Use of Leverage, Short Sales, and Options by Mutual Funds

Paul Calluzzo, Fabio Moneta, and Selim Topaloglu*

This draft: March 2017

Abstract

We study the use of leverage, short sales, and options by equity mutual funds. Consistent with agency-induced motives for the use of these complex instruments, we find that they are often used by poorly monitored funds, and are associated with poor outcomes for investors such as lower performance, higher idiosyncratic risk, more negative skewness, greater kurtosis, and higher fees. Consistent with moral hazard, we also find that mutual funds that use these instruments hold riskier equity positions. Mutual funds attempt to use complex instruments to reduce the risk of their portfolios but in an imperfect and costly way.

JEL Classification: G11, G23
Keywords: mutual funds, leverage, short sales, options, complex instruments, fees, performance, risk

---

* Smith School of Business, Queen's University, 143 Union Street, Kingston, Ontario K7L 3N6, Canada. Emails: paul.calluzzo@queensu.ca, fabio.moneta@queensu.ca, and selim.topaloglu@queensu.ca. We thank George Aragon, Laurent Barras and seminar participants at the 2nd Smith-Ivey Finance Workshop and the 2016 Telfer Annual Conference on Accounting and Finance for their helpful comments.

I can resist anything except temptation.

-Oscar Wilde

1. Introduction

Over the past fifteen years there has been a rise in the complexity of mutual funds as more funds are given the authority to use leverage, short sales, and options. Over this period 42.5% of domestic equity funds have reported using at least one of these instruments. In theory, these complicated investment strategies, which we term *complex instruments*,[1] should enable sophisticated investors to more efficiently exploit profitable trading opportunities. For example, Frazzini and Pedersen (2014) provide evidence that leverage and margin constraints drive up prices on high-beta stocks relative to low-beta stocks. This effect leads to a profitable "betting against beta" strategy for unconstrained investors, such as mutual funds with access to complex instruments. Funds may also use complex instruments to manage and hedge risk, reduce transaction costs and costs associated with fund flows (e.g., Merton, 1995; Koski and Pontiff, 1999; and Deli and Varma, 2002).

However, in practice, there is concern that the same attributes that allow complex instrument users to reap outsized gains when they bet well, will expose them to severe losses when the market turns against them, or when they use the instruments without understanding their implications on the return distribution. In the words of Warren Buffet, "Only when the tide goes out do you discover who has been swimming naked." Anecdotal evidence provides support for this concern. For example, the use of derivatives resulted in some funds suffering large losses during the 2008 subprime mortgage crisis.[2] In response, the Securities and Exchange Commission (SEC) has proposed new rules designed to limit the amount of risk funds can take as they pursue increasingly complex portfolio strategies.[3]

[1] We use the term complex instruments to describe a variety of complex investment strategies (using leverage, short sales, and options) that mutual funds may adopt.
[2] See "Seeking More Clarity on Derivatives in Mutual Funds" The Wall Street Journal, June 15, 2015.
[3] https://www.sec.gov/rules/proposed/2015/ic-31933.pdf

The double-sided nature of these instruments raises the following question: Does complex instrument use by mutual funds benefit or harm fund shareholders? To address this question we extract information about the leverage, short sales, and options use of domestic equity funds from Form N-SAR filings, which are semi-annual reports that mutual funds are required to file with the SEC.[4] The data allow us to identify if funds are allowed to use and actually use each complex instrument, as well as their level of use. We merge this data with the CRSP mutual fund database, which provides daily net mutual fund returns and other fund characteristics. Using these data sources, we develop a deterministic model to understand the motives for complex instrument use. The model considers two potential explanations for why funds use these instruments. First, funds may use complex instruments to reduce costs associated with fund flows (Edelen, 1999). Alternatively, complex instruments can serve as powerful tools to change the risk level of the portfolio. Funds may seek to alter their distribution of returns because of opportunistic motives or more benign hedging considerations.[5] We find support for both explanations. Consistent with fund flow management, we find that funds are more likely to initiate complex instrument positions after they experience outflows. However, more consistent with return distribution manipulation, we find that funds are more likely to initiate complex instrument positions after poor performance and after experiencing high levels of risk. We also document that these positions are more likely to be initiated in funds with low levels of institutional ownership, which are likely to be less monitored and experience more intense agency problems (James and Karceski, 2006).

Given the divergent motives for complex instrument use, it is unclear whether the net effects for fund shareholders are positive or negative. We consider the effects of complex instrument use on three dimensions of shareholder outcomes: fund fees, performance, and risk. Using panel regressions, we first examine the relation between complex instrument use and fund fees, measured using the net expense ratio.[6] The use of these instruments is associated with higher

---

[4] https://www.sec.gov/about/forms/formn-sar.pdf

[5] For example, mutual funds may manipulate their risk exposure in response to the non-linear relation between fund flow and performance (Brown et al., 1996; Chevalier and Ellison, 1997; and Sirri and Tufano, 1998).

[6] This expense ratio is obtained from N-SAR filings and is net of expense reimbursements, interest expenses, and other expenses. See Section 3 for more details.

fees. Specifically, using a composite measure, which is a dummy variable that indicates if the fund used at least one of the three complex instruments (leverage, short sales, and options), we find that complex instrument use is associated with 0.072% higher annual fees relative to funds that choose not to use complex instruments. When we compare against funds that are not allowed to use complex instruments we find that the higher fees are even more pronounced, 0.19% per year.

Higher fees need not be harmful to investors. For example, investors would be willing to accept higher fees if fund managers were able to generate superior risk-adjusted returns to compensate investors for the extra fees. We examine whether this is the case by analyzing the effect of complex instrument use on fund performance. We use returns in excess of the risk-free rate and the Carhart (1997) four-factor alphas to measure performance. Using our composite measure of complex instrument use, we find that the actual use of these instruments is associated with economically and statistically significant lower excess returns and four-factor alphas relative to funds that choose not to use them. Specifically, the composite measure is associated with 0.59% lower annual excess return and 0.46% lower annual four-factor alpha. When we focus on the effect of the individual instruments, we find that the negative excess returns are driven by all three types of instruments, but that the negative alpha is most strongly associated with leverage use and bought options. In contrast, written options are associated with positive fund alpha, although this relation is insignificant when we adopt the manipulation-proof performance measure derived by Goetzmann et al. (2007), which is robust to potential biases created by nonlinearity and asymmetry in option returns.

We next look at the relation between complex instruments and fund risk by regressing fund risk on our measures of complex instrument use. We examine five dimensions of fund risk: total risk using the fund's standard deviation of returns, systematic risk using the fund's beta exposure, idiosyncratic volatility, skewness, and kurtosis. For our composite measure, we find that complex instrument use is associated with undesirable outcomes for investors such as more idiosyncratic volatility, left skewness, and higher kurtosis. However, we find no relation between complex instrument use and standard deviation, and a negative relation with respect to the fund's beta exposure, which is consistent with a hedging motive. The unique nature of each type of complex instrument highlights the importance of examining individual complex instruments in tandem with the composite measure. Not surprisingly, when we focus on the individual instruments, we observe that leverage is associated with greater risk. On the other hand, short sales and option use are associated with lower standard deviation and beta exposure but more idiosyncratic volatility, left skewness, and higher kurtosis.

One concern is that the insurance-like effects of complex instruments, especially options and short sales, can create a moral hazard problem for the fund. For example, a fund manager could be less worried about the risk of her equity investments given that she could use complex instruments to reduce portfolio risk. In this case, we expect funds that are allowed to use complex instruments to hold riskier underlying securities than those that are not allowed. However, when those funds actually use complex instruments they will use them to reduce risk. To test the validity of this explanation we examine the risk of the underlying equity holdings of the fund, and the association between the fund's equity risk and our measures of complex instrument use. We find that funds that use complex instruments have higher risk in their equity holdings than funds that choose not to use these instruments. To further examine the moral hazard problem, we consider the effect of simply being allowed to use complex instruments on fund risk. Consistent with moral hazard, we find that complex instrument authorization is associated with higher levels of total and systematic risk at the fund.

We also examine underlying equity holding characteristics to determine whether funds use complex instruments to overcome constraints that can lead to suboptimal portfolios. Specifically, we expect funds that use complex instruments, especially leverage, to take advantage of the low-beta anomaly by buying and leveraging low-beta stocks. Contrary to our expectation, we find that funds that use leverage actually buy higher beta stocks than funds that choose not to use leverage.

To isolate the impact of complex instrument use on fund risk, we develop risk gap measures that we define as the difference between the realized risk of the fund and the risk of the fund's underlying equity holdings. The underlying assumption is that the equity risk level of the fund represents a counterfactual risk level if the fund invested only in equity securities. With the exception of leverage, we find a strong negative relation between use and the standard deviation and beta exposure risk gap measures, which is consistent with funds using those complex instruments to hedge. This result provides further confirmation that hedging is an important motive for complex instrument use. However, with respect to the higher order risks, we find that complex instrument use is associated with undesirable outcomes such as more left skewness and higher kurtosis in the funds' return distributions.

If complex instrument use is indeed harmful to fund shareholders, we expect these effects to be stronger among the heaviest users. We distinguish between heavy and light users of each instrument using balance sheet information. Across all three measures of fund performance, we find that heavy users have significantly worse performance than light users. Similarly, we find that the effects associated with risk are significantly stronger among heavy users across all our risk measures except for fund skewness.

Taken together, our findings provide some insight into why funds that use complex instruments underperform. In particular, funds that use these instruments decrease systematic risk but increase unsystematic risk. This proportional shift in the risk exposure of the fund may not be optimal for fund shareholders as funds are trading away a rewarded risk for an unrewarded one. Our results are also consistent with the behavioral changes expected in the presence of a moral hazard problem. Specifically, complex instruments provide tools to protect the fund portfolio from adverse outcomes. However, we find that the risk-taking behavior of funds that use these complex instruments differs from those that are constrained. Although they use the instruments in a manner that decreases the fund's systematic risk, they hold portfolios of riskier stocks that offset the insurance capabilities of the complex instruments. Furthermore, by using options and short selling they alter the distribution of returns in a suboptimal way with more negative skewness and higher kurtosis.

