are computed using all fund-quarter observations in the 1990-2003 period. Alphas are estimated at the end of each quarter from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors. The skill uncertainty proxies $StDev(\alpha)_q$, $StDev(R\text{-}R^M)_q$, and $StDev(R\text{-}R^{9S})_q$ are defined in Section 3.2. In columns 2 and 3 we present the average and median values as of the end of 2003 for the subset of semi-annual and quarterly funds, respectively, with the exception of the average and median alpha and uncertainty proxies, which are calculated as the average and median quarter-end values of all funds in the respective sample between 1999 and 2003. Size is expressed in millions of US dollars, Age in months, Expense Ratio and Turnover in percentage per year, Alpha in percentage per month, and all three measures of uncertainty in percentage per year.

	All Funds	Semi-annual Funds	Quarterly Funds	Semi-annual - Quarterly
	1990-2003	End of 2003	End of 2003	
Number of Funds	2270	1140	413	
Average Size	166.94	1667.29	1277.66	389.64**
Median Size	175.1	298.60	388.00	-89.40**
Average Age	100	156	170	-14*
Median Age	96	134	139	-5
Average Expense Ratio	1.37	1.52	1.43	0.09***
Median Expense Ratio	1.25	1.29	1.37	-0.08**
Average Turnover	92.69	88.84	86.57	2.27
Median Turnover	68.85	67.00	62.50	4.50
	1990-2003	1999-2003	1999-2003	
Average Alpha	-0.07	0.05	0.02	0.03
Median Alpha	-0.09	0.02	0.00	0.02
Average $StDev(\alpha)_q$	3.10	4.08	3.85	0.23
Median $StDev(\alpha)_q$	2.17	3.38	3.39	-0.01
Average $StDev(R\text{-}R^M)_q$	2.95	3.75	3.53	0.22*
Median $StDev(R\text{-}R^M)_q$	2.41	3.48	3.33	0.15
Average $StDev(R\text{-}R^{9S})_q$	2.48	3.75	3.53	0.22*
Median $StDev(R\text{-}R^{9S})_q$	1.90	2.90	2.81	0.08
Fraction Quarterly=1	0.38			

Table 2. Likelihood of Voluntary Quarterly Disclosure in the Pre-regulation Period

The table presents the results of logistic regressions of quarterly disclosure on lagged variables. The dependent variable $Quarterly_q$ takes the value of 1 if the fund disclosed its holdings both in quarters q and q-1. Skill $Uncertainty_{q-2}$ is calculated as the decile rank of $StDev(\alpha)_{q-2}$ (specifications (1) and (2)), $StDev(R\text{-}R^M)_{q-2}$ (specifications (3) and (4)), and $StDev(R\text{-}R^{9S})_{q-2}$ (specifications (5) and (6)) as defined in Section 3.2. $Log(Size)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^Y_{q-1}$ is estimated at the end of quarter *q-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{q-1}$ is an indicator variable taking the value of 1 if the fund is a load fund and zero otherwise. Depending on the specification, we include time/style/ fixed effects and/or clustered standard errors on the fund level. The time-frame is 1990-2003. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	Dependent Variable: $Quarterly_q$					
	$StDev(\alpha)_{q-2}$		$StDev(R\text{-}R^M)_{q-2}$		$StDev(R\text{-}R^{9S})_{q-2}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Skill $Uncertainty_{q-2}$	-0.023***	-0.017**	-0.023***	-0.014*	-0.021***	-0.014*
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
$Log(Size)_{q-2}$	-0.018	-0.021	-0.016	-0.021	-0.022	-0.024
	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)
$Log(Age)_{q-2}$	0.219***	0.184***	0.254***	0.185***	0.217***	0.183***
	(0.034)	(0.037)	(0.031)	(0.035)	(0.034)	(0.037)
$Alpha^Y_{q-2}$	0.040***	0.014	0.048***	0.019	0.043***	0.016
	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)	(0.013)
$ExpRatio_{q-2}$	-0.028	-0.043*	-0.016	-0.033	-0.024	-0.041*
	(0.022)	(0.023)	(0.021)	(0.022)	(0.021)	(0.023)
$Turn_{q-2}$	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Load_{q-2}$	0.007	-0.037	0.002	-0.041	0.009	-0.035
	(0.053)	(0.056)	(0.051)	(0.054)	(0.053)	(0.056)
cse	yes	yes	yes	yes	yes	yes
style fe	yes	yes	yes	yes	yes	yes
time fe	no	yes	no	yes	no	yes
Intercept	yes	yes	yes	yes	yes	yes
Obs	56,630	56,630	60,641	60,641	56,673	56,673
Pseudo R^2	0.00753	0.0561	0.0110	0.0606	0.00805	0.0562

