A Unique View of Hedge Fund Derivatives Usage: Safeguard or Speculation?

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ABSTRACT

We study the volatility timing ability and selectivity skill revealed by the call, put, and common equity positions of hedge fund investment advisors over the 1999–2006 period. We find that hedge funds' option positions are associated with significantly higher than normal subsequent realized volatility on the underlying security. For instance, hedge funds greatly increased their usage of puts amidst the unraveling of the Nasdaq technology bubble. We also find a strong positive (negative) relation between call (put) holdings and subsequent abnormal stock returns. These relations persist even after the holdings disclosures become publicly available. A real-time feasible tracking portfolio of stocks based upon publicly observable hedge fund option holdings earns annualized abnormal returns of 14.8%. Compared to non-users, hedge fund option users manage larger portfolios and portfolios with two post-fee performance features favorable for their constituent hedge fund investors: lower return volatility and higher Sharpe ratio. Overall, the results highlight a previously undocumented speculative role of derivatives among professional investors.

Keywords: Hedge funds; investment advisors; informed trade; derivatives.
JEL Codes: G11, G12

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Abstract

We study the volatility timing ability and selectivity skill revealed by the call, put, and common equity positions of hedge fund investment advisors over the 1999–2006 period. We find that hedge funds' option positions are associated with significantly higher than normal subsequent realized volatility on the underlying security. For instance, hedge funds greatly increased their usage of puts amidst the unraveling of the Nasdaq technology bubble. We also find a strong positive (negative) relation between call (put) holdings and subsequent abnormal stock returns. These relations persist even after the holdings disclosures become publicly available. A real-time feasible tracking portfolio of stocks based upon publicly observable hedge fund option holdings earns annualized abnormal returns of 14.8%. Compared to non-users, hedge fund option users manage larger portfolios and portfolios with two post-fee performance features favorable for their constituent hedge fund investors: lower return volatility and higher Sharpe ratio. Overall, the results highlight a previously undocumented speculative role of derivatives among professional investors.

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How derivatives are actually used by professional investors is still largely unknown territory in the finance literature. Although investors can use derivatives to speculate on private information, the few available empirical studies highlight non-speculative motives. For example, Koski and Pontiff (1999) find that derivatives are used by mutual funds to reduce fluctuations in portfolio risk, especially systematic risk. In another study of U.S. mutual funds, Deli and Varma (2002) conclude that (p.97), "[the] primary benefits associated with...derivatives are the potential to economize on trading costs, costs of liquidity-motivated trading, and the opportunity costs of holding cash." These activities neither imply nor are implied by managerial possession of private information about stock fundamentals. In this paper, we directly examine whether derivatives also play a speculative role in institutional portfolios by studying the common stock and equity option holdings of a large sample of hedge fund investment advisors over the 1999–2006 period.

The hedge fund industry provides an attractive setting in which to study speculative motives for holdings derivatives. Transparent institutions, such as mutual funds, must comply with the Investment Company Act of 1940. The 1940 Act entails certain regulatory requirements that make using derivatives difficult.[1] In contrast, as private firms hedge funds face few restrictions on trading derivatives, and therefore a hedge fund setting will better enable us to detect speculative motives if they exist.

It is also plausible that hedge fund managers are more likely to use derivatives for speculative reasons. Equity options are an obvious potential vehicle for exploiting "volatility timing", superior knowledge about stocks' volatility. Calls and puts are also a high leverage channel through which

[1] The 1940 Act's provisions include: segregation requirements to avoid senior security issues, diversification requirements, limits on illiquid investments, compliance procedures to monitor derivatives use, increased disclosure, and the daily valuation of net assets. Restrictions on derivatives use in mutual funds also result from voluntary contracting between managers and investors. Almazan, et al. (2004) report that around 25% of U. S. equity mutual funds adopt outright prohibitions on the holdings of individual equity options.

an investor can profit from "selectivity skill", information about the direction of the underlying stock price.[2] Restrictions on derivatives might be burdensome for all managers, but would be the most inhibitive for any subset of managers with private information. To the extent those best informed are attracted to the less restricted hedge fund industry, our approach is well suited to study the role of derivatives in utilizing superior information.[3]

We report several new empirical findings. First, we examine the well publicized case of the Nasdaq technology bubble. Brunnermeier and Nagel (2004) report that hedge funds heavily invest in highly priced tech stocks over the period 1999 to 2000. We likewise find a positive tech bias in the aggregate hedge fund stock portfolio over this period. Our examination of stock and options positions, however, reveals that the technology sector constitutes nearly half of the total notional value underlying aggregate hedge fund put holdings. Thus, as volatility increases over the summer of calendar year 2000, these positions effectively win doubly, from both price direction and volatility.

Second, we undertake a comprehensive investigation into volatility timing ability as revealed by hedge funds' holdings of options over the period 1999–2006. Whereas in general it is the case that Black-Scholes implied volatilities consistently overestimate subsequent realized volatilities, we document a clear pattern where hedge funds' non-directional option strategies (e.g., protective puts and straddles) are associated with an attenuation or outright reversal of this effect. For example, we estimate that the difference between realized and implied volatility is -4.09% per month and significant among securities for which no advisors hold corresponding option positions. In stark contrast, this difference equals 11.75% when all advisors use the security as part of a

[2]See, e.g., Black and Scholes (1973), Merton (1973), and Cox and Rubinstein (1985).

[3]Asness, Krail, and Liew (2001) report that the aggregate hedge fund index exhibits a market model beta and R-squared of 0.84 and 35.3%, respectively. This "long bias", combined with the typical fee structure of managers, suggests that the hedge fund business model is less about hedging and more about alpha creation.

non-directional option strategy. In effect, realized volatilities following hedge funds' reported long option holdings are higher than normal. A decomposition of the volatility differences suggests the effect is stock-specific rather than systematic.

Third, we test the selectivity skill revealed by advisors' option holdings through measurement of subsequent abnormal returns in the underlying stocks. We find, in contrast to hedge funds' common equity positions, that call and put option positions reflect strong selectivity skill. Specifically, a "call-minus-put" portfolio that buys (sells) stocks underlying call (put) holdings earns average abnormal returns of 1.40% per month over the three months following each quarter-end.

Fourth, we analyze how quickly the directional information contained in option holdings is reflected in security prices. Typically, there is a significant lag between quarter-end and the public filing date. We exploit this feature of the data and partition the sample depending upon whether or not the holdings disclosures are yet publicly observable. A portfolio that buys (sells) stocks underlying call (put) holdings the day after the filing date earns average abnormal returns of 1.72% through the end of the quarter. This works out to an annualized return of 14.83% at the median realized reporting lag of 45 days. This portfolio is based upon publicly available disclosure information, so this evidence would potentially qualify as a rejection of the joint hypothesis of semi-strong form market efficiency and the benchmark employed.

To further investigate the feasibility of these returns, and circumvent any short sales constraints on the common stocks underlying the put holdings, we also formulate option trading portfolios directly. A portfolio that buys (sells) 1-month expiry, near-the-money puts on securities underlying advisors' puts (calls) the day after the filing date earns average hold-to-maturity returns of 18.71% in excess of the expected returns implied by Black and Scholes (1973). Since the longest possible holding period for each position is one month, the associated annualized figure would be astronomical.

Finally, we examine whether the apparent informed character of hedge funds' option holdings contributes to the success of their constituent investors. To address the effectiveness of option usage, we analyze the after-fee portfolio returns and assets under management reported to the TASS hedge fund database. We find that funds reporting option holdings have significantly more assets under management than funds reporting no option holdings ($147 vs. $50 million). Option usage is also associated with significantly lower after-fee return volatility and higher Sharpe ratio. However, we find no difference in the market model alphas of users and non-users. Thus, while option holdings are reflective of volatility timing information and selectivity skill, these rents are not necessarily passed through to investors in the form of after-fee returns.

Our main inferences are drawn from a unique data set of SEC-required quarterly disclosures of equity and equity option holdings of 250 hedge fund advisors. In contrast, most of the data used by existing studies must rely on coarse fund-level indicators of derivatives use, and not actual holdings. For example, Chen (2006) finds lower return volatility among hedge funds with a stated policy of allowing derivatives, as compared to funds with no such policy. Some patterns of derivatives usage have also been inferred from the nonlinear interactions between hedge fund portfolio returns and systematic factors. See, for example, Fung and Hsieh (1997, 2001) and Agarwal and Naik (2004). Our knowledge of individual equity option positions allows us to directly examine the role of derivatives in capitalizing on superior information about stock fundamentals.

The findings here also broaden those reached in recent studies of hedge funds' common equity holdings. Extending Griffin and Xu (2007) (306 advisors) and Brunnermeier and Nagel (2004) (53 advisors), our data are collected from original SEC filings rather than the processed commercially available Spectrum database that omits the mandatory call and put holdings disclosures. Griffin and Xu's (2007) analysis of stock holdings raises serious questions about the perceived superior skill of hedge fund managers. Complementing those results, the evidence here suggests that volatility timing and selectivity skill are more evident in hedge funds' holdings of alternative assets like individual equity options.

Our findings also significantly extend and broaden evidence suggesting that option market data are informative about the characteristics of future stock prices. While the option data used in existing studies are market volume aggregates that include uninformed and informed trades,[4] our sample design includes only holdings that one might expect to be informed. In addition, Pan and Poteshman (2006) present strong evidence that option market trading activity is a predictor of subsequent stock prices. However, they conclude that, "the economic source of [predictability] is valuable private information in the option volume rather than an inefficiency across the stock and option market" (p. 873). In contrast, our findings suggest that profitable trading strategies in both the stock and options markets can be identified using only publicly observable information contained in filings of Form 13F.

The remainder of the paper is organized as follows. Section 1 describes the data. Section 2 discusses the methodology and empirical results on volatility. Section 3 considers directional option positions and stock returns. Section 4 addresses hedge funds' portfolio performance. Section 5 concludes.

[4] See, e.g., Kumar, Sarin, and Shastri (1992), Chakravarty, Gulen, and Mayhew (2004), Easley, O'Hara, and Srinivas (1998), Cao, Chen, and Griffin (2005), Pan and Poteshman (2006), Mayhew, Sarin, and Shastri (1995), and Fleming, Ostdiek, and Whaley (1996). More recently, Ni, Pan, and Poteshman (2007) find evidence that option market volume can predict subsequent stock market volatility.

1 Data

1.1 Hedge Fund Investment Advisors

We begin with Bloomberg's list of all 13(f)-obligated hedge fund managers, those managers of over $100 million who are all required by Section 13(f) of the Exchange Act to make quarterly holdings disclosures to the SEC on Form 13F. We also use the Lipper/TASS database to identify the investment advisors of hedge funds. Each individual fund in TASS reports the name of its management firm. These names are then manually matched with SEC EDGAR in order to identify which advisor firms are subject to Section 13(f). The TASS database lists the investment advisors of both live and defunct hedge funds, thereby reducing the potential for survivorship bias.