Although in aggregate we find that complex instrument use is associated with poor shareholder outcomes, the results of our deterministic model raise the question: Are the outcomes of the use of complex instruments more favorable when they are employed for shareholder-friendly reasons or in shareholder-friendly environments? For example, if managing fund flows reduces transaction costs associated with outflows, then its use in this setting may have a positive effect on fund outcomes. Alternatively, we would expect the most negative effects associated with complex instruments to be concentrated in funds that use these instruments for opportunistic reasons. Inconsistent with complex instrument use motivated by flow management improving fund outcomes, we find that funds that use complex instruments after both inflows and outflows experience poor performance and high idiosyncratic volatility. Consistent with potential opportunistic motives for complex instrument use harming fund shareholders, we find negative investor outcomes associated with complex instrument use following high levels of risk, low performance, and in funds that have low levels of institutional ownership. The only setting where the use of complex instruments is not associated with negative shareholder outcomes is when funds use complex instruments in the presence of high levels of institutional ownership. Our finding that the harmful effects associated with complex instrument use is neutralized in the presence of good monitoring is useful information for the SEC as they craft new regulation for complex instrument use by mutual funds.

Our paper contributes to the literature that investigates the use of complex investment strategies by mutual funds by showing that complex instrument use is harmful to fund shareholders. This result is novel as previous studies have found that these instrument have either no effect or a positive effect on shareholder outcomes. Specifically, Koski and Pontiff (1999) were the first to study the use of derivatives by equity mutual funds. Using a 1992-1994 sample period, they document that derivative users have risk exposure and return performance that are similar to non-users, and that managers may use derivatives to attenuate the impact of fund flows on fund risk.[7] Furthermore, they do not find evidence that mutual funds use derivatives to engage in

[7] Other papers investigate the use of derivatives by mutual funds in Canada (Johnson and Yu, 2004), Australia (Pinnuck, 2004), and the UK (Fletcher et al., 2002) with similar results to Koski and Pontiff (1999). Also there are papers that study the use of derivatives by other institutional investors such as hedge funds (see Aragon and Martin, 2011; and Chen, 2011). Hedge funds, however, are very different from mutual funds since they are lightly regulated, open only to a limited number of investors, and less constrained in using derivatives for speculation.

opportunistic risk-shifting behavior (e.g., Brown et al., 1996). In this paper, we use more detailed information about complex positions instead of relying on survey evidence as done by Koski and Pontiff (1999), and given significant changes in the growth of mutual funds and their complexity since 1994, it is important to provide a new assessment of the effects of complex instruments on shareholder outcomes.

The most closely related papers to ours that also use N-SAR data are Deli and Varma (2002), Almazan et al. (2004), Chen et al. (2013), and Natter et al. (2016). Deli and Varma (2002) examine the benefits and costs of allowing mutual funds to invest in derivatives. In line with a cost-reduction explanation, they find that the use of derivatives among mutual funds is associated with transaction-cost benefits. However, they do not examine whether these cost reductions lead to better fund performance. Almazan et al. (2004) do not examine actual use, but instead focus on the decision to allow or restrict complex instrument use. They find that restrictions are more common when there is weaker governance and less managerial career concerns. However, they find that there is no difference in performance between low- and high-constraint funds.

We differ from the most recent papers in several ways. First, Chen et al. (2013) focus on short selling whereas Natter et al. (2016) focus on options. We take a broader perspective by also considering leverage in addition to both options and short selling. We argue that considering the effect of leverage is important as it is more common than short selling and used as frequently as options. Second, we differ in our empirical design. The focus of both Chen et al. (2013) and Natter et al. (2016) is the contemporaneous relation between complex instrument use and performance.[8] In contrast, we consider a lead-lag relation, which is important for inferring casual effects. Third, we provide a deeper analysis of the economic impact of using complex instruments by analyzing the impact on risk, (Chen et al., 2013, focus on the impact on fund performance), and considering additional risk measures not examined by Natter et al. (2016) such as idiosyncratic volatility and

[8] In one (Table 5) of their eight tables Chen et al. (2013) consider a lead-lag relation. However their analysis is conducted on a small dataset comprising 5,515 observations. In contrast, our dataset is almost an order of magnitude larger with 49,811 observations.

the risk of equity holdings. Finally, our mutual fund sample is much larger than those used by both papers, which, together with the differences in empirical design, explain some of the divergent findings.[9] Indeed, our paper shows that although there may be some benefits to using short sales and options consistent with Chen et al. (2013) and Natter et al. (2016), these benefits are not sufficiently high to offset the costs and the net effect for investors is negative. Warren Buffet is famously quoted as saying that "derivatives are financial weapons of mass destruction."[10] The poor shareholder outcomes associated with complex instrument use provide some ammunition for this claim.

2. Data

Although mutual funds are often perceived as long-only 'plain vanilla' investment vehicles, they are often allowed to use a variety of complex investment strategies. However, in addition to voluntary investment restrictions that mutual funds can adopt, the Investment Company Act imposes some restrictions. In particular, Section 18 of the Act regulates the use of leverage. Whereas long option positions are not treated as leverage because they do not require further payments aside from the initial price, uncovered written options and short selling are regulated as a form of leverage. Open-end funds can use leverage as long as they maintain the asset coverage requirement of at least 300% (i.e., the fund's net assets plus market value of the written options and/or the securities sold short divided by market value of the written options and/or the securities sold short is at least 300%).[11]

[9] A lead-lag relation is also used by Cici and Palacios (2015). They examine the use of exchange-traded options and find, more consistent with the results of our study, that the use of options by equity mutual funds is not associated with performance benefits.
[10] See Chairman's Letter (www.berkshirehathaway.com/letters/2002pdf.pdf) in the 2002 Berkshire Hathaway Annual Report
[11] As explained by Chen et al. (2013), the SEC has progressively relaxed restrictions on short selling over time. In particular, mutual funds would be compliant with the asset coverage restriction if they held a sufficient amount in segregated accounts to cover the market value of the securities sold short. Moreover, the Taxpayer Relief Act of 1997 made it easier for mutual funds to use short sales by repealing the "short-short" rule that limited gains from short-term positions to less than 30% of income.

We extract data on mutual funds' investment practices from the SEC's Form N-SAR that registered investment companies have to file twice a year. We download these filings from the SEC's EDGAR FTP server. We extract data on investment practices (Question 70), income statement (Question 72), and balance sheet (Question 74) items. In particular, Question 70 asks with a "yes" or "no" answer whether or not a mutual fund had the authorization to use and if it actually used different complex instruments during the reporting period. We focus on the following complex instruments: leverage (Question 70O), short selling (Question 70R), options on equities (Question 70B), options on stock indices (Question 70D), options on futures (Question 70G), and options on stock index futures (Question 70H).[12] We group together the options, and for each complex instrument, we compute the proportion of funds each year that are allowed to use the instrument and that actually use the instrument. In addition to examining the permission to use separately leverage, short sales, and options, we calculate a composite measure which is a dummy variable that takes the value of one if a fund is allowed to use at least one of the complex instruments. We also develop a composite complex instrument use variable which identifies if a fund uses at least one of the complex instruments.

We include both form N-SAR-A, which covers the first half of the reporting year, and form N-SAR-B which covers the full year, filed from January 1999 through December 2015 for a total of 104,849 individual filings.[13] Because of the semi-annual reporting requirement of the N-SAR, our dataset is structured at the semi-annual-fund level. Throughout the paper we refer to each semi-annual period as a semester. N-SAR filings are available since 1994, but we start in 1999 because daily mutual fund net-return data are available only from 1999. Then, we drop filings if they are filed more than 90 days after the end of the reporting period and if the income statement and balance sheet items are not reported at the fund level. There are 101,074 filings remaining that contain on average 3.7 funds per filing given that a registrant typically files information for more

[12] According to form N-SAR instructions leverage should not include the practice of borrowing money from a bank for temporary or emergency purposes, and not for investment, in an amount not exceeding 5% of net assets.
[13] The N-SAR-A is usually filed in June and the N-SAR-B is usually filed in December. However in the case of a fiscal year end which does not align with these months, we use data from the most recent filing preceding either June or December.

than one fund at a time. Our collection process distinguishes which set of information filed by the registrant pertains to each fund.

We take several steps to insure that our sample contains only domestic open-end equity mutual funds. We keep a fund if it is an open-end investment company (Question 27) and if it invests in equity securities (Question 66.A). We drop funds that invest primarily in debt securities (Question 62.A), balanced funds (Question 67), funds that have more than 50% of its net assets at the end of the current period invested in i) the securities of issuers engaged primarily in the production or distribution of precious metals; or ii) the securities of issuers located primarily in countries other than the United States (Question 68). We also exclude index funds (Question 69). We check the fund names and if the name suggests that the fund focuses on commodities, fixed income securities, international stocks, preferred and/or convertible securities, real estate, or if it is an ETF or an index fund then we drop those funds. After applying these filters, our sample contains 153,488 fund-filing combinations.

We next match the data from the N-SAR filings to the CRSP mutual fund database for access to more information such as net returns and fund characteristics. Given that there is no common identifier, the matching is done using fund names. Specifically, we use a computer algorithm together with manual checks. From 2006, tickers are reported on N-SAR filings. We match those tickers to the CRSP mutual fund database for cross-checking and additional matches. Once we match funds from N-SAR to CRSP mutual funds through fund names or tickers, we use the CRSP class group information (crsp_cl_grp) to combine multiple share classes of a single fund. Overall, we match 119,565 fund-filing combinations to a CRSP class group for a success rate of 77.9%. Finally, we include three more filters. We eliminate funds with total assets less than $5 million, funds not classified as domestic equity funds by CRSP, and funds with non-equity assets greater than 25% of total assets.[14] The final sample includes 4,793 funds for 61,980 fund-semester

[14] Non-equity assets is defined as the sum of short-term debt securities (Question 74C), long-term securities including convertible debt (Question 74D), preferred securities (Question 74E), and other investments (Question 74I).

observations. This is significantly larger than the sample used by recent papers such as Chen et al. (2013), 2,066 funds, Natter et al. (2015), 2,576 funds, and Cici and Palacios (2016), 2,509 funds.

We use daily net mutual fund returns from CRSP to compute performance and risk measures.[15] Given that the frequency of the filings is semiannual, we compute the performance and risk measures every six months requiring a minimum of 100 daily observations. Using data at the daily frequency is important to obtain more precise estimates of the fund risk measures (e.g., Busse 1999). Furthermore, obtaining the measure every semester allows us to use panel data regressions, which are better able to capture the time-series variation in the relation between complex instrument use and outcomes.

Finally, to construct holdings-based measures we use data from the intersection of Thomson Reuters mutual fund holdings database and the CRSP mutual fund database. Thomson Reuters provides information on equity mutual funds' stock holdings at the quarterly or semi-annual frequency. We select the report date closest to June and December. This ensures that the period for which we compute the return of the equity holdings matches the period used for the overall fund returns. We match the holdings with the CRSP daily security returns to compute value-weighted fund gross returns that are used to obtain performance and risk measures during six-month periods after the report date.