Table 3. The Effect of the 2004 Regulation on the Likelihood of Forced Managerial Turnover

The table presents the results of yearly logistic regressions of forced turnover on lagged variables. The dependent variable $ForcedTurnover_y$ takes the value of 1 if at least half of the fund's managers left their position in year *y*, conditional on the fund being in the lowest quintile of fund alpha in year *y-1*. Fund alpha in year *t-1* is estimated from a factor model monthly data and Rm, SMB, HML, and MOM as risk factors. In each specification we include a Skill Uncertainty measure -- Uns(α) in specification (1), $Uns(R\text{-}R^{M})$ in specification (2), and $Uns(R\text{-}R^{9S})$ in specification (3). The Skill Uncertainty proxies are defined in Section 3.2. Ret^{dgtw}_{y-1} measures the cumulative DGTW-adjusted return in year *y-1* of the fund's most recently reported fund holdings, expressed in percentage points. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $Log(Size)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^{Y}_{y-1}$ is estimated at the end of year y-1 from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{y-1}$ is an indicator variable taking the value of 1 if the fund is a load fund in year *y-1* and zero otherwise. In all specifications we include style and time fixed effects and cluster the standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1990-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 3, continued

	Dependent Variable: $ForcedTurnover_y$		
	Uns(α)	Uns(R-R^M)	Uns(R-R^{9S})
	(1)	(2)	(3)
Skill Uncertainty*Reg*Ret^{dgtw}_{y-1}	-0.024**	-0.021*	-0.023*
	(0.010)	(0.012)	(0.013)
Ret^{dgtw}_{y-1}	-0.168***	-0.176***	-0.185***
	(0.034)	(0.062)	(0.065)
Skill Uncertainty	0.094**	0.049	0.074*
	(0.040)	(0.039)	(0.045)
Reg*Skill Uncertainty	-0.107**	-0.080	-0.113*
	(0.054)	(0.053)	(0.059)
Skill Uncertainty*Ret^{dgtw}_{y-1}	0.026***	0.025***	0.025***
	(0.006)	(0.009)	(0.010)
Reg*Ret^{dgtw}_{y-1}	0.111*	0.090	0.122
	(0.061)	(0.080)	(0.088)
$Log(Size)_{y-1}$	-0.033	-0.038	-0.036
	(0.037)	(0.036)	(0.037)
$Log(Age)_{y-1}$	0.231**	0.238**	0.235**
	(0.108)	(0.105)	(0.106)
$Alpha^Y_{y-1}$	-1.551***	-1.535***	-1.522***
	(0.132)	(0.131)	(0.133)
$ExpRatio_{y-1}$	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
$Turn_{y-1}$	-0.407***	-0.394***	-0.389***
	(0.096)	(0.090)	(0.092)
$Load_{y-1}$	0.450***	0.455***	0.455***
	(0.152)	(0.151)	(0.151)
cse by fund	yes	yes	yes
style fe	yes	yes	yes
time fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	10,932	10,939	10,932
Pseudo R^2	0.232	0.228	0.228

Table 4. The Effect of the 2004 Regulation on the Sensitivity of Fund Flows to Past Portfolio Performance

The table presents the results of yearly OLS regressions of fund flows on lagged variables. The dependent variable $Flow_y$ measures yearly fund flows at the end of year *y*, expressed in percentage points. In each specification we include a Skill Uncertainty measure -- Uns(α) in specification (1), Uns($R-R^M$) in specification (2), and Uns($R-R^{9S}$) in specification (3). The Skill Uncertainty proxies are defined in Section 3.2. Ret^{dgtw}_{y-1} measures the cumulative DGTW-adjusted return in year *y-1* of the fund's most recently reported fund holdings, expressed in percentage points. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $Log(Size)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha_{y-1}$ is estimated at the end of year *y-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{y-1}$ is an indicator variable taking the value of 1 if the fund is a load fund in year *y-1* and zero otherwise. $Flow_{y-1}$ measures yearly fund flows at the end of year *y-1*, expressed in percentage points. In all specifications we include fund and time fixed effects. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1990-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 4, continued