The resulting list is merged with all quarterly 13F filings from the SEC Edgar website. The sample period begins in the first quarter of 1999–the earliest period for which 13F's are available in electronic format from EDGAR. Although downloading the individual 13F files is straightforward, the formatting is complex and laborious to decipher due to manager-specific idiosyncracies in reporting styles so a random sample of 250 advisors is used.

1.2 Section 13(f) and Form 13F

According to the Securities Exchange Act of 1934 as amended in 1975 to enact Section 13(f), "every [institutional investment] manager which exercises investment discretion with respect to accounts holding Section 13(f) securities, having an aggregate fair market value on the last trading day of any month of any calendar year of at least $100,000,000 shall file a report on the last day of each of the first three calendar quarters of the subsequent calendar year." For each 13(f) security, the manager is required to report the name of the security issuer, title of the issue, security CUSIP, fair market value, and amount of the security. Individual equity options constitute between 40–45 percent of the Official List of 13(f) Securities over our sample period.[5]

Form 13F has specific rules for the reporting of options. A manager must report holdings of options only if the options themselves are 13(f) securities. For purposes of the $100,000,000 threshold, the manager should consider only the value of such options, not the value of the underlying shares. The manager must give the entries about CUSIP, fair value, and amount in terms of the securities underlying the options, not the options themselves. Advisors are also required to report whether the options are calls or puts. Form 13F makes no explicit request for an option's striking price or maturity date, and we can exactly identify these additional contract features only for a small subset of holdings.[6]

The omission of option holdings in studies of 13F filings is usually unavoidable because the databases compiled by Thomson Financial and/or CDA/Spectrum contain common equity holdings only. In other words, the data vendors omit holdings of non-equity securities that are otherwise 13(f) securities, including equity options. Table 1 presents a striking example of the disconnect between a complete 13F filing, obtained directly from the SEC, and the incomplete filings data available from Thomson. This evidence suggests that Thomson's master security file does not include preferred stock, debt securities, and equity calls, puts, and warrants. In this study we avoid abridgment by collecting a sample of complete 13F filings directly from the SEC.

Even unabridged, the raw required filings do not contain entire portfolios at the fund level. In addition to securities not on the list or held in relatively small positions, short positions are generally omitted from the filings. Hedge fund advisors' short positions could theoretically constitute a significant portion of their total portfolio at times. Nevertheless, our main research questions concern whether observable positions contain information about stock fundamentals,

[5] Source: http://www.sec.gov/divisions/investment/13flists.htm.
[6] Source: http://www.sec.gov/about/forms/form13f.pdf.

and not about advisors' portfolio performance. Thus, any omission of short positions would have the effect of weakening our ability to reject the null hypothesis that the complete set of advisors' holdings contains no information about future stock returns and/or volatility.

1.3 Public vs. Non-Public Information

Each Form 13F report must be filed with the SEC within 45 days after the end of each calendar year and each of the first three calendar quarters of each calendar year. Therefore, after each quarter there is potentially a significant period during which the contents of the 13F are non-public information. However, each 13F in our sample was publicly observable on the EDGAR website on and after the filing date reported in each filing. At the start of 1999, the SEC adopted rules to require electronic filing of Form 13F by institutional investment managers through the EDGAR system. According to the SEC, "...rapid dissemination of the institutional disclosure information to the public is a fundamental purpose of the bill."[7] Every submission transmitted to EDGAR is immediately validated based on criteria required by EDGAR standards for all electronic filings. If the submission meets all validation criteria, the submission is considered accepted, permanently stored in the EDGAR database, and immediately disseminated to the public.[8]

In Table 3 we summarize the reporting lag for the 5,038 filings of Form 13F in our sample. The reporting lag is defined as the number of days between the quarter-end and the actual filing date. The median reporting lag is exactly 44 days, indicating that most managers do not choose to exercise their option to report early. However, there is significant variation in the reporting lag as indicated by a standard deviation of 36 days. In addition, the reporting lag of several filings exceeds 45 days, while others are filed over a quarter late (> 90). The evidence here suggests

[7] Source: http://www.sec.gov/rules/final/34-40934.htm

[8] Submissions have a filing date of the next business when the transmission is started after 5:30pm, Eastern Time. Source: Edgar Filer Handbook: A Guide for Electronic Filing with the SEC By Charles H. Rider, Rider Published by Aspen Publishers Online, 2000.

that the data contained in 13F filings are generally non-public at the quarter-end, and that the filing date is necessary and sufficient to precisely determine when the contents of a specific filing become part of the public's information set.

1.4 Other Data

We use daily observations of implied volatilities, bid/offer quotes, and contract terms of S&P 500 Index and individual option implied volatilities provided by the Ivy OptionMetrics database. These data are used in tests to detect private information contained in option holdings about volatility and option returns. We also use CRSP daily and monthly files, with returns adjusted for stock delisting to avoid survivorship bias, following Shumway (1997).[9] We also use the quarterly sales (data2) data provided by Compustat and the daily risk-free rate provided by Kenneth French's website. Finally, we use the stock assignments and monthly returns corresponding to the characteristic-based benchmarks of Daniel, et al. (1997).[10] We use these benchmarks in tests to detect the presence of private information in holdings about future stock returns.

2 Methodology and Results: Volatility and Hedging

2.1 Tech Bubble Example

Brunnermeier and Nagel (2004, p. 2023) report that hedge fund holdings were heavily invested in Nasdaq technology stocks over the 1999–2000 period, and these holdings slowly diminished after

[9] In particular, the last return used is either the last return available on CRSP, or the delisting return, if available. While a last return for the stock of -100% is naturally included in the study, a return of -30% is assigned if the deletion reason is coded in CRSP as 500 (reason unavailable), 520 (went to OTC), 551-573 and 580 (various reasons), 574 (bankruptcy) and 584 (does not meet exchange financial guidelines). Shumway (1997) reports that -30% is the average delisting return, examining the OTC returns of delisted stocks. Amihud (2002) and Acharya and Pedersen (2005) employ an identical survivorship bias correction.

[10] The DGTW benchmarks are available at
http://www.smith.umd.edu/faculty/rwermers/ftpsite/DGTW/coverpage.htm. See Daniel, et al. (1997) and Wermers (2004) for details on the construction of benchmark portfolios.

the Nasdaq peak in March 2000. These stock holdings alone, however, do not give a complete picture of the funds' overall strategies. Indeed, funds not specializing in short selling had returns with a much steadier net exposure to the $TECH$ factor over the year (p. 2029).[11] Following Brunnermeier and Nagel (2004), we define the bubble segment based on rankings of Price-to-Sales (P/S) ratios. At the end of each quarter, we sort all stocks into P/S quintiles based on the end-of-quarter market capitalization and P/S ratio using sales figures that are lagged at least six months.

In Figure 1, we plot the time series of hedge fund holdings of put options on Nasdaq technology stocks from 1999 to 2001. Specifically, at the end of each quarter, we aggregate all put option holdings retrieved from the 13F filings into a single hedge fund put portfolio. We compute the total notional value underlying hedge fund put options on tech stocks and relate them to the total notional value underlying all put options held. For comparison, we also report the same figure for the total value of hedge fund tech stock holdings relative to all hedge fund stock holdings. Consistent with Brunnermeier and Nagel (2004), we find a positive tech bias in the aggregate hedge fund stock portfolio in our sample over this period. However, the new finding here is that the technology sector represented nearly half of all the notional value underlying the aggregated hedge fund put holdings. Thus, as volatility increased over the summer of calendar year 2000, these put positions effectively won doubly, from both price direction and volatility.

In Panel B, we plot the average notional value (in $millions) underlying the put options on Nadaq tech stocks across all advisors in a given quarter. We estimate that in December 1999 and March 2000 (the Nasdaq peak), the average hedge fund advisor filing Form 13F held put options on tech stocks with an underlying notional amount of about 12 and 11 billion dollars, respectively.

[11] In comparison, the short selling specialist funds developed a large and growing negative exposure to the TECH factor.

In contrast, the average notional value was only about 60 million dollars in March and June of 1999. Overall, the time series is consistent with some hedge funds believing that an end to the bubble was at hand. We can also contrast this case, where some informed belief about coming returns is plausible, with the unexpected (and unexpectable) volatility shock that occurred in September of 2001. Hedge fund put option positions overall were declining in the summer quarter of 2001. The evidence here warrants a more comprehensive look at the potential volatility timing and selectivity skill information in hedge fund option positions.

2.2 Volatility Benchmarks

Options may provide an opportunity to use special knowledge about stock return volatility to obtain a portfolio with positive risk-adjusted returns. In the absence of special information, options may still provide a means of hedging against unanticipated changes in volatility.[12] In the following we examine the relation between hedge funds' reported holdings and subsequent volatility. A natural test is to compare volatility in two cases: when positions do appear to involve volatility speculation, and when they do not.

We classify a call option position as directional if the advisor does not simultaneously report a position in a put option on the same underlying security. Likewise, we classify a put option position as directional if the advisor does not simultaneously report a common stock or call option position in the underlying firm. This criterion thus classifies straddles and protective put strategies as non-directional options strategies.[13]

For each month k following quarter t, we compute a measure of unexpected volatility for

[12] For example, see Cox and Rubinstein (1985, p.54).

[13] Ideally, we would measure directional magnitude of option strategies for a given stock through the net delta of an advisor's position in various securities for the same security issuer. However, as noted in Section 1, the striking price and expiry date for many options positions are not reported by our sample advisors.

security i as the difference between realized and implied volatility

$$UVOL_{i,t+k} = VOL_{i,t+k} - IVOL_{i,t+k-1}, \quad k = 1, 2, 3.$$

Following Merton (1980) and French, Schwert, and Stambaugh (1987), we use daily returns to compute the annualized realized monthly volatility of stock i:

$$VOL_{it+k} = \sqrt{\left(\sum_{d=1}^{D_{i,t+k}} r_{itd}^2 + 2 \sum_{d=1}^{D_{i,t+k}} r_{itd} r_{it,d-1} \right) \times \frac{365}{N_{i,t+k}}}$$

where $D_{i,t+k}$ and $N_{i,t+k}$ are the number of daily return observations and calendar days in month $t+k$, respectively. $IVOL_{i,t+k-1}$ corresponds to the annualized implied volatility at the end of month $t+k-1$ of the nearest-to-the-money call or put option on stock i that expires in month $t+k$. Specifically, at the end of each month, we identify all call and put option contracts for each underlying security i that expires in the following month. For each set of calls and puts, we select the contract with the minimum absolute moneyness-defined as minus one plus the ratio of the contract's striking price and the current price of the underlying security. All contracts with absolute moneyness greater than 10% are dropped. For each underlying security, therefore, we have potentially two observations of implied volatility-one for each call and/or put. If both observations are available, we take the average implied volatility from the call and put contracts.