3. Univariate Results

Figure 1 reports time-series trends in complex instrument use by funds. Over our 17-year sample period, there has been an increase of funds allowed to use at least one complex instrument, from 95.3% of funds in 1999 to 99.2% in 2015. Although not shown in the figure, when we look at the proportion of funds allowed to use all three instruments the rise is more dramatic, from 25.7% in 1999 to 62.6% in 2015. This increase is present across all three instruments. For example, the proportion of funds allowed to use options increased from 86.9% to 93.7%, for short selling

[15] The information provided by CRSP is at the share class level. We compute value-weighted daily fund net returns across multiple share classes using the latest total net assets as weights. We apply the same process for fund characteristics with the exception of age, which is based on the oldest share class.

from 35.5% to 71.2% and for leverage from 78.5% to 90.1%. However, despite a reduction in the constraints faced by mutual funds, the increase in actual use has been relatively modest. For example, in 1999 16.6% of funds used at least one complex instrument compared to 17.3% of funds in 2015. Options and leverage use have actually decreased, however short selling use has increased almost threefold, from 1.7% to 4.7% over the sample period. There is also some cyclicality in the use of these instruments. After 2000, coinciding with the dot com bubble bursting, there was a drop in leverage use by funds. There was also a drop in the use of all three complex instruments after 2003 and then another one after 2008, coinciding with increased scrutiny from regulators concerning the use of these instruments following the financial crises. When we look at the entire life of funds we find that 42.5% of funds in our sample use a complex instrument at least once. For individual instruments 25.3% use options, 9.3% short sell and 20.6% use leverage.

We use the balance sheet information obtained from each fund's N-SAR filing to identify the magnitude of complex instrument use. [16] To measure the size of short sale positions we use Question 74R2 (short sales), to measure the size of long option positions we sum Question 74G (options on equities) and 74H (options on all futures); and to measure the size of short option positions we use Question 74R3 (written options). Among users of each instrument, as proportion of total fund assets (listed in Question 74N), we find that the average short sale position is 18.3%, long option position is 0.9% and written option is 0.7%. Because of the embedded leverage in options the impact on the fund's portfolio is likely larger than implied by the magnitude of these positions.

Next, we examine how fund characteristics vary by complex instrument use (see Table 1). Our fund characteristics are defined as follows: Fund Size – assets under management (AUM), as reported in Question 74N in N-SAR; Fund Family Size – the aggregate fund size within the fund's family as classified by CRSP; Expense Ratio – fees reported in N-SAR data scaled by fund size;[17]

[16] There is no specific question that identifies a fund's level of leverage. Question 74Q (senior long-term debt) does not adequately capture the use of leverage because it is not well populated for users of leverage.

[17] To measure a fund's fees, we start with the total expenses reported in its N-SAR filings. We subtract expense reimbursements, interest expenses and other expenses from this figure, then scale by total assets and then annualize

Fund Age –the number of years since the fund's inception as reported by CRSP; Institutional Ownership - proportion of fund's AUM composed of institutional share classes as reported by CRSP; Fund Flows - the proportional change of the funds AUM adjusted for the return of the fund as in Chevalier and Ellison (1997); Excess Return – annualized net fund return minus the risk-free rate; Standard Deviation – annualized standard deviation of the excess returns.

The results presented in Table 1 show that the characteristics of funds that are not allowed to use, choose not to use and actually use complex instruments are generally very different.[18] For example, funds that are not allowed to use complex instruments tend to be larger, older, have lower fees, higher fund flows, lower levels of institutional ownership, lower returns, and lower standard deviations than funds that are allowed to use these instruments. The existence of these differences motivates us to focus on the subsample of funds that are allowed to use complex instruments when examining the relationship between complex instrument use and fund outcomes. This distinction contrasts with the previous literature, which tends to consider only users and non-users without accounting for the existence of fund bylaws that allow complex instrument use.

4. Motivations for Complex Instrument Use

As documented in the previous section, funds that use complex instruments differ from funds that choose not to use them. Given these differences, we next present tests aimed at uncovering motives for why mutual funds choose to use complex instruments. The existing literature (e.g., Koski and Pontiff, 1999) highlights several reasons why fund managers may use complex instruments. On the one hand, complex instruments may be used with good intentions. The structure of open-end mutual funds require them to provide liquidity to investors who wish to

---

the figure if the N-SAR is for a reporting period of less than 12 months to arrive at the fund's net expense ratio. We subtract out interest expenses and other expenses as complex instruments can mechanically add to these expenses (for example dividends paid on shorted stocks are counted in other expenses) and including these items in the expense ratios figure would bias us towards finding a relation between complex instruments and higher fees. This is also the reason why we do not use the expense ratio from CRSP because it is not clear if it includes interest expenses.

[18] For example, for the composite measure, in unreported tests we find that all the differences are statistically significant except for the difference in standard deviation between not allowed to use and use.

exit the fund. The cost of this liquidity-motivated trading is often borne by existing shareholders (e.g., Edelen, 1999). Complex instruments, in particular options and leverage, could help mitigate the impact of negative flows and thus reduce these costs. On the other hand, agency issues may encourage funds to use complex instruments in ways that harm shareholders. For example, convexity in the fund flow-performance relation and managerial career concerns may drive funds to use complex instruments to shift the risk-return profile of their investments in opportunistic ways.

To test if these factors are indeed in play, we use a deterministic model for complex instrument use. The dependent variable is a dummy variable that identifies if funds use complex instruments. For additional granularity, we also run specifications where the dependent variable is a dummy variable for each individual complex instrument. Furthermore, using information contained in the fund's balance sheet, we create dummy variables that identify if the fund's option use was from bought or written options.[19] We limit our sample to funds that have not used complex instruments in the past year (two semesters), thus the dependent variable can be interpreted as the initiation of a complex instrument position. This restriction ensures that our independent variables are not being driven by pre-existing complex instrument positions. Our independent variables are all lagged one semester. To test if funds use complex instruments to manage fund flows, we include fund flows in the regression. To test if fund complex instrument use is related to their risk-reward profile, we include variables that measure funds' standard deviation, and two dummy variables that identify if the fund was performing in the top and bottom tercile for the semester in their fund style, where performance is measured using four-factor alphas and fund style is measured using the fund's CRSP objective code. We prefer to use terciles rather than a continuous measure to capture potential nonlinearities in the relationship between performance and complex instrument use. If complex instrument use is driven by agency issues between fund management and

[19] In particular, to identify whether a fund is an option buyer we use Question 74G (options on equities) and 74H (options on all futures); to identify whether a fund is an option writer we use Question 74R3 (written options). This distinction is also important later in the paper when we examine the effect of complex instruments on fund outcomes as bought and written options can have different effects on the distributions of returns, and including them together can cancel out these individual effects.

shareholders, we expect it to be less (more) prominent among well (poorly) monitored funds. We measure monitoring quality using the institutional ownership variable (James and Karceski, 2006). Additionally, we include in the regression control variables that measure the size and age of the fund, and the size of the fund's family.

Table 2 reports the results of our deterministic model. Consistent with fund flow management, we find a negative relation between fund flows and complex instrument use. However, we also find some evidence that suggests risk drives complex instrument use. Specifically, the use is positively related to the fund's risk and being in the bottom alpha tercile. Finally, consistent with agency motivations for complex instrument use and a monitor role of institutions, we find that the higher the proportion of the fund's shares held by institutions, the less likely they are to use complex instruments. With respect to the individual instruments, we find that only leverage use is related to fund flows and funds' standard deviation. The relation with fund flows aligns with funds borrowing to mitigate the harmful effects of liquidity demands created by outflows. However, the relation with risk is more worrisome. Given the fact that leverage increases risk, this result is consistent with funds using complex instruments to 'double down' on rather than hedge risks. With respect to past performance, being in the bottom performance tercile is positively related to using leverage and writing options, consistent with poorly performing funds trying to increase risk to catch up.[20] We find no significant relations between any of the individual complex instruments and positive past performance. Lastly, consistent with agency related motives, we find that short sales and option use are both negative related the fund's level of institutional ownership.

5. Outcomes of Complex Instrument Use

Given the heterogeneity in the motivations for complex instrument use, it is unclear if they are being used to benefit or harm fund shareholders. For example, using complex instruments to manage fund flows or to exploit superior information may lead to outperformance. However,

[20]In an unreported analysis, we also test for risk shifting within the calendar year (e.g., Brown et al., 1996). Consistent with Busse (2001), who also uses daily data to compute the funds' standard deviation, there is no evidence of risk shifting behavior from the first semester to the second semester.

agency induced use of complex instruments may expose fund shareholders to unnecessary costs and unrewarded risks. In this section, we empirically address whether the positive or negative effects are dominant.

We run panel data regressions to analyze the consequences of complex instrument use on relevant outcomes for investors along three dimensions: fund fees, fund returns, and fund risk. We only consider funds that have permission to use complex instruments during the respective reporting period. Thus, the comparison group includes funds that are allowed to use complex instruments but choose not to employ them in a given semester. Throughout our paper, we focus on the association between current complex instrument use and future outcomes. The use of a lead-lag specification helps us to address endogeneity concerns resulting from some of our outcome variables potentially driving complex instrument use. For example, if funds use complex instruments in an attempt to 'double down' after bad performance, in a contemporaneous setting the direction of causality between bad performance and complex instrument use would be ambiguous. This approach is also advantageous as it more accurately reflects an actionable investment strategy for a mutual fund investor based on the fund's complex instrument use.