	Dependent Variable: $Flow_y$		
	Uns(α)	Uns(R-R^M)	Uns(R-R^{9S})
	(1)	(2)	(3)
Skill Uncertainty*Reg*Ret^{dgtw}_{y-1}	0.005**	0.004**	0.003
	(0.002)	(0.002)	(0.002)
Ret^{dgtw}_{y-1}	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)
Skill Uncertainty	-0.559	-0.658	-0.732
	(0.382)	(0.448)	(0.495)
Reg*Skill Uncertainty	-0.012	-0.008	-0.005
	(0.009)	(0.009)	(0.010)
Skill Uncertainty*Ret^{dgtw}_{y-1}	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
Reg*Ret^{dgtw}_{y-1}	0.048***	0.046***	0.038***
	(0.015)	(0.014)	(0.015)
$Log(Size)_{y-1}$	-0.285***	-0.284***	-0.284***
	(0.014)	(0.014)	(0.014)
$Log(Age)_{y-1}$	-0.057	-0.057	-0.057
	(0.046)	(0.046)	(0.046)
$Alpha_{y-1}$	0.013	0.013	0.013
	(0.011)	(0.011)	(0.011)
$ExpRatio_{y-1}$	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)
$Turn_{y-1}$	-0.172***	-0.170***	-0.169***
	(0.059)	(0.059)	(0.059)
$Load_{y-1}$	0.019	0.020	0.020
	(0.039)	(0.039)	(0.039)
$Flow_{y-1}$	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)
fund fe	yes	yes	yes
time fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	9,416	9,421	9,416
R^2	0.174	0.174	0.174

Table 5. The Effect of the 2004 Regulation on Management Fees

The table presents the results of yearly OLS regressions of management fees on lagged variables. The dependent variable $ManFee_y$ is calculated at the end of year *y* as the fund's most recently reported management fees, expressed in percentages. In each specification we include a Skill Uncertainty measure -- Uns(α) in specifications (1) – (3), Uns($R-R^M$) in specifications (4) – (6), and Uns($R-R^{9S}$) in specification (7) – (9). The Skill Uncertainty proxies are defined in Section 3.2. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $Log(Size)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{y-1}$ is calculated at the end of year *y-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^Y_{y-1}$ is estimated at the end of year *y-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{y-1}$ is an indicator variable taking the value of 1 if the fund is a load fund in year *y-1* and zero otherwise. $ManFee_{y-1}$ is calculated at the end of year *y-1* as the fund's most recently reported management fees, expressed in percentages. Depending on the specification, we include time/style/fund fixed effects and/or clustered standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1998-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5, continued

	Dependent Variable: $ManFee_y$								
		Uns(α)			Uns(R-R^M)			Uns(R-R^{9S})	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reg*Skill Uncertainty	0.004*	0.004**	0.004**	0.002	0.003**	0.003**	0.004*	0.004*	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Reg	-0.014*			-0.008			-0.013		
	(0.008)			(0.007)			(0.008)		
Skill Uncertainty	-0.010*	-0.010*		-0.007*	-0.007*		-0.009*	-0.009*	
	(0.005)	(0.005)		(0.004)	(0.004)		(0.005)	(0.005)	
$Log(Size)_{y-1}$	0.017**	0.017*	0.007*	0.018*	0.017*	0.007*	0.017**	0.017*	0.007*
	(0.009)	(0.009)	(0.004)	(0.009)	(0.009)	(0.004)	(0.009)	(0.009)	(0.004)
$Log(Age)_{y-1}$	0.007	0.006	-0.026	0.007	0.006	-0.025	0.006	0.005	-0.026
	(0.007)	(0.006)	(0.016)	(0.007)	(0.006)	(0.016)	(0.006)	(0.006)	(0.016)
$Alpha^Y_{y-1}$	-0.010	-0.012	-0.007***	-0.010	-0.013	-0.007***	-0.010	-0.013	-0.007***
	(0.013)	(0.014)	(0.003)	(0.013)	(0.014)	(0.003)	(0.013)	(0.014)	(0.003)
$ExpRatio_{y-1}$	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Turn_{y-1}$	0.166**	0.166**	0.250***	0.165**	0.165**	0.250***	0.165**	0.165**	0.250***
	(0.075)	(0.075)	(0.012)	(0.075)	(0.075)	(0.012)	(0.075)	(0.075)	(0.012)
$Load_{y-1}$	-0.057**	-0.056**	-0.014	-0.057**	-0.057**	-0.015	-0.056**	-0.056**	-0.015
	(0.024)	(0.024)	(0.011)	(0.024)	(0.024)	(0.011)	(0.024)	(0.024)	(0.011)
$ManFee_{y-1}$	1.043***	1.044***	1.025***	1.041***	1.042***	1.025***	1.042***	1.043***	1.025***
	(0.082)	(0.083)	(0.023)	(0.082)	(0.082)	(0.022)	(0.082)	(0.082)	(0.023)
cse by fund	yes	yes	no	yes	yes	no	yes	yes	no
style fe	yes	yes	no	yes	yes	no	yes	yes	no
time fe	no	yes	yes	no	yes	yes	no	yes	yes
fund fe	no	no	yes	no	no	yes	no	no	yes
Intercept	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	10,590	10,590	10,613	10,597	10,597	10,620	10,590	10,590	10,613
R^2	0.771	0.771	0.815	0.770	0.771	0.815	0.771	0.771	0.815