Our use of implied volatility as a benchmark for market expectations has the advantage that it is extracted from option prices and therefore forward-looking. According to the IVY DB manual (p. 27), "The implied volatilities and option sensitivities contained in Ivy DB are calculated in accordance with standard conventions used by participants in the equity and index option markets." For European-style options, implied volatility is obtained by inverting the Black Scholes model after setting the option price to the midpoint of the bid and ask quote. For American-style options, the implied volatility is obtained after inverting a proprietary pricing algorithm that is based on the Cox-Ross-Rubinstein binomial tree model.[14]

The information in option holdings could be about systematic or idiosyncratic volatility. Following the above approach for total volatility, we construct a forward-looking benchmark for idiosyncratic volatility using option market prices. Specifically, for each underlying security i in the k'th month following quarter t, we first estimate a market model beta, $\beta_{i,t+k-1}$ using the previous sixty monthly return observations and the S&P 500 Index. We then decompose the implied volatility, $IVOL_{i,t+k-1}$, using the following relation:

$$IVOL^2_{i,t+k-1} = \beta^2_{i,t+k-1} IMVOL^2_{t+k-1} + IEVOL^2_{i,t+k-1}, \tag{1}$$

where $IMVOL_{t+k-1}$ is the average implied volatility at the end of month $k-1$ following quarter t of closest-to-the-money call and put options on the S&P 500 index with a one month expiry. Our measure of benchmark-adjusted idiosyncratic volatility ($UEVOL_{i,t+k}$) is obtained by subtracting the implied idiosyncratic volatility, $IEVOL_{i,t+k-1}$, from the realized idiosyncratic volatility (decomposed from the sum of squared daily residual stock returns) over the subsequent month, $EVOL_{i,t+k}$.

2.3 Volatility results by security

For each quarter-end, we identify the unique set of firms underlying the stock and option holdings across all advisors. We then fit the following cross sectional regression in each of the

[14] At the index level at least, the search for unbiased predictors remains the subject of much current research. See, for instance, Andersen and Bondarenko (2007), and Jiang and Tan (2005).

three months following each of the 32 sample quarters:

$$UVOL_{i,t+k} = \alpha_{t+k} + \gamma_{t+k} DIR_{i,t} + \delta_{t+k} NONDIR_{i,t} + \epsilon_{i,t+k}, \tag{2}$$

where $DIR_{i,t}$ is the proportion of advisors disclosing a directional option position on underlying security i at the end of quarter t, and $NONDIR_{i,t}$ is the proportion of advisors disclosing a nondirectional option position on underlying security i at the end of quarter t.

Table 4 reports averages of the monthly estimated coefficients in Eq. (2) by year and for the full sample period 1999-2006. The intercept term shows the difference between realized and implied volatilities when no options positions are reported on otherwise optionable stocks. Table 2 shows that common stock positions constitute the majority of all holdings, and therefore exert a major influence on the unconditional average deviation from implied volatility. The estimated intercept, an annualized deviation of -4.09%, is significant. This result is consistent with existing evidence that Black-Scholes implied volatilities are on average biased predictors of realized volatility in the subsequent period.[15]

The positive coefficients on DIR and $NONDIR$ indicate greater positive deviations of realized volatility from implied volatility of stocks underlying option positions as compared to when there are no options positions reported on stock. Both coefficients are statistically significant. We interpret this as saying that hedge funds' option positions are undertaken at times when volatility is higher than normal, and therefore when having done so turned out to be a good thing. In fact, contrary to the overall average behavior, realized volatility is significantly higher than the Black-Scholes implied volatility when 100% of advisors hold either a directional or non-directional

[15] See, for instance, Canina and Figlewski (1993), Day and Lewis (1992), Lamoureux and Lastrapes (1993), Jorion (1995), and Fleming (1998).

option position on the underlying security. Moreover, consistent with the idea that volatility timing is a non-directional bet, the coefficient on $NONDIR$ is much larger as compared to DIR. Specifically, annualized monthly deviations of realized volatility from implied volatility is 11.75% (vs. 0.91%) when all advisors implement a nondirectional option strategy on the underlying security. The evidence here provides evidence of volatility timing information in option positions, and especially so for non-directional option positions.

Next we consider a finer partition of hedge fund positions. We classify the directional positions as either bullish (containing one or more calls) or bearish (containing one or more puts). We classify the non-directional positions as either protective put (containing put and common) or straddle (containing both calls and puts). We then fit the following cross sectional regression in each of the three months following each of the 32 sample quarters:

$$\begin{aligned} UVOL_{i,t+k} = \alpha_{t+k} &+ \gamma_{1,t+k} BULL_{i,t} + \gamma_{2,t+k} BEAR_{i,t} \\ &+ \delta_{1,t+k} PPUT_{i,t} + \delta_{2,t+k} STRAD_{i,t} + \epsilon_{i,t+k}, \end{aligned} \tag{3}$$

where $BULL_{i,t}$ is the proportion of advisors disclosing a directional call option position on underlying security i at the end of quarter t, $BEAR_{i,t}$ is the proportion of advisors disclosing a directional put option position on underlying security i at the end of quarter t, $PPUT_{i,t}$ is the proportion of advisors disclosing a protective put position on underlying security i at the end of quarter t, and $STRAD_{i,t}$ is the proportion of advisors disclosing a straddle on underlying security i at the end of quarter t.

The results are reported in Table 4. The intercept term again shows the difference between realized and implied volatilities when no options positions are reported on otherwise optionable stocks. It remains negative and significant. The $BULL$ and $STRAD$ coefficients are positive but insignificantly different from zero. In contrast, the coefficients on $BEAR$ and $PPUT$ are significant and positive. Hedge fund directional puts and protective puts tend to be undertaken at times when volatility is higher than the benchmark.

2.4 Stock-Specific Information

To test whether the information is stock specific, we repeat our analysis with benchmark-adjusted idiosyncratic volatility as the dependent variable. We then fit the following cross sectional regression in each of the three months following each of the 32 sample quarters:

$$\begin{aligned} UEVOL_{i,t+k} = \alpha_{t+k} \quad &+ \quad \gamma_{1,t+k} BULL_{i,t} + \gamma_{2,t+k} BEAR_{i,t} \\ &+ \quad \delta_{1,t+k} PPUT_{i,t} + \delta_{2,t+k} STRAD_{i,t} + \epsilon_{i,t+k}, \end{aligned} \tag{4}$$

The results are reported in Table 5. The coefficients on all option variables are positive. In addition, the coefficient estimates on $PPUT$ and $STRAD$ are significant and larger in magnitude than those reported in Table 4. The evidence here suggests that the volatility timing information contained in nondirectional holdings of individual equity options is mainly stock-specific.

2.5 Aggregation By Advisor

The above evidence shows that option holdings, at the level of the individual security, are associated with higher deviations of realized volatility from implied volatility. In this subsection we examine the same relation at the level of an individual hedge fund advisor. Specifically, for each of the four position types (bullish, bearish, protective put, straddle) we compute within-advisor averages of $UVOL$ and $UEVOL$ for each of the three months following each reporting quarter t. As a benchmark, we also compute a within-advisor average for stocks held as common only but are otherwise optionable.

The results are reported in Table 6. In Panel A, the annual averages across advisors are reported for $VOL_{i,t} - IVOL_{i,t-1}$, which is a rough measure of unexpected total volatility. Bullish option strategies are associated with 0.16% greater deviations of volatility from implied volatility as compared to holdings of otherwise optionable common stock. However, the coefficient is not significant. The bearish positions deviate from the average behavior significantly, by 0.78%. The non-directional strategies, protective puts and straddles, exhibit significant averages of 1.29% and 1.23% above the benchmark, respectively.

In Table 7, the annual averages across advisors are reported for $EVOL_{i,t} - IEVOL_{i,t-1}$, which is our measure of unexpected stock-specific volatility. Both bullish and bearish strategies show significant positive differences from the common stock holdings benchmark, 0.66% and 0.74%, respectively. The protective puts and straddles exhibit large positive and significant averages, 1.06% and 1.77% above the benchmark, respectively. Overall, the results are consistent with our earlier findings that stock-specific volatility timing information is contained in the individual equity option positions reported by hedge funds in Form 13F, and especially so for positions held in non-directional strategies.

2.6 Performance of Holdings-Based Straddle Portfolios

In this section we use straddle returns as another measure of the volatility timing information contained in option positions. Straddles have a positive volatility beta and therefore, under delta-neutrality, higher straddle returns must correspond to higher than expected realized volatility. We begin each quarter by identifying all unique securities held as either common equity or that underly holdings of call and or put options across all advisors in our sample. A straddle position on each security is constructed by purchasing a call and a put option on that security. Both options are closest-to-the-money, expire in the following month, and are held to maturity. The straddle return is calculated using the realized payoffs at expiration and the prevailing market prices at the time of purchase. For each advisor and quarter-end, we sort each straddle return into groups depending on whether the security is part of an option strategy (bear, bull, pput, or straddle) or is held as common equity only. For each month in our sample we compute advisor/month/strategy observations of straddle returns as

$$STR^s_{a,t+k} = \frac{1}{N^s_{a,t+k}} \sum_{i=1}^{N^s_{a,t+k}} R_{i,t+k}, \quad , s = com, bull, bear, pput, strad$$

where $N^s_{a,t+k}$ is the number of unique underlying securities held by advisor a in strategy s at the end of quarter t, and $R_{i,t+k}$ is the return of a straddle on security i that was closest to the money at the end of month $t+k-1$ and that expires in month $t+k$.[16]

Straddle positions will likely violate delta-neutrality between the purchase date and option maturity. Therefore, the realized returns that we observe might instead reflect a realized market risk premium, as opposed to higher than expected volatility. To address this issue we follow Broadie, Chernov, and Johannes (2007) and "de-lever" the realized straddle returns using the expected returns implied by option pricing models. Specifically, in our analysis we calculate option returns in excess of the expected returns implied by Black and Scholes (1973).[17] Details

[16]Specifically, the straddle return is given by

$$R_{i,t+k} = \frac{V^c_{i,t+k} + V^p_{i,t+k}}{P^c_{i,t+k} + P^p_{i,t+k}} - 1$$

where $V^c_{i,t+k}$ denotes the hold-to-maturity payoff of the call option on security i that was closest to the money at the end of month $t+k-1$ and that expires in month $t+k$, and $P^c_{i,t+k}$ denotes the time $t+k-1$ price (bid/offer midpoint) of the call option on security i that is closest to the money and that expires in month $t+k$. $V^p_{i,t+k}$ and $P^p_{i,t+k}$ are defined similarly for puts.

[17]Rubinstein (1984) derives an analytical expression for expected returns on European options under lognormality,

of this procedure are provided in the Appendix.

In Table 8 we present averages of the return spread $STR^{s}_{a,t+k} - STR^{com}_{a,t+k}$ for each option strategy. The return spread reflects the return from buying (selling) a straddle portfolio based on hedge fund advisor's holdings of a particular option strategy (common equity). We find that the average return spread for each option strategy is positive, thereby indicating that straddle returns are more likely to be profitable if they are constructed using hedge funds' option holdings (versus common holdings). For example, straddle portfolios constructed from holdings of directional and non-directional option strategies are associated with 2.27% and 3.49% higher excess monthly returns as compared to straddle portfolios constructed from common equity holdings, respectively. The differences are also significant. Among individual option strategies, straddle portfolios constructed from hedge funds' own straddle trades yield the highest return spread at 5.32% and significant. Overall, the evidence is consistent with our earlier findings that nondirectional option positions are associated with higher unexpected volatility on the underlying security.