Our dependent variables are either fund fees, fund performance measures, or fund risk measures. Our independent variables of interest are our various complex instrument use dummy variables. Our control variables include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, level of institutional ownership, and fund flows. Additionally, we include fund style-time interactive fixed effects. All independent variables are lagged one semester. Each column of our tables reports the results of three separate regressions. A regression where the composite measure (Row 1) is our variable of interest, where leverage, short sales, and options are our variables of interest (Row 2-4), and a regression where we replace options with bought options and written options (Row 5-6). For this last regression, we report only coefficients on these two variables. The regressions take the following form where *i* indicates the fund and *t* refers to the semester:

$$Outcome_{i,t} = \beta_0 + \sum_{j=1}^{J} \beta_j \cdot Complex\ Instrument\ Use_{i,t-1} + \sum_{k=J+1}^{J+K} \beta_k \cdot Controls_{k,i,t-1} + FE_{Fund\ Style*Time} + \varepsilon_{i,t} \quad (1)$$

5.1 Complex Instrument Use and Fund Fees

We begin by examining the relation between complex instrument use and fund fees. The first row of Table 3 reports the results of the regression using our composite complex instrument variable. The coefficient on the composite measure indicates that using at least one of the three complex instruments is associated with a 0.072% annual increase in net expense ratio. This figure is statistically significant at the one percent level but economically modest. The next three rows report results for a regression that includes dummy variables that indicate the use of leverage, short sales and options. We find that funds that use short sales (0.136%) and use options (0.100%) are associated with higher fees, whereas the relation between leverage use and fees is insignificant. The last two rows report results when we examine bought options and written options separately. Written options are associated with higher fees (0.058%), but the relation between bought options and fund fees are statistically indistinguishable from zero.[21]

Taken together, the results provide evidence that investors pay to access funds that use complex instruments. This result is unsurprising and aligns with the intuition that the more complex the product, the more it will cost. Furthermore, it is worth noting that the above analysis focuses only on funds that are allowed to use complex instruments. Our univariate results in Table 1 show that investors pay a premium to access funds with these bylaws. Compared to funds that use complex instruments, constrained funds have 0.19% lower annual fees and compared to funds

[21] As discussed earlier our expense ratios are computed using data reported in the fund's N-SAR filings. We find that our results are stronger if we use the expense ratio reported in CRSP. For example, the coefficient on the composite use measure increases from 0.072% to 0.098%, and the coefficient on short sale use almost doubles, from 0.136% to 0.260%.

that are allowed to use complex instruments but don't use them, constrained funds have 0.07% lower fees.[22] In the remainder of the section, we examine what investors are getting in return for paying this extra cost.

5.2 Complex Instrument Use and Fund Performance

To address the impact of complex instruments on performance, we use the fund's net returns in excess of the risk-free rate and the fund's Carhart (1997) four-factor alphas computed from daily net returns as the outcome variable in equation (1). Furthermore, the nonlinearity and asymmetry in the returns associated with complex instruments could create a bias in the four-factor alphas. To address this concern, we also use the manipulation-proof performance measure (MPPM) derived by Goetzmann et al. (2007) as an alternative dependent variable. Compared to traditional performance measures, MPPM is more difficult for complex instrument users to game.[23]

The first row of Table 4 presents results for the composite measure. The results show that complex instrument use is associated with significantly negative annualized excess returns (-0.594%), alphas (-0.458%), and MPPM (-0.636%). In the next three rows, we examine the use of the individual complex instruments. We find that using leverage (-0.360%), short sales (-0.731%), and options (-0.668%) are all associated with lower annualized excess returns in the following semester, although the relationship is only statistically significant with respect to options. We also find that all three instruments are associated with lower alpha and MPPM, but that the relation is

[22] In unreported panel regressions that include our set of control variables, we find that being allowed to use complex instruments is associated with a 0.099% larger expense ratio. Therefore, the combined effect of being allowed to and actually using complex instruments is a more economically meaningful 0.171% (0.072% + 0.099%) compared to funds that are restricted from using complex instruments.

[23] The MPPM can be interpreted as the annualized geometric excess return certainty equivalent of a particular fund. Goetzmann et al. (2007) show four conditions that are met by the MPPM but not by other traditional performance measures. These conditions are: (1) recognize arbitrage opportunities; (2) be concave; (3) be time separable; and (4) have a power form to be consistent with an economic equilibrium. The MPPM measure is computed for each semester and fund using a coefficient of relative risk aversion equal to 3, which is the value suggested by Goetzmann et al. (2007).

only significant with respect to leverage.[24] In the last two rows, we examine bought and written options separately. Similar to the other complex instruments, we find a significantly negative relation between bought options and future returns (-0.795%) and alpha (-0.852%). However, with respect to written options we find a positive but statistically insignificant relation between written options and future returns (0.111%), and a positive and statistically significant relationship with respect to the future alpha (1.091%). This finding, which is consistent with Natter et al. (2016), is likely due to the additional income generated by writing options. For example, writing covered calls could result in a seemingly superior performance provided the underlying stocks do not experience large gains. However, this type of strategy alters the shape of the distribution of returns and creates risk, which is likely not captured by the four-factor model. Consistent with this explanation, when we use the MPPM to measure performance, the coefficient on written options becomes insignificant.

Together with our finding that complex instrument use is associated with higher fees, the finding that they are also associated with lower excess returns, four-factor alphas and MPPM compared to funds that are permitted but do not use complex instruments suggests that complex instrument use is harmful to investors.

5.3 Complex Instrument Use and Fund Risk

Funds may use complex instruments for hedging, which should reduce fund risk, or for speculation, which might increase fund risk. It is ultimately an empirical question as to which effect dominates. To address this question we examine the effect of complex instrument use on fund risk. We measure the fund's total risk using the fund's standard deviation, systematic risk using the fund's CAPM beta exposure, and unsystematic risk using the fund's idiosyncratic risk as computed from the four-factor model. Given that complex instruments can be used to alter the return distribution, we also examine the higher moments of the fund return distribution using

---

[24] The lack of a positive alpha associated with short sale positions is in contrast to Chen et al. (2013). See Section 6 for a comparison between our results and Chen et al. (2013).

skewness and kurtosis. For instance, writing covered call options truncates upside gains and creates more negatively skewed return distributions.

The first row of Table 5 shows results for the composite measure. We find no significant relation between complex instrument use and standard deviation. Funds that use at least one complex instrument have lower betas (-0.023), but also higher idiosyncratic volatility (0.394). With respect to the higher order risks, the negative coefficient with respect to skewness (-0.009) suggests that users are more exposed to the left tail of the distribution, and the positive coefficient with respect to kurtosis (0.040) suggests that these funds have fatter tails.

We next examine the relation between the individual complex instruments and fund risk. As each complex instrument has a distinct nature, we do not expect their impact on firm risk to be uniform. We find that leverage use amplifies fund's standard deviation (0.557), beta exposure (0.029) and idiosyncratic volatility (0.285), although we find no significant relation between leverage use and fund skewness or kurtosis. This result is unsurprising. In contrast to the other complex instruments, which have the potential to be used as hedging or speculative tools, leverage mechanically increases risk. With that said, firms that use leverage need not have greater risk. For example, a risk parity or betting against beta strategy, in which lower risk assets are levered up could lead to portfolios that use leverage and have similar levels of risk as portfolios that do not use leverage.

In contrast, we find that both short sales and option use decreases funds' standard deviation and beta exposure, but are associated with higher idiosyncratic volatility, more negative skewness and greater kurtosis. We find a similar, albeit statistically weaker, relation when we examine bought and written options separately. One exception to these findings is with respect to skewness, where we find that bought options have a positive, although insignificant, effect on fund skewness (0.009), whereas written options have a significant negative effect (-0.023). These results are not surprising as buying options provides a payoff of frequent small losses with the occasional large gain, while writing options gives the opposite exposure, frequent small gains with the occasional large loss. The results are also consistent with funds writing covered calls and hence limiting upside gains.

Modern portfolio theory dictates that investors should eliminate their exposure to unsystematic risk, which is unrewarded by financial markets, so that they are only exposed to systematic risk, which is rewarded. Given this paradigm, it is curious, and potentially harmful to shareholders, that complex instrument use increases the fund's exposure to unsystematic risk while at the same time decreasing the fund's exposure to systematic risk. The decrease in rewarded risk may explain our earlier finding that funds that use complex instruments have lower excess returns than those that do not. If we think about investors' higher order risk preferences, investors should prefer funds that deliver returns with more positive skewness and lower kurtosis. However, funds that use complex instruments deliver the opposite outcome.

5.4 Complex Instrument Use and the Risk of Fund Equity Holdings

It is unclear if the observed reduction in systematic risk is the result of a hedging strategy or a betting against beta strategy. If it were the latter, then equity holdings rather than complex instruments would drive the reduction in systematic risk. However, a moral hazard problem may also explain this finding, where funds that use complex instruments take more risk in their non-complex instrument positions and then use the complex instruments to hedge away some of the increased risk. However, their hedging activity reduces the systematic risk, but not the idiosyncratic risk, of the fund. To understand which explanation is supported by the data, we examine the risk of the equity positions held by complex instrument users.

The first row of Table 6 shows results for the composite measure. Consistent with complex instrument users holding riskier equity portfolios, we find that these funds have a significantly higher equity standard deviation (0.451), equity beta exposure (0.017), and equity idiosyncratic volatility (0.407) than funds that choose not to use complex instruments. With respect to the higher order risks, these funds exhibit negative coefficients with respect to equity skewness (-0.006) and equity kurtosis (-0.011).

We also examine the relation between the individual complex instruments and fund equity risk. We find that leverage use is associated with higher fund equity risk as measured by the standard deviation, beta exposure, and idiosyncratic volatility. The finding that funds that use leverage buy higher beta stocks is counter-intuitive as past research suggests investor preference for high-risk stocks is driven by leverage constraints (see, for example, Frazzini and Pedersen, 2014). One might expect a sophisticated investor to use leverage to avoid investing in risky stocks and instead capture the low-beta premium by implementing a betting-against-beta strategy. Instead, we find mutual funds do the opposite; they buy high-beta stocks when they have access to leverage suggesting that their preference for high-beta stocks is unrelated to the leverage constraints. It appears that these funds are risk seekers that load up on risk through both their equity positions and the use of leverage.

We also find that short sales and option use are associated with equity positions that have returns with higher standard deviation, higher idiosyncratic volatility, and more negative skewness relative to the equity portfolios of funds that choose not to use the complex instruments. However, we find no significant relation with respect to the beta or kurtosis of these holdings. Lastly, with respect to bought and written options, we find that funds that bought options have higher equity standard deviation and idiosyncratic volatility, but there is little relation between written options and the riskiness of the fund's equity positions.

The results show that funds that use complex instruments hold equities with higher levels of risk than funds that choose not to use complex instruments. The fact that the presence of complex instruments alters the characteristics of the stocks that equity funds choose to hold can make it difficult to determine if the effect of the complex instruments on fund risk is driven by the change in the fund's equity risk characteristics or the complex instruments themselves. We try to disentangle these two effects by constructing "risk gap" measures, which are defined as the difference in the fund's actual risk and the risk of their underlying equity holdings. The assumption is that the gap between the actual risk and equity risk for the fund is explained by the fund's complex instrument use. Of course, the gap can also be explained by holding non-equity and non-complex instrument assets or by the fund changing holdings within the semester. This first concern is mitigated by the fact that we focus on the subset of funds classified as domestic equity funds. While we remain concerned that a within-semester change in holdings may drive the results, as long as the change in holdings does not affect complex instrument funds differently than non-complex instrument funds, this effect will not bias the results.