Table 6. The Effect of the 2004 Regulation on Active Share

The table presents the results of quarterly OLS regressions of fund active share on lagged variables. The dependent variable $ActiveShare_q$ measures the fund's Active Share in quarter *q* and ranges between 0 and 1. In each specification we include a Skill Uncertainty measure -- Uns(α) in specifications (1) – (3), $Uns(R\text{-}R^{M})$ in specifications (4) – (6), and $Uns(R\text{-}R^{9S})$ in specification (7) – (9). The Skill Uncertainty proxies are defined in Section 3.2. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $ActiveShare_{q-1}$ measures the fund's Active Share in quarter *q-1*. $Log(Size)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^{M}_{q-1}$ is estimated at the end of each quarter *q-1* from a factor model using the last 3 months of daily returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{q-1}$ is an indicator variable taking the value of 1 if the fund is a load fund and zero otherwise. $Alpha^{Y}_{q-1}$ is estimated at the end of quarter *q-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $Flow_{q-1}$ measures quarterly fund flows at the end of quarter *y-1*, expressed in percentage points. Depending on the specification, we include time/style/fund fixed effects and/or clustered standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1998-2009 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 6, continued

	Dependent Variable: $ActiveShare_q$								
	Uns(α)			Uns(R-R^M)			Uns(R-R^{9S})		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reg*Skill Uncertainty	-0.010***	-0.010***	-0.010***	-0.010***	-0.011***	-0.011***	-0.010***	-0.011***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Reg	0.064***			0.057***			0.057***		
	(0.012)			(0.011)			(0.012)		
Skill Uncertainty	0.044***	0.044***		0.040***	0.040***		0.047***	0.047***	
	(0.002)	(0.002)		(0.002)	(0.002)		(0.003)	(0.003)	
$ActiveShare_{q-1}$	-0.002	-0.003	-0.001	-0.004	-0.004*	-0.001	-0.004*	-0.005*	-0.001
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.001)
$Log(Size)_{q-1}$	-0.008***	-0.009***	-0.017***	-0.011***	-0.012***	-0.016***	-0.008***	-0.009***	-0.016***
	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)	(0.001)
$Log(Age)_{q-1}$	0.008	0.012	0.014***	0.012	0.017**	0.016***	0.009	0.013*	0.014***
	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)	(0.003)	(0.007)	(0.007)	(0.003)
$Alpha^M_{q-1}$	-0.002***	-0.003***	-0.002***	-0.002**	-0.003***	-0.002***	-0.003***	-0.004***	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
$ExpRatio_{q-1}$	0.097***	0.097***	-0.002	0.103***	0.103***	-0.003	0.088***	0.089***	-0.002
	(0.019)	(0.019)	(0.003)	(0.019)	(0.020)	(0.003)	(0.019)	(0.019)	(0.003)
$Turn_{q-1}$	-0.000***	-0.000***	-0.000	-0.000*	-0.000**	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Load_{q-1}$	-0.010	-0.009	0.002	-0.007	-0.006	0.003	-0.006	-0.005	0.002
	(0.011)	(0.011)	(0.002)	(0.011)	(0.011)	(0.002)	(0.011)	(0.011)	(0.002)
$Alpha^Y_{q-1}$	0.014***	0.015***	0.004***	0.012***	0.013***	0.004***	0.012***	0.013***	0.004***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
$Flow_{q-1}$	-0.006	-0.004	-0.001	-0.003	-0.001	-0.001	-0.006	-0.005	-0.001
	(0.005)	(0.005)	(0.002)	(0.005)	(0.005)	(0.002)	(0.004)	(0.004)	(0.002)
cse by fund	yes	yes	no	yes	yes	no	yes	yes	no
style fe	yes	yes	no	yes	yes	no	yes	yes	no
time fe	no	yes	yes	no	yes	yes	no	yes	yes
fund fe	no	no	yes	no	no	yes	no	no	yes
Intercept	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	19,835	19,835	19,929	19,854	19,854	19,949	19,835	19,835	19,929
R^2	0.511	0.517	0.888	0.496	0.502	0.889	0.522	0.527	0.888

