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Use of Interest Rate Derivatives by U.S

Based Domestic and Global Bond Mutual Funds

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Abstract

We investigate the use of interest rate derivatives by U.S. based domestic and global bond mutual funds. Using SEC filings and monthly return data, we document the use of derivatives across subcategories of bond funds and examine differences in returns between users and non-users of derivatives. Compared with previous studies on equity mutual funds, our bond mutual fund sample shows a wider use of derivatives. However, as with previous studies on equity funds, our results show no overall difference in fund returns for non-users and users of derivatives. One exception is the Global Bonds fund subcategory.

Keywords: Bond Mutual Funds, Derivatives Use

1. Introduction

"Derivatives are popping up everywhere – even in plain-vanilla bond funds – and it is making financial advisers and regulators nervous," and their use among mutual funds, ETFs, and closed-end funds is expected to increase according to Hoffman (2007). To the average investor, derivatives can seem complicated, and if used in strategies to enhance yield derivatives may be adding to the risk of the investment in a way that is not transparent to the investor. Quoting Andrew Donohue, director of the SEC's division of investment management, Hoffman (2007) notes, "…investors may be taking on more risk than they realize." Warren Buffet has been an outspoken critic of derivatives, calling them "time bombs, both for the parties that deal in them and the economic system." (Berkshire Hathaway, 2002)

With respect to mutual funds in particular, previous academic studies, have generally come to different conclusions, showing rather limited use and no impact on returns for mutual funds in particular. The studies tended to focus on equity funds, however, and with relatively low bond yields during the first part of the decade beginning in year 2000, fund managers may have been motivated to increase their use of derivatives.

1.1 Literature Review

The academic community has widely documented the use of derivatives by institutional investors and large corporations. For instance, Levich et al. (1999) conducted an extensive survey of the risk management practices of U.S. institutional investors, while Bodnar et al. (1998) performed a similar study for non-financial firms. Other papers have taken a narrower approach, focusing either on one type of institution, or on specific issues associated with the use of derivatives. For instance, Sinkey and Carter (1995) analyzed derivative use by commercial banks based on firm characteristics. Nance et al. (1993) and Geczy et al. (1997) analyzed characteristics of corporations that are associated with the decision to use derivatives. More recently, Guay and Kothari (2003) have explored the magnitude of corporations' risk exposure hedged with financial derivatives. Finally, Cummins et al. (1996) examined characteristics of insurance companies that use derivatives.

Only fairly recently, and as a result of the exponential growth of the mutual fund industry worldwide, has academic research focused on the use of derivative instruments by mutual funds. Under the amended Investment Company Act of 1940, investment in over-the-counter and exchange-traded derivatives by registered investment companies is allowed for hedging, income enhancement, and as a substitute for investment in traditional securities. Fund disclosure statements ("prospectus") must also contain information on funds' significant investment practices and risks, including those relating to investments or potential investments in derivatives. In addition, funds generally impose their own restrictions on their use of derivative contracts by specifying that their position in such contracts cannot exceed a certain percent of the fund's total assets. It is common to read in a prospectus that the fund has discretion to invest up to 15% or 20% of its assets in derivatives.

Yet, despite the significant leeway granted by regulators, previous evidence has shown that the use of derivative instruments by U.S. based mutual funds has remained quite limited. Lynch-Koski and Pontiff (1999) performed a survey of 679 general domestic equity mutual funds that showed only 21% of them used derivative securities. Among those, about 45%

reported using derivatives primarily for hedging and 8.5% reported using derivatives for income enhancement purposes. About two-thirds of the mutual funds surveyed that used derivatives did so using futures and options. Cao et al. (2001) corroborated the limited use of derivative instruments by U.S. based equity mutual funds. Using financial statement information for mutual funds from the Securities and Exchange Commission (SEC) filings, they found that 77% of 4,518 equity funds reporting information between June 1996 and January 1998 were authorized to use derivatives; yet only 14% did. Cao et al. also reported that, during that time frame, the majority of equity funds' derivative exposure was in forward foreign exchange contracts (74%) and that the funds' futures and options exposure was significantly smaller (18% and 8% respectively).

The limited use of derivatives by mutual funds has also been noted in other countries. For instance, Johnson and Yu (2004) observed that Canadian mutual fund managers seldom included derivatives in their portfolios. Only 21.36% of the 988 mutual funds included in their samples used derivatives, ranging from 10.74% of fixed-income mutual funds to 28.12% of domestic equity funds.