The first row of Table 7 shows results for the composite measure. Consistent with hedging, we find that the composite measure is associated with a lower standard deviation gap (-0.501) and beta exposure gap (-0.035). However, consistent with increasing tail risk, we also find the composite measure is associated with a negative skewness gap (-0.003) and positive kurtosis gap (0.053).

The second row reports the results for leverage. Consistent with an amplification of fund risk, we find that leverage use is associated with riskier funds across all five risk measures, although the coefficient is not significant in the kurtosis gap regression. In contrast, we find that short sales and options are associated with lower standard deviation gaps, beta exposure gaps, and idiosyncratic volatility gaps but larger kurtosis gaps. We find similar relations when we examine bought and written options separately.

Together with the equity risk results, the risk gap results suggest that the decrease in beta among funds that use complex instruments is driven by the complex derivative use itself, while the increase in idiosyncratic volatility is driven more by the underlying equity holdings of the fund. There is also evidence of more negative skewness and higher kurtosis being driven by the complex instrument use.[25]

[25] In an untabulated analysis, we construct performance gap measures defined as the difference between the actual returns of the fund and the return of the underlying holdings. We find that when funds use complex instruments, the composite measure is associated with a lower excess return gap, but there is an insignificant effect on the four-factor alpha gap.

5.5 Light vs. Heavy Users of Complex Instruments

If the effects documented above on risk and performance are driven by the actual use of complex instruments, then we expect that these effects will be stronger when we consider the heaviest users. To test if this is the case, we use balance sheet information to identify heavy and light users of complex instruments. Heavy (light) users are defined as funds that hold a given complex instrument above (below) the median level for a given semester conditional on a positive value on the balance sheet for the specified instrument. To proxy for leverage we use a fund's interest expenses (Question 72P) scaled by fund assets (Question 74N). Because interest rates are time-varying, we rank the scaled interest expense by time. To compute the heavy and light user composite measure we assign a score for each instrument: 0 if there is a no position in the instrument indicated on the balance sheet, 1 if they are defined as a light user of that instrument; and 2 if they are defined as heavy user of that instrument. We sum the score of each of the four instruments assigning half weight to options written and options bought (to avoid giving more weight to options compared to leverage or short sales).[26] If the composite score is above (below) the median for the semester, conditional on a non-zero score, the fund is designated as a heavy (light) composite.

Table 8 reports the panel regression results when we use the heavy and light user dummies.[27] Consistent with a direct impact of complex instrument use on performance and risk, we find that the results are different for heavy users versus light users. With respect to fund performance (Table 8 Panel A), using the composite measure, we find that the negative effect on excess returns, four-factor alphas and MPPM is significantly greater for heavy users. This pattern is consistent across different types of complex instruments. With respect to risk (Table 8 Panel B), we also find that the decrease in total and systematic risk, and the increase in idiosyncratic risk

---

[26] In an untabulated test, we compute the Heavy and Light Composition score using the maximum of the two option scores, instead of the average. This approach yields comparable results.

[27] We also compute the average value of short selling, long options, and written options scaled by total assets. Heavy users of short-selling held positions that are worth 29.8% of the assets. Heavy users of long options held positions that are worth 1.8% of the assets. Heavy users of written options held positions that are worth 1.4% of the assets.

and kurtosis are significantly stronger for the heavy composite users. We find similar relationships among the heavy users of the individual complex instruments.

5.6 Allowed to Use

The finding that the use of options is associated with lower systematic risk is consistent with Cici and Palacios (2015) and Natter et al. (2015). In addition to extending the analysis to more complex instruments, one interesting new finding is that complex instrument users hold riskier equity positions. One possible explanation for this finding is that the use of complex instruments is associated with a perception of safety, which in turn creates a moral hazard problem and alters their risk-taking behavior. If this explanation is correct, we expect that simply being allowed to use complex instruments would encourage funds to take more risk in their other positions. To test whether this is the case we use a dummy variable for a fund that is allowed to use complex instruments, and expand our sample to include all domestic equity mutual funds rather than just those that are allowed to use the instruments.

Table 9 reports our results. Consistent with a moral hazard problem, relative to funds that are not allowed, we find that funds that are allowed to use complex instruments have significantly higher standard deviations (0.641) and beta exposures (0.039), although we find no relation with respect to the composite measure and idiosyncratic volatility, skewness and kurtosis. For these dimensions of risk, it is actual use rather than allowance that seems to matter. With respect to the individual complex instruments, we find that leverage, short sale and option allowance are all positively and significantly associated with the fund's standard deviation and beta exposure. With respect to the other dimensions of risk, we find that short sale allowance is associated with more idiosyncratic volatility and left skewness but less kurtosis. In contrast, we find that option allowance is associated with less idiosyncratic volatility and more positive skewness. We find no relation between these higher moment measures of risk and leverage allowance.[28]

[28] In unreported results, we examine the relation between being allowed to use complex instruments and fund returns. For the composite measure, we find an insignificant relation. With respect to the individual instruments, we find that

5.7 Fund Performance and Risk and the Motivations for Complex Instrument Use

Given that funds initiate complex instrument positions for predictable reasons, a follow-up question is whether the outcomes of using complex instruments vary according to the different motivations. To examine if this is the case, we sort funds into terciles, by semester and fund style, based on the fund's flows, standard deviation of returns, institutional ownership, and performance observed at semester *t-2*. Within each subsample, we then examine the consequence of using complex instruments at time *t-1* on fund return and other outcomes at time *t*. One advantage of examining different subsamples is that it allows us to compare how the outcomes of funds experiencing a similar environment (depending on the sorting variable) change conditional on their use of complex instruments.

Table 10 presents the results of this analysis. We first examine the effect of fund flow environment on fund outcomes considering our composite measure of complex instrument use. If funds use complex instrument to mitigate the liquidity shocks associated with negative fund flows, we expect to find a more positive association between complex instrument use and fund outcomes in the group of funds that use these instruments following negative flows than in the other groups. Inconsistent with this explanation, we find that complex instrument use is associated with negative excess return and four-factor alpha across all three fund flow terciles. We next examine how the risk environment in which the complex instruments were initiated affects fund outcomes associated with their use. Consistent with our earlier finding that funds use complex instruments to 'double down' on the existing risk, we find that funds that use the instruments after being in the top tercile of risk experience higher subsequent total risk and systematic risk than those using the instruments after being in the lowest tercile. Furthermore, these risky funds experience significantly lower four-factor alphas. Next, we examine how complex instrument outcomes vary by the level of institutional ownership at the fund. If our observed negative outcomes associated with complex instrument use are driven by agency problems, we expect these outcomes to be the

---

option allowance is associated with lower excess returns and short sale allowance is associated with lower four-factor alphas.

most (least) acute where monitoring is weak (strong). Consistent with this prediction, we find that the presence of institutional owners mitigate the negative effects of complex instrument use. We find that complex instrument use is associated with negative excess returns and four-factor alphas at the bottom tercile of institutional ownership funds but not in the top tercile of institutional ownership funds. Similarly, we find that the decrease in systematic risk and increase in idiosyncratic volatility is the strongest among complex instrument users in the lowest tercile of institutional ownership. Lastly, we examine how the performance environment in which complex instruments are used effect fund outcomes. Consistent with funds using complex instruments to play catch up when they are behind and lock in gains when they are ahead, we find that the negative returns associated with complex instrument use is concentrated in funds that use complex instrument that are in the lowest tercile of alpha, and that reduction of risk is concentrated in high alpha tercile complex instrument users.

6. Comparison with Related Literature

Almazan, Brown, Carlson, and Chapman (ABCC, 2004) using N-SAR filings data construct a "constraint score" to capture the cumulative impact of the constraints imposed on mutual funds. In particular, the score is constructed placing equal weights on constraints imposed on three different categories: derivatives, illiquid assets, and leverage. ABCC find that using their score to divide funds into low- and high- constraint funds produce similar performance. We find instead that low-constraint funds, in particular funds that are not constrained to invest and actually invest in complex securities, deliver poor performance.

To ensure that the difference between our findings and ABCC is not driven by the difference in the construction of the constraint measure and/or by the methodology, we replicate the analysis of ABCC on our sample of funds using a similar methodology and both their score and our composite measure.[29] In particular, every six months we sort funds into terciles according

[29] Our composite measure is constructed somewhat differently than ABCC. Indeed, for the derivatives we did not include stock index futures and instead included options on futures and options on stock index futures. Furthermore,

to the ABCC score or the composite measure. The bottom (top) tercile includes low (high) constraint funds. We then compute equally-weighted fund portfolio returns during the next six months using monthly returns. We use monthly instead of daily returns to be consistent with ABCC. We rebalance the portfolios every six months and we end up with a time-series of excess returns for each portfolio, which we can regress on the four factors to obtain the four-factor alpha. Table 11 presents the results. The worst performing funds are the unconstrained funds with almost -1% annual alpha, which is marginally significant for the ABCC score. The alpha of the constrained funds is negative but the magnitude is more than halved and the difference between the constrained and unconstrained funds is statistically significant for both the ABCC score and the composite score. Hence, the difference between our results and ABCC are likely to stem from sample differences rather than from a different definition of the constraint measure or a different methodology.

We also compare our results with Natter et al. (2016) and Chen et al. (2013) who also employ N-SAR data to examine mutual funds that use options and short selling, respectively. Similar to Natter et al. (2016), we find that options use is associated with a reduction in systematic risk. Furthermore, the increase in both left skewness and four-factor alpha, but not MPPM, is consistent with the frequent use of a covered call income generating strategy as suggested by Natter et al. (2016). With respect to Chen et al. (2013), both our paper and their paper find that short selling is associated with a reduction in market beta exposure.