Table 7. The Effect of the 2004 Regulation on Net Fund Performance

The table presents the results of quarterly OLS regressions of fund net returns on lagged variables. The dependent variable $Alpha^{Q}_{q}$ is estimated at the end of each quarter *q* from a factor model using the last 3 months of daily returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. In each specification we include a Skill Uncertainty measure -- Uns(α) in specifications (1) – (3), Uns($R\text{-}R^{M}$) in specifications (4) – (6), and Uns($R\text{-}R^{9S}$) in specification (7) – (9). The Skill Uncertainty proxies are defined in Section 3.2. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $Log(Size)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^{Q}_{q-1}$ is estimated at the end of each quarter q-1 from a factor model using the last 3 months of daily returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{q-1}$ is an indicator variable taking the value of 1 if the fund is a load fund and zero otherwise. $Alpha^{Y}_{q-1}$ is estimated at the end of quarter q-1 from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $Flow_{q-1}$ measures quarterly fund flows at the end of quarter *y-1*, expressed in percentage points. Depending on the specification, we include time/style/fund fixed effects and/or clustered standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1998-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 7, continued

	Dependent Variable: $Alpha^Q_q$								
	Uns(α)			Uns(R-R^M)			Uns(R-R^{9S})		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reg*Skill Uncertainty	-0.026***	-0.026***	-0.026***	-0.022***	-0.021***	-0.018***	-0.035***	-0.034***	-0.030***
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.008)
Reg	0.099***			0.073***			0.129***		
	(0.029)			(0.026)			(0.030)		
Skill Uncertainty	0.013*	0.012*		0.014**	0.014**		0.029***	0.027***	
	(0.007)	(0.007)		(0.007)	(0.007)		(0.008)	(0.008)	
$Log(Size)_{q-1}$	0.003	-0.005	-0.178***	0.004	-0.005	-0.177***	0.006	-0.003	-0.175***
	(0.007)	(0.007)	(0.012)	(0.007)	(0.007)	(0.012)	(0.007)	(0.007)	(0.012)
$Log(Age)_{q-1}$	-0.048***	0.002	0.015	-0.049***	0.001	0.012	-0.050***	0.000	0.012
	(0.015)	(0.016)	(0.054)	(0.015)	(0.016)	(0.054)	(0.015)	(0.016)	(0.054)
$Alpha^Q_{q-1}$	0.077***	0.068***	0.037***	0.077***	0.068***	0.037***	0.077***	0.068***	0.037***
	(0.013)	(0.014)	(0.006)	(0.013)	(0.014)	(0.006)	(0.014)	(0.014)	(0.006)
$ExpRatio_{q-1}$	-0.064***	-0.065***	-0.024***	-0.064***	-0.066***	-0.024***	-0.066***	-0.067***	-0.024***
	(0.014)	(0.015)	(0.008)	(0.015)	(0.015)	(0.008)	(0.015)	(0.015)	(0.008)
$Turn_{q-1}$	-0.001*	-0.001**	0.000	-0.001*	-0.001**	0.000	-0.001**	-0.001**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Load_{q-1}$	-0.036*	-0.021	0.017	-0.035*	-0.021	0.020	-0.038*	-0.024	0.016
	(0.020)	(0.020)	(0.034)	(0.020)	(0.020)	(0.034)	(0.020)	(0.020)	(0.034)
$Alpha^Y_{q-1}$	0.021	0.026	-0.010	0.020	0.025	-0.010	0.018	0.023	-0.010
	(0.019)	(0.020)	(0.010)	(0.019)	(0.020)	(0.010)	(0.019)	(0.020)	(0.010)
$Flow_{q-1}$	0.029	0.027	0.045	0.029	0.027	0.046	0.027	0.025	0.045
	(0.029)	(0.028)	(0.031)	(0.029)	(0.028)	(0.031)	(0.029)	(0.028)	(0.031)
cse by fund	yes	yes	no	yes	yes	no	yes	yes	no
style fe	yes	yes	no	yes	yes	no	yes	yes	no
time fe	no	yes	yes	no	yes	yes	no	yes	yes
fund fe	no	no	yes	no	no	yes	no	no	yes
Intercept	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	31,993	31,993	32,151	32,016	32,016	32,175	31,993	31,993	32,151
R^2	0.017	0.076	0.113	0.017	0.076	0.112	0.017	0.076	0.113