Besides documenting the limited use of derivative instruments by mutual funds, previous research has focused on whether derivative use affects the return-risk distribution of mutual funds. Two common arguments are: (1) the use of derivatives could decrease the risk in a mutual fund portfolio as a result of hedging, or (2) the use of derivatives could affect mean returns by allowing trading at lower costs. Silber (1985) first recognized that the opportunity to use derivatives could allow a fund manager to implement trades at a lower cost, and to manage more efficiently the inflows and outflows of money to and from the fund. If so, then funds that use derivatives should achieve higher returns (after trading costs) than those that do not. Lynch-Koski and Pontiff (1999) contended the typical equity fund using derivatives shows no perceptible effect on returns. This is explained by the fact that equity mutual funds are light users of derivatives, i.e. they invest less than 1% or 2% of their assets in derivatives. Cao et al. (2001) corroborated Lynch-Koski and Pontiff's findings for light derivatives users. However, due to their more extensive sample, they also found funds that are heavy derivative users, particularly of forward foreign exchange contracts, show significantly higher returns than other funds without a significant increase in risk during the sample period. Johnson and Yu's findings (2004) are more ambiguous in that they found no systematic differences in returns and risks between derivatives users and non-users for the foreign and domestic Canadian equity mutual funds (if warrants are excluded from the definition of derivatives for domestic equity mutual funds). However, they did observe, for Canadian bond funds, users of derivatives showed higher returns and higher risks than non-users.

Researchers have also investigated the cost of investing in derivatives to both mutual funds and their investors. Costs involved are generally of two types: agency costs and trading/transaction costs. Papers by Brown et al. (1996) and Chevallier and Ellison (1997) showed both well performing and poorly performing fund advisors have an incentive to enter "managerial gaming", that is to manipulate fund risk. However, the literature is unclear on whether or how such an incentive translates into agency costs to investors. Lynch-Koski and Pontiff (1999) suggested fund advisors may use derivatives to maintain a fund's risk exposure at the lowest possible cost, rather than manipulate risk in ways detrimental to fund

investors. Deli and Varma (2002) also asserted fund advisors are more motivated by increased efficiencies and transaction-cost benefits than advisor opportunism when they make an initial decision to allow investment in derivatives. In particular, the authors noted the lack of liquidity in some cash markets may drive fund advisors to authorize use of derivatives. In a section of their paper, they showed funds investing in foreign securities are more likely to permit investment in derivatives because foreign securities are generally more thinly traded. They also showed long-term government bonds and long-term corporate debt funds are eight or nine times more likely than short-term government debt funds to allow investment in debt derivatives, because both the long-term government and corporate bond markets are more illiquid than the short-term debt market.

1.2 Motivation for the Study

Our research focuses on the use of interest rate derivative instruments (in particular interest rate futures, options and swaps) by domestic and global bond (i.e., fixed income) mutual funds based in the U.S. "Use of derivatives" is defined here as long or short positions, in futures, options or swaps during the period of the study. A fund manager's motivation for having a position is beyond our ability to discern from the filings; typically derivatives are used for anticipatory hedging, inventory hedging or income enhancement. First, we investigate the use of derivatives impact on the risk and return distribution of bond mutual funds. We then perform cross-sectional analysis to assess whether heavy users of these derivatives outperform light users.

This paper is unique in several ways. First, although there is previous evidence regarding the use of derivatives by the U.S. mutual fund industry, no one has exclusively examined the magnitude of the use of derivatives by bond mutual funds based in the U.S. Until now, research has mostly focused on equity mutual funds, because, according to Lynch-Koski and Pontiff (1999) "the wide variety of fixed income derivative securities makes it difficult to define what constitutes a derivative security". This problem is avoided here, because the methodology we used in selecting the funds engaging in derivatives transactions is more rigorous than Lynch-Koski and Pontiff. Similar to the Cao et al. (2001) methodology, we use funds' filings with the Securities and Exchange Commission (SEC) which allows us to identify funds involved in very well defined interest rate-related derivatives, more specifically in U.S. and foreign interest rate futures and options, Eurodollar futures and interest rate swap transactions. Lynch-Koski and Pontiff rely more heavily on survey techniques to assess mutual fund participation in derivatives markets, which may produce more biased answers from survey respondents.