Our main results are different from the findings of Natter et al. (2016) and Chen et al. (2013). In particular, our findings suggest that the overall impact of complex instrument use on fund shareholders is negative rather than positive. We relate our contrasting findings to differences in our empirical approach and our larger sample size. A main difference in our empirical approach is that we examine lead-lag relationships to avoid endogeneity issues. For example, we find a negative relationship, albeit weak, between a fund being in the bottom alpha tercile and subsequent

we did not consider restricted securities and margin purchases. The main reason for excluding some of the questions is that we excluded investments for which we could not quantify the magnitude in the balance sheet.

short sale use, which may bias results in an empirical design that examines a contemporaneous relation between short sales use and fund returns. In untabulated tests we replicate our Tables 4 and 5 using a contemporaneous specification. We find that the relation between complex instrument use and fund performance is weaker but still negative for all performance measures and significant for the four-factor alpha. The relation with respect to risk is very similar in magnitude and statistical significance across all five variables. These results suggest that the difference between our findings and previous papers is not entirely driven by our lead-lag empirical design. An additional difference is that we compute our risk and return measures using daily rather than monthly mutual fund return data.[30] Using the daily frequency is important for estimating the measures every semester. Semester-level measures allow us to perform panel regressions instead of cross-sectional regressions, and to obtain more precise estimates of performance and risk (e.g., Busse, 1999).

7. Conclusion

Like the righteous and iniquitous angels in *The Shepherd of Hermas*, complex instruments are dual-natured with the ability to either lead funds to safety or to the temptation to seek higher risk. This negative potential has raised concerns at the SEC which is considering reforms designed to limit complex instrument use by mutual funds in an effort to protect investors, predominantly retail, that invest in these funds. Whether the use of complex instruments helps or harms fund shareholders is ultimately an empirical question that we address in this paper using a comprehensive dataset of mutual fund use of leverage, short sales, and options.

Our results suggest that the use of complex instruments is associated with outcomes that harm shareholders: lower returns, higher unsystematic risk, more negative skewness, greater kurtosis, and higher fees. Consistent with mutual funds using these instruments to hedge, we find that their use is associated with lower systematic risk. One concern is that the perceived safety generated by providing funds with the possibility of using complex instruments creates a moral

[30] In some of their analyses Natter et al. (2016) use daily data, but their performance and risk measures are computed using a rather short window length of one month.

hazard problem and alters their risk-taking behavior. Indeed, we find not only that funds that use complex instruments take more risk, both systematic and idiosyncratic, in their equity positions, but also that bylaws that authorize complex instrument use are associated with greater fund risk. We then find that funds use complex instruments to try to hedge away this increased risk, but only manage to decrease their beta exposure, not their idiosyncratic risk or higher-moment risk. As financial theory suggests, only systematic risk is rewarded in financial markets. Thus, increasing the relative portion of idiosyncratic risk in the fund's risk profile, while simultaneously changing the distribution of returns to increase higher moment risks, can be harmful to shareholders.

By highlighting concerns about the use of complex instruments by mutual funds, our research provides useful information for regulators. In aggregate, we find that these instruments can have a harmful effect on fund investors, which suggests that the concerns of regulators are justified. At the same time, in environments where their use is well monitored and they are used in moderation, their harmful effects seem to be neutralized. Overall, it appears that mutual fund investors are better off choosing simplicity. This finding is consistent with DeMiguel et al. (2009) who show, in a different context, that a simple equal-weighted portfolio strategy outperforms more complicated strategies based on portfolio optimization. Célérier and Vallée (2013) also argue that, in the market for structured products, complexity serves as a moat that allows institutions to charge high fees in increasingly competitive markets for financial products. The question remains, if these funds underperform, why do they exist in equilibrium? One explanation is that these funds cater to an investor bias towards complexity. This bias may be reinforced by SEC regulations that restrict retail investors who earn less than $200,000 a year or have less than $1,000,000 net worth from investing in hedge funds. Investors may think that accessing complex hedge-fund like investment strategies facilitates outperformance. This explanation is consistent with our finding that complex instrument use is more common in funds held predominantly by retail investors.

REFERENCES

Almazan, A., K. Brown, M. Carlson, and D. Chapman, 2004, "Why constrain your mutual fund manager?", *Journal of Financial Economics* 73, 289–321.

Aragon, G., and J. Martin, 2011, "A unique view of hedge fund derivatives usage: Safeguard or speculation?", *Journal of Financial Economics* 99, 560-580.

Brown, K., W. Harlow, and L. Starks, 1996, "Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry", *Journal of Finance* 51, 85–110.

Busse, J., 1999, "Volatility timing in mutual funds: Evidence from daily returns", *Review of Financial Studies* 12, 1009-1041.

Busse, J., 2001, "Another look at mutual fund tournaments", *Journal of financial and Quantitative Analysis* 36, 53-73.

Carhart, M., 1997, "On persistence in mutual fund performance", *Journal of Finance* 52, 57–82.

Célérier, C. and B. Vallée, 2013, "What drives financial complexity? A look into the retail market for structured products", Working Paper.

Chen, Y., 2011, "Derivatives use and risk taking: Evidence from the hedge fund industry", *Journal of Financial and Quantitative Analysis* 46, 1073-1106.

Chen, H., H. Desai, and S. Krishnamurthy, 2013, "A first look at mutual funds that use short sales", *Journal of Financial and Quantitative Analysis* 46, 1073-1106.

Chevalier, J., and G. Ellison, 1997, "Risk taking by mutual funds as a response to incentives", *Journal of Political Economy* 105, 1167–1200.

Cici, G., and L. Palacios, 2015, "On the use of options by mutual funds: Do they know what they are doing?", *Journal of Banking & Finance* 50, 157-168.

Deli, D., and R. Varma, 2002, "Contracting in the investment management industry: Evidence from mutual funds", *Journal of Financial Economics* 63, 79–98.

DeMiguel, V., Garlappi, L. and R. Uppal, 2009, "Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy?" *Review of Financial Studies* 22, 1915-1953.

Edelen, R., 1999, "Investor flows and the assessed performance of open-end mutual funds", *Journal of Financial Economics* 53, 439-466.

Fletcher, J., D. Forbes, and A. Marshall, 2002, "An investigation of the impact of derivatives use on the risk and performance of UK unit trusts", *Financial Services Review* 11, 174–187.

Frazzini, A. and Pedersen, L.H., 2014, "Betting against beta", *Journal of Financial Economics,* 111, 1-25.

Goetzmann, W., Ingersoll, J., M. Spiegel, and I. Welch, 2007, "Portfolio performance manipulation and

manipulation-proof performance measures", *Review of Financial Studies* 20, 1503–1546.

James, C. and J. Karceski, 2006, "Investor monitoring and differences in mutual fund performance", *Journal of Banking & Finance* 30, 2787-2808.

Johnson, L., and W. Yu, 2004, "An analysis of the use of derivatives by the Canadian mutual fund industry", *Journal of International Money and Finance* 23, 947-970.

Koski, J., and J. Pontiff, 1999, "How are derivatives used? Evidence from the mutual fund industry", *Journal of Finance* 54, 791-816.

Merton, R., 1995, "Financial innovation and the management and regulation of financial institutions", *Journal of Banking and Finance* 19, 461-481.

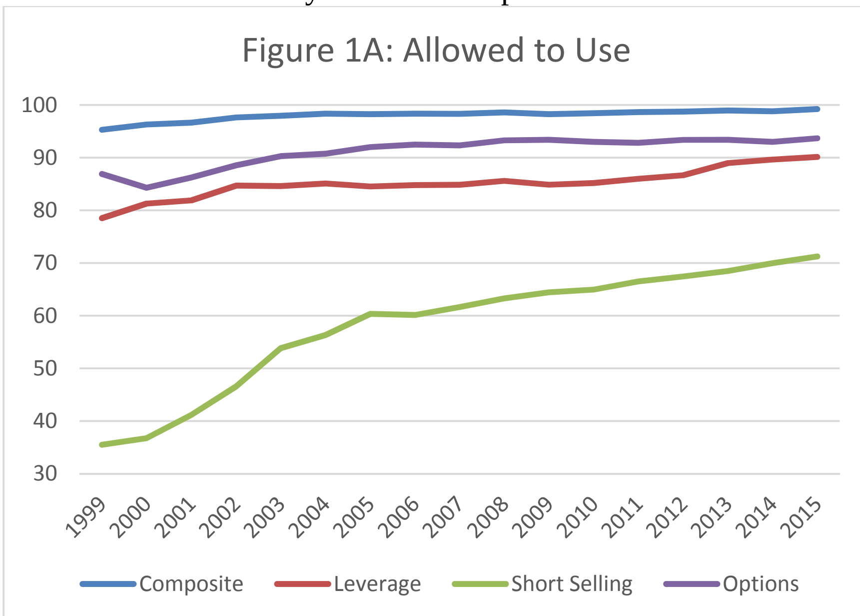
Natter, M., M. Rohleder, D. Schulte, and M. Wilkens, 2016, "The benefits of option use by mutual funds", *Journal of Financial Intermediation* 26, 142–168.

Pinnuck, M., 2004, "Stock preferences and derivative activities of Australian fund managers", *Accounting and Finance* 44, 97-120.

Sirri, E., and P. Tufano, 1998, “Costly search and mutual fund flows”, *Journal of Finance* 53, 1589–1622.

Figure 1
Complex Instrument Use over Time

These figures reports complex instrument allowed to and actual use by domestic equity funds over the 1999-2015 sample period. Figure 1A reports the proportion of funds that are allowed to use each complex instrument. Figure 1B reports the proportion of funds that actually use each complex instrument.



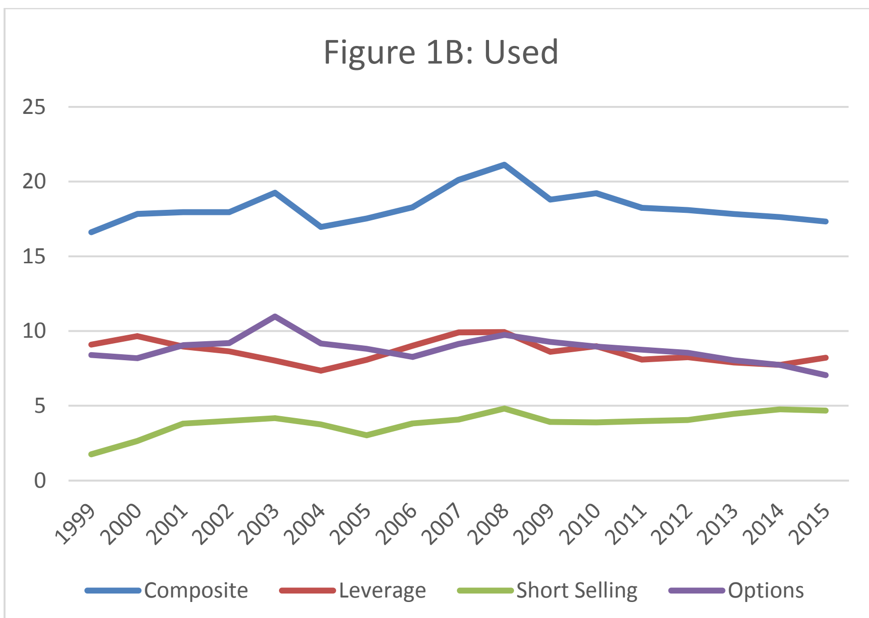


Table 1

Fund Characteristics by Complex Instrument Use

This table reports mean fund characteristics by complex instrument use. It reports the fund size in millions, fund family size in millions, annual expense ratio (%), age (years), the percentage of AUM in the institutional share classes, six-month fund flow (%), annualized excess return (%), and standard deviation of returns (%). Columns 1-3 report summary statistics for our composite measure, columns 4-6 for options, columns 7-9 for short selling, and columns 10-12 for leverage. Columns 1, 4, 7, 10 report mean values of each measure for funds that are not allowed to use each complex instrument. Columns 2, 5, 8, 11 report mean values of each measure for funds that although permitted, do not use each complex instrument. Columns 3, 6, 9, 12 report mean values of each measure for funds that use each complex instrument.