Appendix A: Additional Tests

Table A1. The Effect of the 2004 Regulation on Window Dressing

The table presents the results of quarterly OLS regressions of fund window dressing on lagged variables. The dependent variable $RankGap_q$ measures the fund's Rank Gap score in quarter *q*, a window dressing proxy defined in Section 4.5. In each specification we include a Skill Uncertainty measure -- Uns(α) in specifications (1) – (3), Uns(R-R^M) in specifications (4) – (6), and Uns(R-R^{9S}) in specification (7) – (9). The Skill Uncertainty proxies are defined in Section 3.2. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $RankGap_{q-1}$ measures the fund's Rank Gap score in quarter *q-1*. $Log(Size)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^Q{}_{q-1}$ is estimated at the end of each quarter *q-1* from a factor model using the last 3 months of daily returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{q-1}$ is an indicator variable taking the value of 1 if the fund is a load fund and zero otherwise. $Alpha^Y{}_{q-1}$ is estimated at the end of quarter *q-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $Flow_{q-1}$ measures quarterly fund flows at the end of quarter *y-1*, expressed in percentage points. Depending on the specification, we include time/style/fund fixed effects and/or clustered standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1998-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table A1, continued

	Dependent Variable: $RankGap_q$								
	Uns(α)			Uns(R-R^M)			Uns(R-R^{9S})		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reg*Skill Uncertainty	0.000	0.000	0.001	0.001	0.001	0.001**	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Reg	-0.003			-0.005			-0.005		
	(0.003)			(0.003)			(0.003)		
Skill Uncertainty	-0.001**	-0.001**		-0.002***	-0.002***		-0.003***	-0.002***	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$RankGap_{q-1}$	0.299***	0.304***	0.225***	0.299***	0.303***	0.224***	0.298***	0.303***	0.225***
	(0.012)	(0.012)	(0.008)	(0.012)	(0.012)	(0.008)	(0.012)	(0.012)	(0.008)
$Log(Size)_{q-1}$	0.001	0.001	0.013***	0.001*	0.001	0.013***	0.001	0.000	0.013***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
$Log(Age)_{q-1}$	-0.001	-0.001	-0.002	-0.001	-0.001	-0.002	-0.001	-0.001	-0.002
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
$Alpha^M_{q-1}$	0.000	0.001*	-0.000	0.000	0.001*	-0.000	0.000	0.001*	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$ExpRatio_{q-1}$	0.002***	0.002***	0.002*	0.002***	0.002***	0.002*	0.002***	0.002***	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Turn_{q-1}$	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Load_{q-1}$	0.002	0.003	-0.000	0.002	0.002	-0.000	0.002	0.003	-0.000
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
$Alpha^y_{q-1}$	-0.005***	-0.006***	-0.002**	-0.005***	-0.006***	-0.002**	-0.005***	-0.006***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Flow_{q-1}$	-0.001	-0.002	-0.004	-0.001	-0.002	-0.004	-0.001	-0.002	-0.004
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
cse by fund	yes	yes	no	yes	yes	no	yes	yes	no
style fe	yes	yes	no	yes	yes	no	yes	yes	no
time fe	no	yes	yes	no	yes	yes	no	yes	yes
fund fe	no	no	yes	no	no	yes	no	no	yes
Intercept	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	19,194	19,194	19,262	19,217	19,217	19,286	19,194	19,194	19,262
R^2	0.132	0.156	0.221	0.132	0.156	0.221	0.133	0.157	0.221