3 Methodology and Results: Holdings and Returns

In the previous section, we present evidence that individual equity option positions, especially those held as part of non-directional strategies like protective puts and straddles, are associated with greater positive deviations of realized volatility from implied volatility. We next turn to the question of whether directional option positions are informative about stock returns.

continuous trading, and constant risk-free rate and volatility.

3.1 Abnormal Returns, Stock by Stock

For each stock i held each quarter-end t, we first compute monthly excess returns $R_{i,t+k} - R_{ib,t+k}$, where $R_{i,t+k}$ is the realized return on stock i over the kth month following the quarter-end, and $R_{ib,t+k}$ is the corresponding return on a size, book-to-market, and momentum characteristics-based benchmark portfolio. The benchmarks are from Daniel, Grinblatt, Titman, and Wermers (1997). We then estimate the following model over the 1999–2006 period:

$$\begin{aligned} R_{i,t+k} - R_{ib,t+k} = \alpha_{t+k} &+ \gamma_{1,t+k} BULL_{i,t} + \gamma_{2,t+k} BEAR_{i,t} \\ &+ \delta_{1,t+k} PPUT_{i,t} + \delta_{2,t+k} STRAD_{i,t} + \epsilon_{i,t+k}, \end{aligned} \tag{5}$$

for months $k = 1, 2, 3$.

Table 9 reports averages of the monthly estimated coefficients in Eq. (5) by year and for the full sample period 1999-2006. The intercept, estimated at 0.01% and insignificant, is the expected monthly return on stocks held only as common by hedge funds, in excess of the return on a portfolio with the same size, book-to-market, and lagged return characteristics. The result is consistent with Griffin and Xu's (2007) conclusion that measures of hedge fund stock ownership cannot predict future returns over and above the information contained in past returns. In addition, the estimated coefficients are insignificant for both directional and non-directional option strategies. However, $DIROPT$ is a composite of calls and puts, and the finer decomposition in Model 2 reveals a significant negative relation between put holdings and future returns. Specifically, the benchmark-adjusted return on the underlying common stock averages a significant -7.02% for directional put holdings. The estimated coefficients are also negative for $PPUT$, but statistically insignificant. We interpret the result as saying that selectivity skill is reflected in directional put positions held by hedge fund advisors.

3.2 Detecting Directional Information: Tracking Portfolios

For a more intuitive approach to the question of directional information, we can use the disclosed positions to form portfolios and draw from the performance evaluation literature, where manager skill is inferred from portfolio returns. We check each advisor each quarter for bullish and bearish directional positions. In the bullish portfolio, a stock's portfolio weight equals the market value underlying the call positions on that stock divided by the aggregated market value underlying all reported call positions. In the bearish portfolio, a stock's portfolio weight equals the market value underlying the put positions on that stock divided by the aggregated market value underlying all reported put positions.

For each advisor and month, we calculate:

$$GT_{n,t} = \sum_{i=1}^{I} \left(w_{n,t-1,i} - w_{n,t-4,i}\right) \times r_{i,t}, \tag{6}$$

where $w_{n,t,i}$ is advisor n's portfolio weight in security i at the end of month t, $r_{i,t}$ is the month t return on stock i, and the summation is taken over all securities I. Portfolio weights are held constant across months within each quarter at the previous quarter-end weights. This measure comes from Grinblatt and Titman (1993), and it has the virtue of being return benchmark-free. We also compute:

$$CS_{n,t} = \sum_{i=1}^{I} w_{n,t-1,i} \times \left(r_{i,t} - r_{i,b,t}\right), \tag{7}$$

where $r_{i,b,t}$ is the month t return on stock i's characteristic-based benchmark portfolio. This is the measure from Daniel, Grinblatt, Titman, and Wermers (1997).

The portfolio change measure (GT) reflects the month t difference in returns between two portfolios: the actual portfolio held at the end of month $t-1$ and the lagged portfolio held at the end of month $t-4$. The characteristic-adjusted measure (CS) is the difference between the month t return of the portfolio held at the end of month $t-1$ and the month t return of the matching control portfolio.

$GT_{n,t}$ and $CS_{n,t}$ are averaged across advisors n, and then across the 96 sample months t. The null hypothesis is that the average is zero, for GT:

$$H_0 : \frac{1}{96} \sum_{t=1}^{96} \left[\frac{1}{N_t^s} \sum_{n=1}^{N_t^s} GT_{n,t}^s \right] = 0, \quad s \in \{\text{bull}, \text{bear}\} \tag{8}$$

where N_t^s denote the number of advisors with at least one position type s at the end of quarter t, and likewise for CS.[18]

Table 10 reports the GT and CS performance measures for stock portfolios constructed from advisor holdings. The stock portfolio that tracks bull option holdings earns raw returns of 1.05% per month on average, versus -0.74% for the stock portfolio tracking bear option positions. Neither is significant, but the 1.79% difference is highly significant.

Under both the GT and CS measures, we can reject the null hypothesis that advisers do not have private information about the future return on their stock holdings. The average risk-adjusted return on bull portfolios, the stocks underlying hedge funds' disclosed call option holdings, equals 63 and 46 basis points per month, respectively. Depending on the returns benchmark, we can reject the null hypothesis that call options holdings do not contain information about future

[18]The left-hand side of Eq. (8) is the average excess return of a portfolio strategy with weights $\sum_{n=1}^{N_t^s} w_{n,t,i}/N_t^s$ in security i at the end of quarter t, and therefore investable given the holdings at the end of quarter t.

stock returns at the 5% level.

More dramatic results are shown in the bear portfolios, the stocks underlying hedge funds' disclosed put option holdings. The GT and CS returns are -69 and -94 basis points per month, respectively in risk-adjusted returns. Both estimates here are significant. The average return spread from buying (selling) stocks underlying calls (puts) are a significant 1.32% and 1.40% for the GT and CS benchmarks, respectively. Overall, our findings of significant risk-adjusted returns for bull and bear portfolios support the view that the call and put option positions of hedge fund advisors reflect selectivity skill.

Pan and Poteshman (2006) find that stock returns are predictable based on option market volume, but that this predictability is based only on nonpublicly observable signals, and therefore not a violation of market efficiency. As noted in Section 2.6 , the contents of 13F filings are generally unobservable at the quarter-end. Therefore, the predictability that we document might correspond to either a gradual adjustment of market prices to the private information contained in the holdings (occurring within the first 45 days after quarter-end) and/or an immediate adjustment of prices to the public disclosures (occurring in the second month).

In Panel B we separately report statistics for the benchmark-adjusted returns according to each of the three months following the quarter-end. We find that positive abnormal returns associated with call holdings are concentrated in the second month following the quarter-end date. For call positions, therefore, we cannot reject semi-strong form market efficiency as described by Fama (1970). The results for put holdings are different. A stock portfolio tracking put holdings earns -1.42% abnormal returns in the third month following the quarter-end.

Next we divide the sample depending on whether the 13F filings are publicly or non-publicly observable, as proxied by the period before and after the filing date. The post-filing-date returns correspond to a call-minus-put strategy that is implemented on the day after each filing date and held until the end of the quarter. We drop all filings with a reporting lag exceeding 90 days. The results show that the abnormal return spreads obtained from buying (selling) stock portfolios based upon publicly observable call (put) holdings are 2.05% and 1.72% for the GT and CS returns benchmarks, respectively. Both estimates are significant. We interpret this evidence as potentially a rejection of the joint hypothesis of our returns benchmark and semi-strong form market efficiency.

We caution that the abnormal returns reported here do not reflect constraints on selling short the common stocks underlying the put holdings. Therefore, we also study the profitability of long/short portfolios in the options market using publicly observable information. Table 11 summarizes the hold-to-maturity returns from buying next-month expiry, near-the-money puts on stocks underlying put and call holdings. Portfolios are rebalanced at each quarter-end and the end of the first two months following each quarter-end. The returns reflect equal-weighted averages of advisor-specific returns for each month in our sample.

The second column of Panel A shows that the average return from a put portfolio based on hedge fund put holdings is 9.40% per month. In contrast, the average return for the put portfolio formed from call holdings is -4.02%. Thus, buying put options on stocks underlying hedge funds' holdings of call option earn negative average returns. The return spread, at 13.43%, is significant. The final three columns of Panel A report results for put portfolio returns in excess of the expected returns implied by the Black and Scholes (1973) model. For example, the excess return from the bear portfolio is almost 27% per month and significant. The return spread from buying (selling) puts based on put (call) holdings is 15.35% and significant. The results provide further support that hedge fund directional option holdings provide directional information.

In Panel B we divide the sample to examine how quickly the information contained in option holdings is reflected in option prices. The return spread in the put-minus-call put portfolio is positive in each of the three months following the quarter-end, the largest spread appears in the first month. For example, the excess return spread is almost 25% per month and significant in the first month following the quarter-end. We also use the filing date of each 13F to form put portfolios based upon public information ("post-fdate"). Specifically, the post-fdate returns correspond to the same strategy starting the day after each filing date and holding until maturity. Panel B shows reveals a significant 18.71% return corresponding to the strategy using only public information on hedge fund holdings. Our findings suggest that publicly-observable information contained in 13F filings can be used to identify profitable trading strategies in both the stock and options markets.[19]

4 Portfolio Returns Reported to TASS

The above results emphatically point to volatility timing and selectivity skill information in hedge fund positions, but they do not directly measure hedge funds' performance. To address whether option usage is directly related to portfolio performance, we use the subsample of 179 advisors that voluntarily report to the TASS hedge fund database. TASS provides portfolio returns and organizational characteristics for individual funds managed by a given advisor. To permit matching, we aggregate individual fund data at the advisor level.

Table 12 reports summary statistics for advisor-level characteristics and portfolio returns. Comparisons are made based upon whether or not advisors use options as determined by the

[19]Diamond and Verrecchia (1987) predict that short sale constraints reduce the speed of adjustment to news, especially bad news. Consistent with this prediction, we document negative abnormal returns in equities underlying put holdings even after the public disclosure date, while the positive information associated with call holdings is incorporated more quickly. However, the findings for option returns do not depend on short sales constraints, and would therefore also be consistent with the gradual information diffusion theory of Hong and Stein (1999).

portfolio disclosures reported in the SEC-required Form 13F. Panel A reports statistics for the equally weighted average of the characteristics of an advisor's individual funds. Redemption notice and lockup measure the ease with which fund investors can redeem their existing shares in the fund. The average redemption notice period is slightly longer for option-using funds (36 days versus 34 days). Nevertheless, non-users are more likely to impose a lockup provision as compared to users (0.37 versus 0.28). Overall, the differences are not statistically significant. The next two characteristics are parameters in the fund manager's compensation contract. The mean difference in performance fee (0.38%) between user and non-user funds is not significant. However, option-users are associated with 1.07% higher fixed management fee as compared to non-users.