	1	2	3	4	5	6	7	8	9	10	11	12
	At Least One Complex Instrument			Options			Short Sales			Leverage		
	Not Allowed	Don't Use	Use	Not Allowed	Don't Use	Use	Not Allowed	Don't Use	Use	Not Allowed	Don't Use	Use
Fund Size	2397	1287	971	1839	1198	1234	1139	1351	1033	1191	1320	766
Family Size	130999	148783	87720	73992	149213	95252	87268	179232	62810	112663	148045	92656
Expense Ratio	1.02	1.09	1.21	1.11	1.10	1.24	1.12	1.10	1.27	1.18	1.09	1.21
Fund Age	12.16	11.71	11.48	12.04	11.57	12.22	11.71	11.85	8.63	11.90	11.65	11.38
Institutional Ownership	13.00	30.66	24.41	20.56	31.07	21.27	29.51	29.37	26.34	23.22	30.73	26.24
Fund Flow	0.75	0.37	0.23	0.62	0.31	0.28	0.42	0.25	0.71	0.29	0.40	-0.16
Excess Return	3.36	6.43	4.52	4.69	6.33	4.84	4.45	7.44	2.58	5.15	6.37	4.79
Standard Dev.	17.82	18.55	18.20	18.11	18.56	17.92	18.73	18.50	15.30	18.50	18.38	19.15

Table 2
Motivations for Complex Instrument Use

This table examines the motivations for complex instrument use. It reports results from a linear probability model for complex instrument use. The dependent variable is a dummy variable that identifies if funds use each complex instrument as specified. We limit the sample to funds that have not used complex instruments in the past year (two semesters) so that dependent variables can be interpreted as the initiation of a complex instrument position. Our independent variables are all lagged one semester and include fund flows, fund standard deviation, two dummy variables that identify if the fund was performing in the top and bottom tercile in their fund style for performance as measured by the four-factor alphas, and a variable that measures the proportion of the fund AUM that is owned by institutional investors. Additionally, we include variables that measure the size, age of the fund, and the size of the fund's family. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Composite	Leverage	Short Sales	Options	Bought Options	Written Options
	(1)	(2)	(3)	(4)	(5)	(6)
Fund Flow	-0.113	-0.092	-0.002	-0.027	-0.007	0.007
	(0.000)	(0.001)	(0.857)	(0.154)	(0.732)	(0.740)
Standard Deviation	0.002	0.001	0.000	0.000	0.000	0.000
	(0.000)	(0.003)	(0.645)	(0.999)	(0.715)	(0.148)
Bottom Alpha Tercile	0.006	0.005	-0.002	0.001	0.001	0.003
	(0.019)	(0.012)	(0.154)	(0.497)	(0.526)	(0.099)
Top Alpha Tercile	-0.001	-0.002	0.000	0.001	0.000	-0.001
	(0.543)	(0.291)	(0.720)	(0.555)	(0.890)	(0.587)
Institutional Ownership	-0.008	-0.002	-0.004	-0.008	-0.005	-0.005
	(0.010)	(0.352)	(0.002)	(0.000)	(0.007)	(0.022)
Ln(Fund Size)	0.002	0.000	0.001	0.002	0.001	0.001
	(0.073)	(0.542)	(0.055)	(0.001)	(0.177)	(0.029)
Ln(Fund Family Size)	-0.001	-0.001	0.000	0.000	-0.001	-0.001
	(0.251)	(0.203)	(0.114)	(0.329)	(0.018)	(0.011)
Ln(Fund Age)	-0.003	-0.004	0.000	0.000	0.001	0.002
	(0.118)	(0.031)	(0.970)	(0.937)	(0.670)	(0.148)

Table 3
Expense Ratios and Complex Instrument Use

This table reports results from panel regressions of fund net expense ratio on complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund net expense ratio is calculated by subtracting expense reimbursements, interest expenses, and other expenses from a fund's total expenses and scaling by the fund's total assets. The figure is then annualized. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Three separate regressions are estimated. The first row reports results using our composite complex instrument dummy variable, which takes the value of one if at least one of the complex instruments under consideration is used. The next three rows report results for dummy variables capturing the use of leverage, short sales, and options. The last two rows report results for Bought Options and Written Options, which are dummy variables used to identify option buyer and option writer funds respectively. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Expense Ratio
Composite	0.072
	(0.000)
Leverage	0.007
	(0.136)
Short Sales	0.136
	(0.100)
Options	0.100
	(0.000)
Bought Options	0.018
	(0.381)
Written Options	0.058
	(0.002)

Table 4
Fund Performance and Complex Instrument Use

This table reports results from panel regressions of fund performance on complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund performance is measured using net returns in excess of the risk-free rate (1), four-factor alphas (2), and the manipulation-proof performance measure (MPPM) derived by Goetzmann et al. (2007). All measures are computed from daily fund net return data observed during a six-month period, reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Three separate regressions are estimated. The first row reports results using our composite complex instrument dummy variable, which takes the value of one if at least one of the complex instruments under consideration is used. The next three rows report results for dummy variables capturing the use of leverage, short sales, and options. The last two rows report results for Bought Options and Written Options separately, which are dummy variables used to identify option buyer and option writer funds respectively. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Excess Return	Four-Factor Alpha	MPPM
	(1)	(2)	(3)
Composite	-0.594	-0.458	-0.636
	(0.003)	(0.004)	(0.005)
Leverage	-0.360	-0.773	-0.699
	(0.147)	(0.000)	(0.014)
Short Sales	-0.731	-0.124	-0.215
	(0.323)	(0.815)	(0.790)
Options	-0.668	-0.132	-0.454
	(0.012)	(0.526)	(0.126)
Bought Options	-0.795	-0.852	-0.646
	(0.069)	(0.020)	(0.159)
Written Options	0.111	1.091	0.549
	(0.749)	(0.000)	(0.792)

Table 5
Risk and Complex Instrument Use

This table reports results from panel regressions of fund risk on complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund risk is measured using the standard deviation of returns (1), CAPM beta (2), idiosyncratic volatility as computed from the four-factor model (3), skewness (4), and kurtosis (5). All five measures are computed from daily fund net return data observed during a six-month period. The standard deviation and the idiosyncratic volatility are reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Three separate regressions are estimated. The first row reports results using our composite complex instrument dummy variable, which takes the value of one if at least one of the complex instruments under consideration is used. The next three rows report results for dummy variables capturing the use of leverage, short sales, and options. The last two rows report results for Bought Options and Written Options separately, which are dummy variables used to identify option buyer and option writer funds respectively. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Standard Deviation	Beta Exposure	Idiosyncratic Volatility	Skewness	Kurtosis
	(1)	(2)	(3)	(4)	(5)
Composite	-0.077	-0.023	0.394	-0.009	0.040
	(0.484)	(0.001)	(0.000)	(0.000)	(0.040)
Leverage	0.557	0.029	0.285	-0.002	-0.001
	(0.000)	(0.000)	(0.000)	(0.498)	(0.962)
Short Sales	-1.355	-0.147	0.812	-0.023	0.146
	(0.001)	(0.000)	(0.000)	(0.025)	(0.073)
Options	-0.493	-0.039	0.285	-0.011	0.115
	(0.002)	(0.000)	(0.001)	(0.009)	(0.000)
Bought Options	-0.505	-0.040	0.215	0.009	0.115
	(0.078)	(0.042)	(0.157)	(0.289)	(0.046)
Written Options	-0.813	-0.057	0.080	-0.023	0.148
	(0.000)	(0.000)	(0.531)	(0.000)	(0.002)

Table 6
Equity Risk and Complex Instrument Use

This table reports results from panel regressions of fund equity risk on complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund equity risk is measured using the standard deviation of returns (1), CAPM beta (2), idiosyncratic volatility (3) as computed from the four-factor model, skewness (4), and kurtosis (5) of the underlying equity holdings of the fund reported at the end of the previous six-month period. All three measures are computed using daily holdings-based fund gross returns observed during a six-month period. The standard deviation and the idiosyncratic volatility are reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Three separate regressions are estimated. The first row reports results using our composite complex instrument dummy variable, which takes the value of one if at least one of the complex instruments under consideration is used. The next three rows report results for dummy variables capturing the use of leverage, short sales, and options. The last two rows report results for Bought Options and Written Options separately, which are dummy variables used to identify option buyer and option writer funds respectively. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Equity Standard Deviation	Equity Beta Exposure	Equity Idiosyncratic Volatility	Equity Skewness	Equity Kurtosis
	(1)	(2)	(3)	(4)	(5)
Composite	0.451	0.017	0.407	-0.006	-0.011
	(0.000)	(0.000)	(0.000)	(0.004)	(0.011)
Leverage	0.394	0.018	0.173	0.004	-0.007
	(0.002)	(0.003)	(0.041)	(0.158)	(0.476)
Short Sales	0.542	0.006	0.954	-0.022	-0.013
	(0.099)	(0.701)	(0.000)	(0.000)	(0.638)
Options	0.292	0.008	0.413	-0.007	-0.005
	(0.024)	(0.196)	(0.000)	(0.022)	(0.676)
Bought Options	0.407	0.013	0.435	0.002	-0.028
	(0.061)	(0.279)	(0.017)	(0.770)	(0.262)
Written Options	-0.089	-0.009	0.211	-0.011	0.018
	(0.595)	(0.269)	(0.147)	(0.034)	(0.197)