Table A2. The Effect of the 2004 Regulation on Funds' Stock-picking Skills

The table presents the results of quarterly OLS regressions of fund stock picking skills on lagged variables. The dependent variable $StockPicking_q$ measures the fund's stock picking skill in quarter *q* and is defined in Section 4.6. In each specification we include a Skill Uncertainty measure -- Uns(α) in specifications (1) – (3), Uns($R-R^M$) in specifications (4) – (6), and Uns($R-R^{9S}$) in specification (7) – (9). The Skill Uncertainty proxies are defined in Section 3.2. Reg is a dummy variable taking the value of 0 before the regulatory change in 2004 and 1 afterwards. $Log(Size)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's size, measured in millions of dollars. $Log(Age)_{q-1}$ is calculated at the end of quarter *q-1* as the natural logarithm of the fund's age, measured as the number of months since inception. $Alpha^Q_{q-1}$ is estimated at the end of each quarter *q-1* from a factor model using the last 3 months of daily returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $ExpRatio_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual expense ratio, expressed in percentages. $Turn_{q-1}$ is calculated at the end of quarter *q-1* as the fund's most recently reported annual turnover ratio, expressed in percentages. $Load_{q-1}$ is an indicator variable taking the value of 1 if the fund is a load fund and zero otherwise. $Alpha^Y_{q-1}$ is estimated at the end of quarter *q-1* from a factor model using the last 12 months of returns and Rm, SMB, HML, and MOM as risk factors and expressed as a monthly percentage. $Flow_{q-1}$ measures quarterly fund flows at the end of quarter *y-1*, expressed in percentage points. Depending on the specification, we include time/style/fund fixed effects and/or clustered standard errors on the fund level. The sample covers all semi-annual funds, i.e. all funds that did not reported on a quarterly basis at least 75% of the time they existed between 1999 and 2003. The time-frame is 1998-2012 where we drop year 2004. Standard errors are presented in parentheses. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Table A2, continued

	Dependent Variable: $StockPicking_q$								
	Uns(α)			Uns($R-R^M$)			Uns($R-R^{9S}$)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Reg*Skill Uncertainty	0.010	0.009	-0.002	0.011	0.011	-0.000	0.005	0.004	-0.007
	(0.020)	(0.020)	(0.023)	(0.018)	(0.018)	(0.021)	(0.021)	(0.021)	(0.024)
Reg	0.114			0.112			0.136		
	(0.095)			(0.087)			(0.094)		
Skill Uncertainty	0.010	0.012		-0.002	0.001		0.006	0.009	
	(0.016)	(0.016)		(0.015)	(0.015)		(0.017)	(0.017)	
$Log(Size)_{q-1}$	0.002	0.003	-0.015	0.001	0.002	-0.015	0.001	0.002	-0.014
	(0.016)	(0.017)	(0.038)	(0.016)	(0.016)	(0.038)	(0.016)	(0.016)	(0.038)
$Log(Age)_{q-1}$	0.012	0.008	0.185	0.008	0.004	0.193	0.012	0.008	0.188
	(0.038)	(0.040)	(0.166)	(0.038)	(0.040)	(0.166)	(0.038)	(0.040)	(0.166)
$Alpha^Q_{q-1}$	-0.047**	-0.038	-0.043**	-0.048**	-0.039	-0.043**	-0.048**	-0.039	-0.043**
	(0.024)	(0.024)	(0.020)	(0.024)	(0.024)	(0.020)	(0.024)	(0.024)	(0.020)
$ExpRatio_{q-1}$	0.011	0.012	-0.030	0.013	0.014	-0.030	0.012	0.012	-0.030
	(0.011)	(0.011)	(0.030)	(0.012)	(0.012)	(0.030)	(0.011)	(0.011)	(0.030)
$Turn_{q-1}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
$Load_{q-1}$	-0.030	-0.031	-0.017	-0.027	-0.029	-0.017	-0.029	-0.031	-0.017
	(0.049)	(0.049)	(0.102)	(0.049)	(0.049)	(0.102)	(0.049)	(0.049)	(0.102)
$Alpha^Y_{q-1}$	0.018	0.008	-0.006	0.019	0.009	-0.006	0.018	0.008	-0.006
	(0.034)	(0.037)	(0.032)	(0.034)	(0.037)	(0.032)	(0.034)	(0.037)	(0.032)
$Flow_{q-1}$	0.109	0.093	0.123	0.109	0.094	0.123	0.109	0.093	0.122
	(0.067)	(0.066)	(0.113)	(0.066)	(0.066)	(0.113)	(0.067)	(0.066)	(0.113)
cse by fund	yes	yes	no	yes	yes	no	yes	yes	no
style fe	yes	yes	no	yes	yes	no	yes	yes	no
time fe	no	yes	yes	no	yes	yes	no	yes	yes
fund fe	no	no	yes	no	no	yes	no	no	yes
Intercept	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	26,409	26,409	26,540	26,432	26,432	26,564	26,409	26,409	26,540
R^2	0.001	0.009	0.036	0.001	0.009	0.036	0.001	0.009	0.036

Table A3. Placebo Tests Based on a Pseudo Regulatory Change in 2001

The table presents the results of a time-series placebo test of our main findings. In Panel A we report the placebo test of the results in Table 5, in Panel B we report the placebo test of the results in Table 6, and in Panel C we present the placebo test of the results in Table 7. In all panels we falsely assume the regulation change appeared in 2001 instead of 2004; that is, we drop year 2001 from our analysis instead of year 2004 as in the original analysis reported in Tables 5, 6, and 7.