We next compare the portfolio returns for option users and non-users. Panel B reports the mean, standard deviation, Sharpe ratio, and market-model alpha for portfolio returns (after fees) for advisors that use options and those that do not. Each advisor is required to have at least 12 monthly observations to be included in the test. Results are reported for both equal-weighted and asset-weighted averages of an advisor's individual fund returns, and also depending on whether backfilled observations are included in the return calculations. For the backfill-free sample of return observations, the average value-weighted portfolio return for option users is 0.63% per month, as compared to 0.54% for non-users. However, this difference is not significant. Meanwhile, the monthly return standard deviation of option users (3.05%) is significantly lower than that for non-users (4.01%). Taken together, option users achieve significantly higher Sharpe ratios (0.34 versus 0.23). Finally, although option users are associated with a higher market-model alpha (0.55% versus 0.51%), the difference is not significant. The results are qualitatively the same across all portfolio return calculation methodologies.

We interpret the higher Sharpe ratio for option users as additional support for our conclusions that hedge fund option usage reflects volatility timing and selectivity skill.[20] Although there are no significant differences in the market-model alpha, a caveat is in order. The relation between manager skill and equilibrium after-fee fund returns to investors is unclear (see, e.g., Berk and Green (2004)). Instead, Berk (2004 p.3) predicts, "higher skilled managers will manage larger portfolios, which allows these managers to extract more economic rents by collecting fees on assets under management."[21] Panel A shows that option users report significantly more assets under management as compared to non-users ($147 vs. $50 million). We interpret this as additional evidence that option use reflects volatility timing and selectivity skill.

5 Conclusion

We decipher eight years of required disclosures by hedge fund managers in order to directly study whether derivatives play a speculative role in professional investment management. Existing research finds no speculative role for derivatives in mutual fund management, but instead mainly a hedging role. A speculative role for derivatives is more likely to be discovered in the hedge fund industry, to the extent that its managers are both less constrained and more able to generate valuable information than mutual fund managers.

We search for and find evidence of two forms of managerial ability that might be revealed by options holdings. Nondirectional strategies, like straddle positions and protective puts, reveal volatility timing ability because they are followed by significantly higher than normal volatility for the underlying stock. Directional option holdings, simple calls and puts with no accompanying underlying stock holdings reported, reflect significant selectivity skill. Buying stocks in which

[20] Alternatively, this finding is also consistent with a greater manipulation of the Sharpe Ratio among hedge fund advisors that report long positions in individual equity options (see, e.g., Goetzmann et al. (2007)). We therefore view these results as only complementary to our main findings in Sections 2 and 3.

[21] Consistent with this notion, Aragon (2007) finds no significant market model alpha in hedge fund after-fee returns after controlling for share redemption restrictions.

hedge funds take call option positions and holding for one quarter gives a portfolio having 5.7% per year alpha. Buying stocks in which hedge funds take put option positions and holding for one month gives a portfolio exhibiting -10.7% per year alpha. We do not claim these are achievable returns for other investors because of a 45-day reporting lag following the end of each quarter.

Nonetheless, a stock portfolio tracking directional put holdings earns annualized benchmark-adjusted returns of -15.8%, on average, in the third month following the quarter-end. That third month begins two weeks after the 45-day reporting deadline. Another feasible tracking portfolio, one entering positions only after actual filing dates, produces stark differences in call-based and put-based stock returns over the remainder of the quarter, 1.72% or 2.05%, depending upon the benchmark. Trading options themselves rather than the underlying stocks magnifies these differences immensely. Adjusted for the Black-Scholes benchmark, nearby month puts outperform nearby month calls by 18.71% held to expiry, which is never more than one month away.

The numbers here emphatically point out the informed character of hedge fund trades, but they do not directly measure hedge funds' investors' performance. Our analysis of after-fee portfolio returns reveals that, compared to non-users, option users manage portfolio that are larger, have lower return standard deviation, and higher Sharpe ratios, but not higher alphas. Overall, the evidence highlights the option market as a useful tool for allowing managers to exploit information.

Appendix

In this appendix we describe our calculations of expected option returns implied by Black and Scholes (1973). For example, the expected hold-to-maturity return on a European call option is defined as

$$EOR^c = \frac{E[\max\{S_T - K, 0\}]}{P^c}$$

where P^c is the current price of the option implied by Black and Scholes (1973), S_T is the underlying stock price at expiration, and K is the striking price. Under Black and Scholes (1973) assumptions, S_T can be expressed as $S_T = S_0 \exp^{(\mu-\sigma^2/2)T+\sigma\sqrt{T}\epsilon}$, where S_0 and S_T are the prices of the underlying today and at the expiration date, respectively, μ and σ are the annualized continuous expected rate of return and instantaneous volatility of the underlying stock, respectively, and ϵ is a standard normal random variable. Combining the last two expressions and expanding gives

$$E[\max\{S_T - K, 0\}] = S_0 \times \exp^{\mu T} \times N(d_3) - K \times N(d_3 - \sigma\sqrt{T}),$$

where

$$d_3 = \frac{ln(S_0/K) + (\mu + \sigma^2/2)T}{\sigma\sqrt{T}}$$

and N(.) is the standard normal cdf.

By put-call-parity, the expected payoff of the corresponding put option is

$$E[\max\{K - S_T, 0\}] = K \times \left(1 - N(d_3 - \sigma\sqrt{T})\right) - S_0 \times \exp^{\mu T} \times (1 - N(d_3))$$

We compute expected option returns EOR^c, EOR^p by combining the previous expressions with option prices (P^c, P^p) implied by the well-known Black and Scholes (1973) formulae. In addition, each straddle trade involves purchasing an equal number of call and put options on the underlying stock. Therefore, expected straddle returns are computed as

$$EOR^{str} = \left(\frac{\tilde{P}^c}{\tilde{P}^c + \tilde{P}^p}\right) \times EOR^c + \left(\frac{\tilde{P}^p}{\tilde{P}^c + \tilde{P}^p}\right) \times EOR^p,$$

where $\tilde{P}^c$ and $\tilde{P}^p$ denote the midpoint of the closing bid and ask quotes of the call and put options, respectively.

The key inputs to the calculations for expected option returns are the risk-free rate, and expected rate of return and volatility of the underlying stock. The risk-free rate appears in the pricing formulae used to calculate current option prices (P^c, P^p) implied by Black and Scholes (1973). We use the yield on the 30-day Treasury Bill for the risk-free rate. These data are provided by Ibbotson Associates. The volatility input appears both in our calculations of current option prices implied by Black and Scholes (1973) and also expected payoffs at maturity. We use the implied volatility from actual option market prices prevailing at the time the option positions are opened. These data are provided by OptionMetrics and discussed in Section 2.2. Finally, the expected return on the underlying asset is an input to our calculations of expected option payoffs at maturity. We use the historical average return on the underlying asset using the prior 60 observations of monthly returns.

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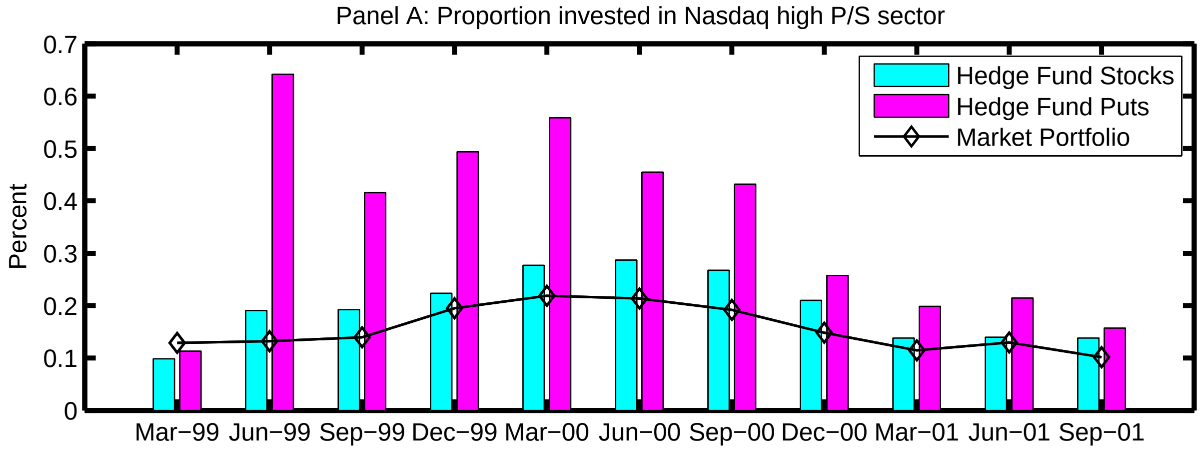

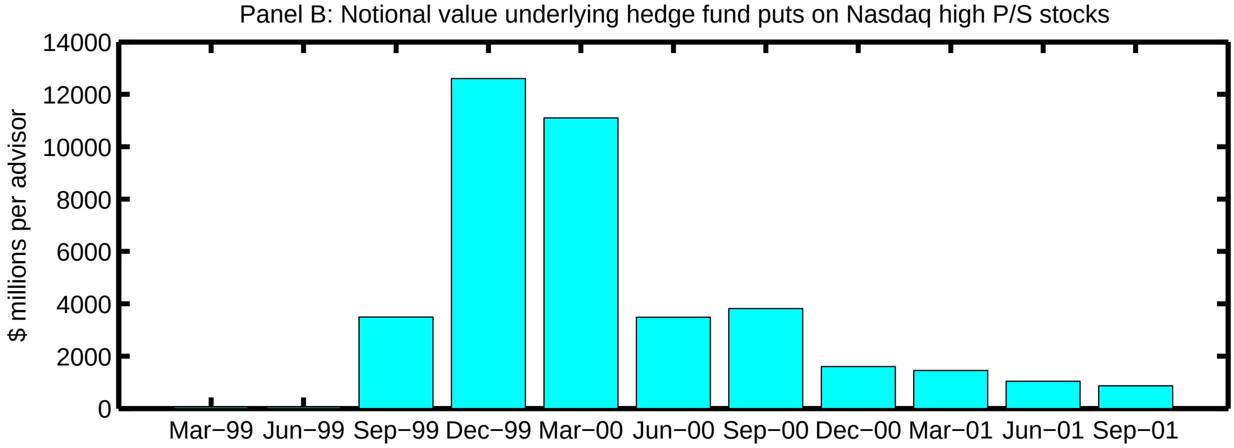

Figure 1. Weight of Nasdaq technology (high P/S) sector in aggregate hedge fund stock and put option holdings. Dates indicate end of quarter reports of holdings. The Nasdaq peak occurred during March 2000. In Panel A we report the proportion invested by hedge funds in the Nasdaq high P/S sector. At the end of each quarter, we compute the weight, in terms of market value, of high P/S quintile Nasdaq stocks in the overall stock portfolio of hedge funds, given their reported holdings on form 13F. We also compute the weight, in terms of underlying notional value, of long put options on high P/S quintile Nasdaq stocks in the overall put option portfolio of hedge funds. For comparison, we also report the value-weight of high P/S stocks in the market portfolio (all stocks on CRSP). In Panel B, we report the total notional value (in $ millions) underlying put options held by hedge funds on Nasdaq high P/S stocks divided by all advisors in the same quarter.