Second, previous research has largely ignored the impact of derivatives use on the risk and return performance of bond mutual funds based in the U.S. Our paper first documents a broader use of derivatives by U.S. bond mutual funds than by U.S. equity funds (as evidenced in previously cited papers), then assesses whether U.S. bond mutual funds use derivatives to alter the return and risk distribution of their bond portfolios.

The last motivation for our paper is that, in the last two decades, interest rate trends may have been important enough for fund managers to consider using futures, options and swaps to modify the duration of their portfolios in order to benefit from declining interest rates or to immunize their portfolios from rising interest rates. As a result, this research relies on more

recent historical data than previous studies, and focuses on the four-year period beginning January 2001, which marks a declining trend in interest rates in the United States. It is possible that during that period, mutual funds utilized derivatives to extend the duration of their portfolios and consequently enhance their returns.

2. Data and Methodology

2.1 Data

We gathered derivative use and return data on bond funds using two databases. First, we established derivative use with a data gathering technique similar to that of Cao and al. (2001) in that we collected data using the Securities and Exchange Commission Electronic Gathering and Retrieval (EDGAR) database. More specifically, for each bond fund, we retrieved N-30D filings, available from the EDGAR database, for the four-year period beginning January 1, 2001. The N-30D filing is a detailed financial statement issued to shareholders semi-annually. It contains a comprehensive list of every individual security held by the fund and also provides disclosure of off-balance sheet items such as futures, options and swaps contracts with some specifics about each contract held or written by the fund. The quality of derivative information in the N-30D varies by fund. Some funds do a good job of reporting the contract maturities, notional amounts, buy (long) and sell (short) positions, and option strikes. Other funds provide much less information, making it difficult to do more than categorize them as users or non-users. Funds were categorized as using derivatives if, at any point during the time period of the study, they had interest rate futures, options, or swaps positions listed in any of these filings. If a fund did not have evidence of derivatives use it was categorized as non-using.

Return data comes from the Center for Research in Securities Prices (CRSP) Survivor Bias Free U.S. Mutual Fund Database. The returns are monthly total returns per share, as of month end. The study covers the 48 month period beginning January 2001.

We began with a list of 1,663 bond funds, based on Morningstar's fund family list. We then collected N-30D filings on these funds from the EDGAR database. These funds were then matched to return data in the CRSP database using the fund name and NASDAQ ticker symbol. Funds which did not have a complete set of N-30D filings over the time period, a NASDAQ ticker, or complete return information were discarded. Our final sample contains 936 funds, of which 348 (or 37%) are categorized as derivative users. We distributed the bond funds across eight subcategories. As shown in Table 1, the largest subcategory is the single state municipal bond fund group, which represents more than a third of the sample. Table 1 also shows fairly widespread use of derivatives by bond mutual funds, for each subcategory (between 23% and 46%). It highlights the fact that managers of bond mutual funds seem to utilize derivatives more than managers of equity mutual funds, as evidenced in the previously cited studies. It is beyond the scope of this paper to address the exact reasons why a higher proportion of bond funds utilize derivatives but one may argue that some categories of bond funds may have more of an economic need to use or add derivatives in their portfolios. For instance, 47% of global fund managers in our sample hold interest rate derivatives in their portfolios. It is possible that illiquidity in some foreign fixed-income markets may force them to use bond futures or options as a substitute for cash securities. The same argument may hold for holders of municipal bond portfolios. In our sample, 34% to

36% of municipal bond funds hold derivatives. The U.S. municipal bond market is notoriously illiquid, and some municipal bond portfolio managers may also substitute futures contracts (like the Chicago Board of Trade municipal bond index futures contract) for cash securities. Further research in this area is warranted.