Panel A:	Dependent variable - $ManFee_y$		
	Uns(α)	Uns($R-R^M$)	Uns($R-R^{9S}$)
	(1)	(2)	(3)
Reg*Skill Uncertainty	-0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	10,584	10,592	10,584
R^2	0.836	0.836	0.836

Panel B:	Dependent variable - $Alpha^Q_q$		
	Uns(α)	Uns($R-R^M$)	Uns($R-R^{9S}$)
	(1)	(2)	(3)
Reg*Skill Uncertainty	-0.005	-0.004	-0.009
	(0.006)	(0.007)	(0.006)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	31,998	32,026	31,998
R^2	0.119	0.118	0.118

Panel C	Dependent Variable - $ActiveShare_q$		
	Uns(α)	Uns($R-R^M$)	Uns($R-R^{9S}$)
	(1)	(2)	(3)
Reg*Skill Uncertainty	-0.004**	-0.003*	-0.004**
	(0.002)	(0.002)	(0.002)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	20,351	20,375	20,351
R^2	0.889	0.890	0.889

Table A4. Placebo Tests Based on the Sample of Quarterly Reporting Funds

The table presents the results of a cross-sectional placebo test of our main findings. In Panel A we report the placebo test of the results in Table 5, in Panel B we report the placebo test of the results in Table 6, and in Panel C we present the placebo test of the results in Table 7. In all panels we falsely assume the regulation change affected the sample of quarterly funds instead of the sample of semi-annual funds; that is, we perform our analysis on the sample of quarterly funds instead of the sample of semi-annual funds as in the original analysis reported in Tables 5, 6, and 7.

Panel A:	Dependent variable - $ManFee_y$		
	Uns(α)	Uns(R-R^M)	Uns(R-R^{9S})
	(1)	(2)	(3)
Reg*Skill Uncertainty	0.000	-0.002*	-0.001
	(0.001)	(0.001)	(0.001)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	3,901	3,901	3,901
R^2	0.921	0.921	0.921

Panel B:	Dependent variable - $Alpha^Q_q$		
	Uns(α)	Uns(R-R^M)	Uns(R-R^{9S})
	(1)	(2)	(3)
Reg*Skill Uncertainty	-0.020*	-0.012	-0.010
	(0.010)	(0.010)	(0.011)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	12,696	12,696	12,696
R^2	0.134	0.134	0.134

Panel C	Dependent Variable - $ActiveShare_q$		
	Uns(α)	Uns(R-R^M)	Uns(R-R^{9S})
	(1)	(2)	(3)
Reg*Skill Uncertainty	-0.005**	-0.004	-0.004*
	(0.003)	(0.003)	(0.003)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	9,583	9,583	9,583
R^2	0.866	0.868	0.865

Table A5. Disentangling the Information vs Agency Channels

The table complements the analysis presented in Table 6 with an additional variable – Top Fund, and its interaction with the regulatory change dummy Reg. To measure Top Fund, we first calculate the quintile rank of alpha for all funds in the semi-annual funds sample between 1999 and 2003. Next, we average those ranks for every fund. The indicator variable Top Fund takes the value of 1 if the fund was in the top quintile of the average alpha rank and zero otherwise.

	Dependent Variable: $Alpha^{Q}_{q}$		
	StDev(α)	StDev($R-R^{M}$)	StDev($R-R^{9S}$)
	(1)	(1)	(3)
Top Fund	-10.066	-3.767	-2.782
	(6.585)	(3.145)	(2.592)
Skill Uncertainty	-1.124*	-0.891*	-0.912*
	(0.637)	(0.498)	(0.502)
Reg*Skill Uncertainty	-0.027***	-0.018***	-0.030***
	(0.007)	(0.007)	(0.008)
Reg*Top Fund	-0.096*	-0.090*	-0.074
	(0.052)	(0.052)	(0.052)
controls	yes	yes	yes
time fe	yes	yes	yes
fund fe	yes	yes	yes
Intercept	yes	yes	yes
Obs	32,151	32,151	32,151
R^2	0.113	0.112	0.113