Table 1

Sample Form 13F for 2004Q1

The table displays the Form 13F filed by a California advisor of $11 billion in assets for the 1st quarter of 2004. Issuer is the name of the issuer, type is the type of the issuer, amount is the number of shares, and value is the market value of the security (in thousands of dollars). For debt securities the amount represents the principal amount. For calls and puts, amount and value correspond to the underlying asset.

Panel A: Positions observable through Thomson

issuer	type	cusip	amount	value
AES CORP	COM	00130H105	2853800	24343
ALLEGHENY ENERGY INC	COM	017361106	5670200	77738
AMC ENTMT INC	COM	001669100	997200	15307
AT&T WIRELESS SVCS INC	COM	00209A106	1450000	19735
AZTAR CORP	COM	054802103	350000	8579
BIOVAIL CORP	COM	09067J109	25000	390
BLOCKBUSTER INC	CL A	093679108	5000	88
CIMA LABS INC	COM	171796105	50000	1572
CITIZENS COMMUNICATIONS CO	COM	17453B101	1117500	14460
COMPUTER ASSOC INTL INC	COM	204912109	558900	15012
DIAMONDS TR	UNIT SER 1	252787106	18500	1923
ECHOSTAR COMMUNICATIONS NEW	CL A	278762109	529900	17354
EDISON INTL	COM	281020107	479500	11647
EDUCATION LENDING GROUP INC	COM	28140A109	121900	1928
EL PASO CORP	COM	28336L109	356385	2534
FOX ENTMT GROUP INC	CL A	35138T107	431300	11688
KINDER MORGAN MANAGEMENT LLC	SHS	49455U100	107936	4566
LADENBURG THALMAN FIN SVCS I	COM	50575Q102	22539	20
LAIDLAW INTL INC	COM	50730R102	247324	3599
LIBERTY MEDIA CORP NEW	COM SER A	530718105	740728	8111
MARTHA STEWART LIVING OMNIME	CL A	573083102	50000	550
MEDCO HEALTH SOLUTIONS INC	COM	58405U102	50000	1700
MGM MIRAGE	COM	552953101	25000	1134
NASDAQ 100 TR	UNIT SER 1	631100104	20000	717
NELNET INC	CL A	64031N108	341500	8674
NEW VY CORP	COM PAR $.01	649080504	1275735	5511
NTL INC DEL	COM	62940M104	124000	7382
PANTRY INC	COM	698657103	183600	3663
PG&E CORP	COM	69331C108	170000	4925
RED HAT INC	COM	756577102	146500	3377
RUSSELL CORP	COM	782352108	250000	4565
SBA COMMUNICATIONS CORP	COM	78388J106	1233700	4787
SBC COMMUNICATIONS INC	COM	78387G103	20000	491
SCIENTIFIC GAMES CORP	CL A	80874P109	11000	206
SIERRA PAC RES NEW	COM	826428104	4117087	30466
SIRIUS SATELLITE RADIO INC	COM	82966U103	558338	1898
SPDR TR	UNIT SER 1	78462F103	18500	2092
STUDENT LN CORP	COM	863902102	150000	23252
TRANS WORLD ENTMT CORP	COM	89336Q100	40625	386
TRITON PCS HLDGS INC	CL A	89677M106	50000	275
UNITED RENTALS INC	COM	911363109	140400	2495
WHX CORP	COM NEW	929248409	41066	122
				349262

Table 1

cont.

Panel B: Positions not observable through Thomson

issuer	type	cusip	amount	value
AT&T WIRELESS SVCS INC	CALL	00209A106	500000	6805
BOEING CO	CALL	097023105	450000	18481
EL PASO CORP	CALL	28336L109	100000	711
MEDIMMUNE INC	CALL	584699102	50000	1154
SPX CORP	CALL	784635104	25000	1137
TIME WARNER INC	CALL	887317105	1550000	26133
FORD MTR CO DEL	PUT	345370100	200000	0
GENERAL MTRS CORP	PUT	370442105	60000	2826
GOODYEAR TIRE & RUBR CO	PUT	382550101	325000	2775
LEVEL 3 COMMUNICATIONS INC	PUT	52729N100	500000	2000
SHAW GROUP INC	PUT	820280105	103000	1117
VERTEX PHARMACEUTICALS INC	PUT	92532F100	100000	942
WINN DIXIE STORES INC	PUT	974280109	605000	4598
NEW VY CORP	*W EXP 06/14/200	649080116	57118	6
CITIZENS UTILS TR	PFD EPPICS CV	177351202	191565	9981
NEWS CORP LTD	SP ADR PFD	652487802	21777	691
WHX CORP	PFD CV SER A	929248201	120000	900
WHX CORP	PFD CV SER B	929248300	5000	35
XEROX CORP	PFD CONV SER C	984121509	28821	3862
AMERICAN TOWER CORP	NOTE 3.250% 8/0	029912AK8	240000	297
BROCADE COMMUNICATIONS SYS I	NOTE 2.000% 1/0	111621AB4	13500000	12504
CELL THERAPEUTICS INC	NOTE 5.750% 6/1	150934AD9	2940000	2988
CEPHALON INC	NOTE 2.500%12/1	156708AE9	26000000	25675
CEPHALON INC	NOTE 6/1	156708AG4	7000000	7770
CIENA CORP	NOTE 3.750% 2/0	171779AA9	10000000	9200
CNET INC	NOTE 5.000% 3/0	125945AC9	5000000	4919
COMPUTER NETWORK TECHNOLOGY	NOTE 3.000% 2/1	204925AC5	9000000	8156
ELECTRONIC DATA SYS NEW	NOTE 3.875% 7/1	285661AF1	5000000	4938
EXTREME NETWORKS INC	NOTE 3.500%12/0	30226DAB2	17000000	16448
GENERAL MLS INC	DBCV 10/2	370334AU8	40000000	28314
GENERAL MTRS CORP	DEB SR CONV B	370442733	5400000	137700
ISIS PHARMACEUTICALS INC DEL	NOTE 5.500% 5/0	464337AC8	5000000	4671
JETBLUE AWYS CORP	NOTE 3.500% 7/1	477143AB7	10500000	10631
JUNIPER NETWORKS INC	NOTE 4.750% 3/1	48203RAA2	1648000	1662
LEVEL 3 COMMUNICATIONS INC	NOTE 2.875% 7/1	52729NBA7	27000000	22545
LTX CORP	NOTE 4.250% 8/1	502392AE3	10000000	9863
MANUGISTICS GROUP INC	NOTE 5.000%11/0	565011AB9	5000000	4881
NEWS AMER INC	NOTE 2/2	652482AZ3	22500000	12994
PMC-SIERRA INC	NOTE 3.750% 8/1	69344FAB2	1500000	1479
QUANTA SVCS INC	NOTE 4.000% 7/0	74762EAA0	10000000	9400
REGENERON PHARMACEUTICALS	NOTE 5.500%10/1	75886FAB3	20000000	19325
RELIANT RES INC	NOTE 5.000% 8/1	75952BAD7	19160000	23165
SANMINA SCI CORP	SDCV 9/1	800907AD9	5000000	2581
SEPRACOR INC	SDCV 5.000% 2/1	817315AL8	10000000	10163
SIERRA PAC RES NEW	NOTE 7.250% 2/1	826428AF1	11900000	22580
SPX CORP	NOTE 2/0	784635AD6	22500000	14400
STARWOOD HOTELS&RESORTS WRLD	NOTE 3.500% 5/1	85590AAJ3	5000000	5281
TEVA PHARMACEUTICAL FIN II L	DBCV 0.250% 2/0	88164RAB3	10000000	10475
VECTOR GROUP LTD	NOTE 6.250% 7/1	92240MAC2	18660000	16912
VENATOR GROUP INC	NOTE 5.500% 6/0	922944AB9	3000000	4939
VITESSE SEMICONDUCTOR CORP	SDCV 4.000% 3/1	928497AB2	8500000	8500
WCI CMNTYS INC	NOTE 4.000% 8/1	92923CAK0	13800000	16577
WEBMD CORP	NOTE 1.750% 6/1	94769MAE5	3320000	3042
				579129

Table 2

Hedge Fund Portfolio Composition

This table shows the portfolio holdings disclosed by 250 hedge fund advisors over the period 1999–2006. Positions are reported every quarter. Panel A shows the number of reported positions by security type. Panel B market value of reported positions by security type. Available market values for options and warrants are in terms of the securities underlying the options rather than the options themselves.

Position Type	N	Mean	Std Dev.
Panel A: Number of Positions			
common stock	1183506	238.39	822.97
debt	53534	10.77	28.46
call options			
hedging	64204	10.50	127.87
directional	14922	2.97	14.64
put options			
hedging	60753	10.21	110.03
directional	4461	0.91	2.69
warrants	2425	0.51	2.22
other	11315	2.98	11.43

Position Type	Total	Mean	Std Dev.
Panel B: Market Value ($ ’000,000)			
common stock	17700000	3180.24	14707.77
debt	5773614	925.65	6713.73
call options			
hedging	3614992	583.52	9057.52
directional	1649857	273.12	3614.94
put options			
hedging	4467458	721.81	10999.14
directional	349234	58.38	660.20
warrants	203570	33.04	191.03
other	190787	42.30	304.49

Table 3

Reporting Lag of Form 13F Over 1999–2006

This table summarizes the reporting lags of the 5,038 filings of Form 13F in our sample. The reporting lag is the number of days between the quarter-end day and the filing date. The filing date is the date the filing was approved by EDGAR. The first column corresponds to the reporting quarter of the filing (not the filing date). The second column gives the total number of filings. Columns three through seven list the number of filings for which the reporting lag is within the stated interval. The remaining columns summarize the reporting lag for all filings.