2.2 Methodology

In order to identify differences in the returns of derivative using funds and non-using funds, we created a matched sample of non-using funds. We formed the matching groups based on fund subcategory. For each subcategory we sorted the funds by their unique CRSP identifier, and then randomly sampled a number equal to those in the derivative using sample. (Note 1)

We analyzed the returns for the derivative using funds versus those of the matched sample using two return metrics: (1) the average monthly return over the 48 month period and (2) the total return over the 48 month period. The total return variable is calculated in a similar fashion to what is reported in many mutual fund prospectus. Starting with an assumed investment of $10,000, a 48 month total return (*TR*) is calculated as:

$$TR = \$10{,}000 \times \prod_{i=1}^{48} (1 + MR_i)$$

where MR_i is the monthly return for month *i*. If the use of derivatives allows the fund manager to trade at a reduced cost then we would expect the return metrics for the derivative using funds to be greater than those of the non-using funds. If, on the other hand, fund managers are using derivatives to hedge, we may expect the return metrics for the derivative using funds to be less than those of the non-using funds. In this case we should expect to see a reduction in the risk of the funds.

To capture the possibility of a change in risk profile from hedging or speculating with derivatives we calculated two metrics: (1) the number of positive monthly returns out of 48, and (2) the return range, calculated as the highest monthly return minus the lowest monthly return. Both of these can be viewed as simple risk measures, which are independent of any particular risk model. This was done in large part because many of the N-30D filings did not provide the level of information necessary to allow us to assess how the derivative contracts affect the fund's return distribution through more traditional risk measures, such as duration. (Note 2) If the use of derivatives allows the fund manager to hedge risk then we would expect the number of positive monthly returns for derivative using funds to exceed those of non-using funds. In addition, we would expect the return range for derivative using funds to be smaller than those of non-using funds.

3. Results

Before analyzing the return and risk metrics defined above, for differences, we examined the assumption of normality. In the derivative-user and non-user samples, Shapiro-Wilk tests showed a lack of normality for the return and risk metrics defined above. As such we employed non-parametric tests in addition to the standard t-tests in the results that follow.

First, we analyzed the return metrics by sub-category. Tables 2 (Average Monthly Return) and 3 (Total Return) present the results for the hypothesis that the centers of the distributions for the return metrics are the same. We provided three test statistic probability values (p-values) in each table: (1) t-test p-value for differences in the mean return metric, (2) sign

p-value for differences in the median return metric, and (3) the sign rank p-value for differences in the median return metric.

Overall, there appear to be mixed results for the "All Funds" category, where the t-tests suggest that non-users of derivatives have higher returns than those that use derivatives, for the matching group. In addition, there are mixed results for the Muni Single State fund category with respect to the total return metric. Finally, for the matching sample the test statistics for the "Global Bond" subcategory appear to suggest funds that are non-users of derivatives outperform those that use derivatives.

Second, we performed a similar analysis for the simple risk measures; we present the results in Tables 4 (Number of Positive Monthly Returns) and 5 (Monthly Return Spread). The results in Tables 4 and 5 seem to be in line with those for the return metrics, and suggest that, overall, funds that use derivatives, when compared with non-users, show little difference in their return distributions. The results in Table 5 also show that the return spread for Global Bond Funds using derivatives is much lower than those not using derivatives. This lower "risk" could be viewed as a reasonable explanation for the return metrics being lower. This results also suggest that bond mutual funds in our sample may use derivatives more for hedging purposes than income enhancement.

The simple risk metrics used in Tables 4 and 5 were designed to allow us to use first moment tests to understand the variability of the returns for the various fund groups. As a follow-up to these tests, we perform three other non-parametric tests on the total return distributions directly (Note 3). Two of these, the Ansari-Bradley (AB) and Siegel-Tukey (ST) tests, check for differences in the dispersion (scale) of the total return variable. The third, the Kolmogorov-Smirnov (KS) procedure, tests for any differences in the distributions. The Ansari-Bradley and Siegel-Tukey tests are based upon the idea that if two distributions have the same dispersion, the ratio of their variances should be 1. In both cases the two samples are combined and ordered. Values at the extremes (highest and lowest) are given lower scores than those in the center of the sample. The samples are then divided, and the assigned scores summed. If the two samples have the same variance, their summed scores should be the same.

The Kolmogorov-Smirnov test is more general, and is used to determine whether two underlying one-dimensional distributions differ. The test is sensitive to differences in both location and dispersion. As with the AB and ST tests, the samples are combined and ordered. Using these combined ordered values, empirical distributions are created for the separate samples. In turn, from the lowest value of the combined sample to the highest, a count is done of how many values in each of the separate samples are equal to or less than this value. The test statistic is based upon the maximum difference in this count (scaled by a factor based upon the two sample sizes). If the distributions are the same, this difference should be zero.