Table 7
Risk Gap and Complex Instrument Use

This table reports results from panel regressions of fund risk gap on complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund risk gap is measured by the difference between the standard deviation of returns (1), CAPM beta (2), the four-factor model idiosyncratic volatility (3), skewness (4), and kurtosis (5) of net returns and the same risk measures computed from the underlying holdings reported at the end of the previous six-month period. All five measures are computed using the daily fund net return and the daily holdings-based fund gross returns, observed during a six-month period. The standard deviation and the idiosyncratic volatility are reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Three separate regressions are estimated. The first row reports results using our composite complex instrument dummy variable, which takes the value of one if at least one of the complex instruments under consideration is used. The next three rows report results for dummy variables capturing the use of leverage, short sales, and options. The last two rows report results for Bought Options and Written Options separately, which are dummy variables used to identify option buyer and option writer funds respectively. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Standard Deviation Gap	Beta Exposure Gap	Idiosyncratic Volatility Gap	Skewness Gap	Kurtosis Gap
	(1)	(2)	(3)	(4)	(5)
Composite	-0.501	-0.035	-0.032	-0.003	0.053
	(0.000)	(0.000)	(0.242)	(0.081)	(0.053)
Leverage	0.140	0.008	0.115	-0.006	0.018
	(0.079)	(0.109)	(0.000)	(0.007)	(0.224)
Short Sales	-1.901	-0.134	-0.177	-0.003	0.215
	(0.000)	(0.000)	(0.105)	(0.715)	(0.000)
Options	-0.755	-0.044	-0.176	-0.004	0.095
	(0.000)	(0.000)	(0.000)	(0.307)	(0.000)
Bought Options	-0.742	-0.048	-0.127	-0.001	0.124
	(0.000)	(0.008)	(0.219)	(0.905)	(0.008)
Written Options	-0.720	-0.045	-0.176	-0.007	0.101
	(0.000)	(0.000)	(0.019)	(0.191)	(0.000)

Table 8

Light and Heavy Users of Complex Instruments and Fund Performance and Risk

This table reports results from panel regressions of fund performance and risk on the level of complex instrument use and a set of controls. All the explanatory variables are observed six months before the dependent variable. We use information reported in each fund's balance sheet to define funds as light (below median) and heavy (above median) complex instrument users. Fund performance (Panel A) is measured by fund net returns in excess of the risk-free rate (1), four-factor alphas (2), and MPPM (3). Fund risk (Panel B) is measured by the standard deviation of returns (1), CAPM beta (2), the four-factor model idiosyncratic volatility (3), skewness (4), and kurtosis (5) of net returns. All measures are computed using the daily fund net returns observed during a six-month period, reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Two separate regressions are estimated. The first two rows report results using our heavy and light composite complex instrument dummy variables. The next eight rows report results for heavy and light Leverage, Short Sales, Options Bought and Written. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses. We also report the p-value for the test of the difference between the coefficients on Composite Light and Composite Heavy.

Panel A	Excess Return	Four-Factor Alpha	MPPM
	(1)	(2)	(3)
Composite Light (A)	0.195	0.221	0.145
	(0.472)	(0.285)	(0.631)
Composite Heavy (B)	-1.673	-0.835	-1.352
	(0.000)	(0.036)	(0.009)
p-value (A-B)	0.000	0.010	0.005
Leverage Light	-0.113	-0.544	-0.316
	(0.809)	(0.113)	(0.542)
Leverage Heavy	-0.840	-1.667	-1.546
	(0.182)	(0.006)	(0.040)
Short Sales Light	0.895	0.810	1.124
	(0.240)	(0.082)	(0.166)
Short Sales Heavy	-1.992	0.286	-0.337
	(0.081)	(0.622)	(0.765)
Options Bought Light	-0.998	-0.928	-0.891
	(0.094)	(0.055)	(0.168)
Option Bought Heavy	-1.453	-1.382	-1.044
	(0.049)	(0.021)	(0.175)
Option Written Light	-0.041	0.616	0.261
	(0.919)	(0.048)	(0.561)
Option Written Heavy	0.010	1.603	0.745
	(0.986)	(0.000)	(0.212)

Panel B	Standard Deviation	Beta Exposure	Idiosyncratic Volatility	Skewness	Kurtosis
	(1)	(2)	(3)	(4)	(5)
Composite Light (A)	0.044	-0.009	0.380	-0.014	0.009
	(0.742)	(0.229)	(0.000)	(0.000)	(0.654)
Composite Heavy (B)	-1.200	-0.136	0.791	-0.018	0.220
	(0.001)	(0.000)	(0.000)	(0.037)	(0.002)
p-value (A-B)	0.001	0.000	0.005	0.656	0.005
Leverage Light	0.375	0.030	-0.004	-0.006	-0.008
	(0.019)	(0.000)	(0.962)	(0.227)	(0.636)
Leverage Heavy	1.111	0.052	0.931	-0.009	0.067
	(0.002)	(0.005)	(0.000)	(0.339)	(0.325)
Short Sales Light	-0.563	-0.074	0.703	-0.035	0.142
	(0.207)	(0.004)	(0.007)	(0.008)	(0.163)
Short Sales Heavy	-4.287	-0.395	0.392	-0.034	0.289
	(0.000)	(0.000)	(0.153)	(0.104)	(0.119)
Options Bought Light	-0.540	-0.037	0.061	-0.008	0.162
	(0.091)	(0.040)	(0.707)	(0.440)	(0.121)
Option Bought Heavy	-0.943	-0.081	0.448	0.030	0.097
	(0.049)	(0.042)	(0.071)	(0.055)	(0.232)
Option Written Light	-0.457	-0.029	0.011	-0.016	-0.023
	(0.011)	(0.008)	(0.925)	(0.011)	(0.423)
Option Written Heavy	-1.535	-0.113	0.163	-0.033	0.385
	(0.000)	(0.000)	(0.411)	(0.006)	(0.001)

Table 9
Complex Instrument Allowance and Fund Risk

This table reports results from panel regressions of fund risk on being allowed to use complex instruments and actual use and a set of controls. All the explanatory variables are observed six months before the dependent variable. Fund risk is measured by the standard deviation of returns (1), CAPM beta (2), the four-factor model idiosyncratic volatility (3), skewness (4), and kurtosis (5) of net returns. All measures are computed using the daily fund net returns observed during a six-month period, reported on an annualized basis and expressed in percentages. Our controls (unreported in the table) include the log of the fund's AUM, the log of the fund family's AUM, the log of the fund's age, the proportion of AUM in the institutional share classes, and fund flows. Additionally, we include time x fund-style fixed effects with fund style measured using the fund's CRSP objective code. Two separate regressions are estimated. The first two rows report results using our composite complex instrument variables. The next six rows report results for Leverage, Short Sales, and Options Use variables. Standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

	Standard Deviation	Beta Exposure	Idiosyncratic Volatility	Skewness	Kurtosis
	(1)	(2)	(3)	(4)	(5)
Composite Used	-0.074	-0.023	0.397	-0.009	0.040
	(0.499)	(0.001)	(0.000)	(0.000)	(0.016)
Composite Allowed	0.641	0.039	-0.066	0.010	-0.026
	(0.030)	(0.013)	(0.714)	(0.204)	(0.332)
Leverage Used	0.532	0.027	0.266	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.682)	(0.979)
Short Sales Used	-1.484	-0.153	0.731	-0.022	0.153
	(0.000)	(0.000)	(0.001)	(0.034)	(0.061)
Options Used	-0.537	-0.042	0.288	-0.011	0.118
	(0.001)	(0.000)	(0.001)	(0.006)	(0.000)
Leverage Allowed	0.306	0.020	0.026	0.000	-0.013
	(0.001)	(0.000)	(0.674)	(0.879)	(0.173)
Short Sales Allowed	0.272	0.011	0.231	-0.004	-0.014
	(0.000)	(0.003)	(0.000)	(0.011)	(0.053)
Options Allowed	0.389	0.025	-0.174	0.009	-0.017
	(0.010)	(0.003)	(0.056)	(0.011)	(0.240)

Table 10

Fund Performance and Risk and the Motivations for Complex Instrument Use

This table examines how different motivations for complex instrument use affects fund performance and risk. Specifically, we replicate our earlier risk and return analysis for four different subsamples based on the tercile of the fund's flows, standard deviation of returns, institutional ownership, and four-factor alpha at semester *t-2*. In both panels standard errors are clustered at the fund level and *p-values* are reported below the coefficient estimates in parentheses.

Panel B: Risk and Return	Fund Flow			Standard Deviation			Institutional Ownership			Four-Factor Alpha		
	Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Four Factor Alpha	-0.710	-0.149	-0.414	-0.119	-0.154	-0.862	-0.772	-0.547	0.060	-0.894	-0.244	-0.198
	(0.001)	(0.492)	(0.102)	(0.555)	(0.398)	(0.002)	(0.007)	(0.016)	(0.781)	(0.000)	(0.161)	(0.377)
Standard Deviation	0.004	-0.069	-0.269	-0.750	0.064	0.257	-0.111	0.061	-0.120	0.023	-0.118	-0.234
	(0.973)	(0.549)	(0.118)	(0.000)	(0.214)	(0.030)	(0.569)	(0.656)	(0.301)	(0.862)	(0.243)	(0.093)
Beta Exposure	-0.015	-0.017	-0.041	-0.069	-0.004	-0.001	-0.038	0.000	-0.013	-0.014	-0.016	-0.039
	(0.048)	(0.009)	(0.001)	(0.000)	(0.258)	(0.862)	(0.003)	(0.981)	(0.083)	(0.073)	(0.014)	(0.000)
Idiosyncratic Volatility	0.367	0.366	0.378	0.384	0.274	0.391	0.651	0.214	0.036	0.419	0.196	0.390
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.602)	(0.000)	(0.000)	(0.000)

Table 11

Performance of Unconstrained and Constrained funds

This table presents the four-factor alphas of portfolio of funds sorted according the ABCC score or the composite score. The ABCC score is defined in Almazan et al. (2004). The composite score is defined in the main text and is based on whether a fund is allowed to use complex instruments such as leverage, short selling, and options. *p-values* are reported in parentheses.

	ABCC score	**Composite score**
Unconstrained	-0.999	-0.901
	(0.078)	(0.123)
Medium constrained	-0.338	-0.269
	(0.552)	(0.748)
Most constrained	-0.452	-0.319
	(0.406)	(0.554)
Most constrained - constrained	0.548	0.582
	(0.037)	(0.039)