		Reporting lag (days)								
Year	N	0–29	30–44	45–50	51–89	90+	mean	med	sd	max
1999	412	47	210	124	24	7	43.3	43	16.1	208
2000	500	59	216	190	26	9	46.0	44	83.0	1866
2001	555	75	271	191	16	2	40.8	44	26.9	627
2002	583	74	318	170	12	9	43.6	43	37.3	537
2003	649	67	344	205	23	10	43.2	44	22.1	411
2004	748	82	410	238	16	2	41.1	43	10.0	133
2005	814	100	355	347	10	2	40.7	43	9.7	144
2006	777	93	310	362	11	1	40.2	44	9.3	122
1999–06	5038	597	2434	1827	138	42	42.1	44	32.5	1866

Table 4

Stock Volatility Following Hedge Funds' Reported Holdings

This table reports the output from cross-sectional regressions of future excess volatility against aggregate hedge fund demand for holding options on a particular security. For each of the three months following each quarter-end we estimate the following two models:

$$\text{Model 1:}\quad VOL_i - IVOL_i = \alpha + \gamma DIR_i + \delta NONDIR_i + \epsilon_i$$
$$\text{Model 2:}\quad VOL_i - IVOL_i = \alpha + \gamma_1 BULL_i + \gamma_2 BEAR_i + \delta_1 PPUT_i + \delta_2 STRAD_i + \epsilon_i$$

For each quarter-end and underlying security i, DIR_i is the proportion of advisors disclosing a directional option position; $NONDIR_i$ is the proportion of advisors disclosing a nondirectional option position; $BULL_i$ is the proportion of advisors disclosing a directional call option position; $BEAR_i$ is the proportion of advisors disclosing a directional put option position; $PPUT_i$ is the proportion of advisors disclosing a protective put position; and $STRAD_i$ is the proportion of advisors disclosing a straddle. $IVOL_i$ denotes the annualized monthly lagged Black-Scholes implied volatility for security i, and VOL_i denotes the annualized realized volatility (sum of squared daily stock returns) of security i's stock return over the subsequent month. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

	Model 1			Model 2				
Year	cons	dir	nondir	cons	bull	bear	pput	strad
1999	-2.87	6.15	40.06	-2.87	5.43	7.19	42.90	54.60
2000	-2.58	3.09	23.27	-2.60	-6.80	22.66	21.62	54.70
2001	-3.76	8.28	24.94	-3.77	7.04	13.68	27.11	-21.04
2002	-4.61	1.41	10.24	-4.63	-2.75	8.07	15.38	14.53
2003	-4.20	6.19	3.46	-4.18	5.59	5.85	7.67	-0.47
2004	-5.14	11.36	13.10	-5.16	11.09	10.28	4.23	20.91
2005	-5.08	-1.15	5.21	-5.12	-3.92	-0.07	-7.23	17.30
2006	-4.48	4.69	6.47	-4.49	2.73	8.11	-0.21	10.14
1999–06	-4.09	5.00	15.84	-4.10	2.30	9.47	13.93	18.84
p-val	0.00	0.01	0.00	0.00	0.33	0.00	0.00	0.10

Table 5

Idiosyncratic Stock Volatility Following Hedge Funds' Reported Holdings

This table reports the output from cross-sectional regressions of future excess volatility against aggregate hedge fund demand for holding options on a particular security. For each of the three months following each quarter-end we estimate the following two models:

$$\text{Model 1:} \quad EVOL_i - IEVOL_i = \alpha + \gamma DIR_i + \delta NONDIR_i + \epsilon_i$$
$$\text{Model 2:} \quad EVOL_i - IEVOL_i = \alpha + \gamma_1 BULL_i + \gamma_2 BEAR_i + \delta_1 PPUT_i + \delta_2 STRAD_i + \epsilon_i$$

For each quarter-end and underlying security i, DIR_i is the proportion of advisors disclosing a directional option position; $NONDIR_i$ is the proportion of advisors disclosing a nondirectional option position; $BULL_i$ is the proportion of advisors disclosing a directional call option position; $BEAR_i$ is the proportion of advisors disclosing a directional put option position; $PPUT_i$ is the proportion of advisors disclosing a protective put position; and $STRAD_i$ is the proportion of advisors disclosing a straddle. $IEVOL_i$ denotes the annualized monthly lagged Black-Scholes implied idiosyncratic volatility for security i, and $EVOL_i$ denotes the annualized realized idiosyncratic volatility (sum of squared daily stock returns) of security i's stock return over the subsequent month. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

	Model 1			Model 2				
Year	cons	dir	nondir	cons	bull	bear	pput	strad
1999	1.61	1.01	56.84	1.60	5.97	-6.46	66.56	35.58
2000	-2.49	4.32	27.63	-2.48	-3.53	16.66	31.73	52.81
2001	-3.54	0.26	34.72	-3.54	-3.38	9.62	34.68	3.87
2002	-1.91	1.66	13.59	-1.95	-4.90	12.20	17.66	13.28
2003	-2.04	8.59	5.02	-2.05	9.65	3.46	1.42	6.72
2004	-3.50	13.43	16.10	-3.56	14.43	10.00	2.17	28.83
2005	-2.51	0.53	8.80	-2.52	0.18	-1.71	-0.91	15.14
2006	-3.41	3.93	9.97	-3.41	1.95	8.78	3.47	12.60
1999–06	-2.22	4.22	21.58	-2.24	2.55	6.57	19.60	21.10
p-val	0.00	0.04	0.00	0.00	0.34	0.06	0.00	0.04

Table 6

Advisor Level Aggregation of Volatility Following Reported Hedge Fund Holdings

The table reports statistics for advisor-specific measures of future volatility corresponding to various option strategies. For each advisor and option strategy, we calculate the equal-weighted average future volatility across all securities held as part of that strategy. The future volatility corresponds to the 1, 2, and 3 months following each quarter-end and is equal to the difference $VOL_i - IVOL_i$, where $IVOL_i$ denotes the annualized lagged month-end Black-Scholes implied volatility for security i, and VOL_i denotes the annualized realized volatility (sum of squared daily stock returns) of security i's stock return over the subsequent month. The bull strategy is a directional call option position; bear is a directional put position; dir is the union of bull and bear; pput is a protective put strategy; strad is a straddle; nondir is the union of pput and strad; and com is a strategy in which the security is held exclusively as common stock. The table reports results for a test of the difference in future volatility between each option strategy and the common only (com) strategy. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

	Directional positions			Non-directional positions		
Year	bull-com	bear-com	dir-com	pput-com	strad-com	nondir-com
1999	-1.03	1.49	-0.10	2.49	0.66	1.67
2000	-1.08	1.49	0.45	1.99	2.86	2.72
2001	1.65	1.19	2.36	-0.14	0.55	0.11
2002	0.40	0.35	0.94	0.19	1.74	0.76
2003	-0.56	0.22	0.04	-0.16	-0.72	-0.56
2004	0.31	2.52	1.37	2.29	-0.23	2.09
2005	0.15	-0.74	-0.27	1.77	2.07	1.74
2006	0.76	0.73	0.70	1.12	2.47	1.66
1999–06	0.16	0.78	0.60	1.29	1.23	1.40
p-val	0.51	0.02	0.01	0.00	0.01	0.00

Table 7

Advisor Level Aggregation of Idiosyncratic Volatility Following Reported Holdings

The table reports statistics for advisor-specific measures of future idiosyncratic volatility corresponding to various option strategies. For each advisor and option strategy, we calculate the equal-weighted average future idiosyncratic volatility across all securities held as part of that strategy. The future idiosyncratic volatility corresponds to the 1, 2, and 3 months following each quarter-end and is equal to the difference $EVOL_i - IEVOL_i$, where $IEVOL_i$ denotes the annualized lagged month-end Black-Scholes implied idiosyncratic volatility for security i, and $EVOL_i$ denotes the annualized realized idiosyncratic volatility (sum of squared daily stock returns) of security i's stock return over the subsequent month. Implied idiosyncratic volatility is inferred from the security's Black-Scholes implied volatility, an estimate of the security's S&P 500 beta, and the Black-Scholes implied volatility for the S&P 500. The bull strategy is a directional call option position; bear is a directional put position; dir is the union of bull and bear; pput is a protective put strategy; strad is a straddle; nondir is the union of pput and strad; and com is a strategy in which the security is held exclusively as common stock. The table reports results for a test of the difference in future volatility between each option strategy and the common only (com) strategy. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

	Directional positions			Non-directional positions		
Year	bull-com	bear-com	dir-com	pput-com	strad-com	nondir-com
1999	-0.39	-3.34	-1.69	2.57	-1.31	1.43
2000	0.87	2.71	2.34	1.02	1.69	1.07
2001	2.74	2.05	3.35	0.73	1.67	0.81
2002	-1.40	-0.03	-0.87	0.83	3.46	1.13
2003	0.86	-0.01	0.64	0.60	0.61	0.59
2004	0.76	2.32	1.53	1.55	1.44	2.20
2005	0.93	-0.41	0.42	0.95	1.76	1.01
2006	0.41	1.57	0.90	0.81	3.05	1.62
1999–06	0.66	0.74	0.85	1.06	1.77	1.30
p-val	0.01	0.03	0.00	0.00	0.00	0.00

Table 8

Advisor Level Aggregation of BS-Adjusted Straddle Returns

The table reports average monthly hold-to-maturity returns for straddle portfolios formed based upon hedge fund advisors' holdings of 13(f) reportable securities. Each individual straddle involves buying a call and a put option on the underlying security held by each advisor. Both options expire in the following month and are closest-to-the-money. Individual straddle returns are averaged by advisor/month/strategy. The bull strategy is a directional call option position; bear is a directional put position; dir is the union of bull and bear; pput is a protective put strategy; strad is a straddle; nondir is the union of pput and strad; opt is the union of dir and nondir; and com is a strategy in which the security is held by the advisor exclusively as common stock. For each advisor and option strategy, we calculate the equal-weighted average straddle return. Each portfolio is rebalanced at the start of the three months following each quarter-end. The table reports results for a test of the difference in straddle returns between each option strategy and the common only (com) strategy. The BS-adjusted return is calculated as in Rubinstein (1984) and Broadie, Chernov, and Johannes (2007) as the difference between the realized option return and the expected return implied by the Black-Scholes model. Inputs to the model are the risk-free rate, the option implied volatility (from Black-Scholes), the value of the underlying, time to maturity, and the expected return on the underlying security. Expected returns on the underlying security are calculated as the average return over the prior 60-months. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

year	bull-com	bear-com	dir-com	pput-com	strad-com	nondir-com	opt-com
1999	1.79	-5.36	-1.17	-1.63	17.80	2.22	-0.79
2000	-2.04	6.22	3.53	10.72	1.10	8.17	3.79
2001	6.83	7.42	8.20	-0.73	-4.31	0.74	5.85
2002	1.82	10.61	8.22	7.73	6.08	7.67	9.10
2003	-0.64	-6.34	-1.11	-3.13	-6.24	-3.63	-0.47
2004	-0.80	8.72	2.28	2.78	-2.07	1.36	1.43
2005	2.23	3.84	1.79	8.13	17.78	11.31	3.77
2006	-0.26	3.41	0.76	-4.64	7.69	-1.97	-0.31
1999–06	0.84	3.88	2.27	2.32	5.32	3.49	2.38
p-val	0.49	0.01	0.04	0.18	0.02	0.03	0.03

Table 9

Stock Returns Following Hedge Funds' Reported Holdings

This table reports the output from cross-sectional regressions of future abnormal stock returns against aggregate hedge fund demand for holding options on a particular security. For each of the three months following each quarter-end we estimate the following two models:

Model 1: $R_i - R_{ib} = \alpha + \gamma DIR_i + \delta NONDIR_i + \epsilon_i$
Model 2: $R_i - R_{ib} = \alpha + \gamma_1 BULL_i + \gamma_2 BEAR_i + \delta_1 PPUT_i + \delta_2 STRAD_i + \epsilon_i$

For each quarter-end and underlying security i, DIR_i is the proportion of advisors disclosing a directional option position; $NONDIR_i$ is the proportion of advisors disclosing a nondirectional option position; $BULL_i$ is the proportion of advisors disclosing a directional call option position; $BEAR_i$ is the proportion of advisors disclosing a directional put option position; $PPUT_i$ is the proportion of advisors disclosing a protective put position; and $STRAD_i$ is the proportion of advisors disclosing a straddle. $R_i - R_{ib}$ is the realized common stock return for security i in excess of the return on a size, book-to-market, and momentum characteristics-based benchmark portfolio over the 1, 2, and 3 months following the quarter-end. The table lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Raw data are winsorized at 99.5% and 0.5%.

	Model 1			Model 2				
Year	cons	dir	nondir	cons	bull	bear	pput	strad
1999	-0.63	6.15	7.17	-0.64	16.71	-4.98	15.56	-8.30
2000	-0.12	-1.18	-3.97	-0.11	0.16	-7.62	-10.53	-0.70
2001	0.30	-2.08	-9.10	0.30	2.97	-14.83	-9.56	-1.14
2002	-0.09	-7.27	-9.40	-0.10	-6.63	-8.88	-9.68	-2.51
2003	0.54	-4.46	2.29	0.53	-4.49	-5.99	-3.82	5.84
2004	0.04	-2.69	-0.26	0.04	-1.25	-5.87	1.66	-2.11
2005	-0.07	-1.93	2.20	-0.08	-0.15	-9.01	-0.34	5.08
2006	0.10	-2.65	-1.67	0.10	-3.94	1.07	-0.32	-2.22
1999–06	0.01	-2.01	-1.59	0.00	0.42	-7.02	-2.13	-0.76
p-val	0.97	0.22	0.58	0.98	0.83	0.00	0.51	0.92

Table 10

Performance of Stock Portfolios Tracking Directional Option Holdings

The table reports average monthly returns for equally-weighted stock portfolios formed based upon hedge fund advisors' holdings of 13(f) reportable securities. Bull (bear) portfolios are long stocks underlying reported call (put) holdings. Quarterly reported notional amounts of options holdings are used to construct advisor-specific portfolios of the underlying common stock. Monthly raw returns and performance of these portfolios are generated over the following quarter assuming monthly rebalancing at the previous quarter's portfolio weights. The table reports the time series of the average raw return and performance across advisors. The GT measure is calculated by subtracting the time t return of the portfolio held at month $t-4$ from the time t return of the portfolio held at $t-1$. The CS measure is the difference between the time t return of the portfolio held at $t-1$ and the time t return of the time $t-1$ matching control portfolio. The return on a control portfolio is the value-weighted return on a group of stocks of similar market value, book-to-market ratio, and lagged one-year returns. Panel A reports average returns for all months by year and by the full sample period (1999–2006). Panel B reports average returns by the month following each quarter-end date. Post-fdate returns correspond to hold-to-maturity returns of a strategy that buys straddles on the day after the 13F filing date. p-values are reported below sample averages and correspond to a two-sided test of the hypothesis that the mean monthly return equals zero. Raw data are winsorized at 99.5% and 0.5%.

				Abnormal Returns					
	Raw Returns			GT Measure			CS Measure		
year	bull	bear	diff	bull	bear	diff	bull	bear	diff
Panel A: by calendar years									
1999	4.93	0.24	4.69	3.22	-0.62	3.84	2.14	-1.27	3.41
2000	-1.90	-5.69	3.79	0.51	-3.19	3.70	0.09	-2.14	2.24
2001	1.38	-1.55	2.93	1.09	-0.66	1.75	0.95	-1.25	2.20
2002	-3.58	-3.97	0.38	-1.87	-1.44	-0.44	-0.75	-1.44	0.68
2003	4.07	3.67	0.40	1.07	1.44	-0.37	0.83	0.17	0.66
2004	1.23	0.13	1.11	0.76	-0.51	1.27	0.55	-0.94	1.49
2005	1.02	0.51	0.51	-0.09	-0.75	0.67	-0.58	-0.79	0.21
2006	1.24	0.71	0.53	0.32	0.22	0.10	0.48	0.14	0.34
1999–06	1.05	-0.74	1.79	0.63	-0.69	1.32	0.46	-0.94	1.40
p-val	0.10	0.30	0.00	0.03	0.04	0.00	0.06	0.00	0.00
Panel B: by post-quarter month and filing date									
1	1.02	-0.55	1.57	0.43	-0.71	1.14	0.54	-0.63	1.17
	0.33	0.66	0.04	0.40	0.21	0.07	0.20	0.29	0.04
2	1.99	0.03	1.96	0.91	-0.47	1.39	0.69	-0.77	1.46
	0.08	0.98	0.00	0.04	0.47	0.05	0.14	0.03	0.01
3	0.14	-1.70	1.85	0.54	-0.89	1.43	0.15	-1.42	1.57
	0.90	0.15	0.01	0.30	0.11	0.03	0.70	0.00	0.00
post–fdate	1.23	-1.38	2.60	1.13	-0.92	2.05	0.11	-1.62	1.72
	0.35	0.37	0.00	0.05	0.27	0.01	0.80	0.00	0.01

Table 11

Performance of Put Option Portfolios Tracking Directional Option Holdings

The table reports average monthly hold-to-maturity returns for put portfolios formed based upon hedge fund advisors' holdings of 13(f) reportable securities. Individual puts expire in the following month and are closest-to-the-money. Individual put returns are averaged by advisor/month/strategy. Advisor/month/strategy averages are then averaged by month/strategy. The bull strategy is a directional call option position; bear is a directional put position; dir is the union of bull and bear; pput is a protective put strategy; strad is a straddle; nondir is the union of pput and strad; opt is the union of dir and nondir; and com is a strategy in which the security is held by the advisor exclusively as common stock. For each advisor and option strategy, we calculate the equal-weighted average straddle return. Each portfolio is rebalanced at the start of the three months following each quarter-end. The BS-adjusted return is calculated as in Rubinstein (1984) and Broadie, Chernov, and Johannes (2007) as the difference between the realized option return and the expected return implied by the Black-Scholes model. Inputs to the model are the risk-free rate, the option implied volatility (from Black-Scholes), the value of the underlying, time to maturity, and the expected return on the underlying security. Expected returns on the underlying security are calculated as the average return over the prior 60-months. Panel A lists the annual averages of monthly estimates. The final rows report the full sample average of the monthly estimates along with p-values corresponding to a two-sided test that the coefficient estimated equals zero. Panel B lists the average estimates for the 1,2, and 3 months following each quarter-end. Post-fdate returns correspond to hold-to-maturity returns of a strategy that buys straddles on the day after the 13F filing date. Raw data are winsorized at 99.5% and 0.5%.

	Raw Returns			BS-Adjusted		
year	bear	bull	diff	bear	bull	diff
Panel A: by calendar years						
1999	-1.40	-14.52	13.12	13.25	3.16	10.09
2000	32.05	6.81	25.24	58.84	19.91	38.92
2001	42.51	4.56	37.94	62.07	22.78	39.28
2002	29.92	34.32	-4.40	45.04	40.22	4.82
2003	-35.78	-44.98	9.19	-17.51	-29.08	11.57
2004	15.07	-1.41	16.47	26.71	16.57	10.15
2005	-4.42	-6.16	1.74	14.28	10.58	3.70
2006	-2.71	-10.82	8.11	12.62	8.36	4.27
1999–06	9.40	-4.02	13.43	26.91	11.56	15.35
p-val	0.28	0.59	0.00	0.00	0.11	0.00
Panel B: by post-quarter month and filing date						
1	22.33	0.94	21.39	39.44	14.88	24.56
	0.14	0.94	0.01	0.01	0.24	0.01
2	-7.35	-18.31	10.96	10.58	0.59	9.99
	0.50	0.03	0.10	0.42	0.95	0.32
3	13.23	5.30	7.93	30.72	19.22	11.50
	0.48	0.75	0.35	0.13	0.23	0.18
post–fdate	12.07	-5.48	17.55	31.45	12.74	18.71
	0.42	0.71	0.01	0.05	0.38	0.00

Table 12

Characteristics and Portfolio Returns of Option Users vs. Non-users

The table summarizes the characteristics and portfolio returns for the sub-sample of 179 advisors that report to the TASS database. Comparisons are made depending on whether advisors use options in accordance with the SEC-required Form 13F portfolio disclosures. Characteristics and portfolio returns are voluntarily reported to the TASS database, and aggregated across individual funds managed by a given advisor. Each characteristic is computed as the sample mean characteristic of the individual funds managed by the same advisor. Characteristics include the redemption notice period (notice), an indicator for whether the fund imposes a lockup restriction (lockup?), and the percentage performance fee and fixed management fee. Ln(assets) is the natural logarithm of the sum of the assets under management across all advisor's individual funds, and is measured at the end of the sample period. Advisor-level portfolio returns are aggregated from underlying individual fund monthly returns either as equal-weighted (equal-weighted) or asset-weighted averages based upon reported assets at the end of the previous quarter. The table summarizes the sample mean, standard deviation, and Sharpe ratio of monthly portfolio returns across advisors. Alpha is computed as the intercept of a regression of advisor monthly portfolio returns on the value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury bill rate (from Ken French). Advisors are required to have at least 12 monthly return observations to compute portfolio return statistics. Results are reported for the full sample of advisor returns and the sub-sample that excludes backfilled returns.

Variable	users	non-users	diff	p(diff)	users	non-users	diff	p(diff)
Panel A: Organization characteristics								
Notice (days)	36.42	33.64	2.78	0.415				
Lockup?	0.28	0.37	-0.09	0.142				
Performance fee (%)	18.35	17.96	0.38	0.614				
Management fee (%)	1.32	1.17	0.15	0.048				
ln($total assets)	18.79	17.72	1.07	0.001				
Panel B: Portfolio returns after fees								
	Full sample				Backfilled-free			
Equally-weighted								
Mean	1.07	0.93	0.14	0.259	0.61	0.56	0.05	0.735
Std. dev.	3.36	4.15	-0.80	0.019	3.08	3.95	-0.87	0.032
Sharpe ratio	0.42	0.26	0.16	0.000	0.34	0.23	0.12	0.016
Alpha	0.93	0.82	0.12	0.354	0.57	0.51	0.06	0.627
Asset-weighted								
Mean	0.90	0.90	-0.01	0.955	0.63	0.54	0.08	0.611
Std. dev.	3.33	4.34	-1.01	0.008	3.05	4.01	-0.96	0.031
Sharpe ratio	0.37	0.25	0.12	0.001	0.34	0.23	0.11	0.028
Alpha	0.74	0.78	-0.04	0.731	0.55	0.51	0.04	0.765