The results appear in Table 6. Overall we cannot reject the hypothesis that the total return distributions are the same for the derivative users and the matched samples. However, as with earlier tests, the Kolmogorov-Smirnov test confirms that there seem to be differences in total returns between users of derivatives and non-users, for the "Global Bonds" groups.

One possible explanation for the lack of difference in the return metrics could be the relatively light use of derivatives among the funds employing those instruments. If derivative contracts make up a relatively small percentage of the portfolio, it is unlikely that their effect would be easy to capture in the return metrics we use.

Unfortunately, we do not have complete data on derivative notional amounts as a percentage of total fund investment, due to differences of reporting by mutual funds in their N-30D filings. (Note 4) However, we do know the number of N-30D filings showing derivative use. Over the four-year period in our sample there are eight filings. Approximately one third of the funds have five or more filings showing derivative use (derivative use more than half of the time in the sample). As a proxy for "heavy" use, we again analyze the total return metric for those funds which have five or more N-30D filings showing derivative use, using the same matched sample methodology described earlier. Of the original 348 funds using derivatives, 113 of them have 5 or more filings showing derivative use. The results appear in Table 7. Due to the reduced sample size we only report the 4 largest subcategories, as well as the overall results for the 113 funds. There does not appear to be a difference in the total return metric for users and non-users. However, interestingly there is some evidence that Muni Single State funds (MS) which do not use derivatives have higher total returns than those that use derivatives.

4. Conclusion

4.1 Summary

This research focuses on the use of U.S. and foreign interest rate futures, options and interest rate swaps by domestic and global bond mutual funds based in the U.S. Using Edgar N-30D filings, we identified funds' derivative use and then compared the returns of those funds against matched samples with data from the CRSP Survivor Bias Free U.S. Mutual Fund Database.

While our mutual fund sample suggests a wider use of derivatives by bond mutual funds, compared to equity mutual funds, our results show that, overall, there seems to be no difference in the return metrics for non-users and users of derivatives. Non-parametric tests are also unable to show any differences in the variance of the two return metrics, average monthly returns and total returns, between derivative users and non-users for the overall sample, and the majority of sub categories.

One exception is the Global Bond funds subcategory, for which the returns of the non-using sample outperformed those of the derivative using sample. Tests suggest that managers of global bond funds may use derivatives to alter the return distribution and risk profile of their portfolios.

4.2 Recommendations for Future Research

This empirical study was conducted on the premise that during periods of decreasing interest rates (a four-year period beginning in January of 2001), bond mutual funds may use derivatives to enhance the duration of their portfolios and boost their return potential. As bond yields have again steadily declined since the summer of 2007, it may be valuable to undertake a similar study and assess whether bond mutual funds' use of derivatives has changed, and whether funds are more willing now to invest in these securities for income

enhancement purposes. In addition, many funds now have a better understanding of derivatives and may include a higher percentage of these instruments in their portfolios. The inconclusive results of our study due to light usage of these instruments may then change.

It may also be interesting to analyze the return metrics and distribution of bond mutual funds during a sustained period of rising interest rates and identify whether some bond mutual funds use derivatives significantly to hedge against a perceived growing interest rate risk in their portfolios.

Finally, the study could also be expanded to test hypotheses related to other decisions made by bond funds regarding the use of derivatives. Since the advent of exchange-traded derivatives in the 1970s, a substantial literature has developed on different portfolio strategies involving the use of derivatives. For instance, portfolio managers and other investors may use futures and options as a substitute for cash securities because they are more liquid, and not necessarily for income enhancement. Consequently, bond funds which employ bond futures or option contracts as a substitute for cash bonds should not show appreciably different return distributions than funds which use a mix of cash and fixed-income securities.

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Notes

Note 1. To verify that our results were not an artifact of the random sampling, we created two other matched samples using the CRSP identifier. After ordering each subcategory of non-user funds by the CRSP identifier we created two matched samples using the first and last n funds respectively, where n is the number of funds in the derivative using sample subcategory. Since the CRSP identifier should have no relationship to returns, this method should also result in essentially random matching. The results were qualitatively the same for these two other matching samples, and will be provided upon request from the authors.

Note 2. Since some funds only give a notional amount, and little else (no contract maturities for futures, no strikes, or call or put information) there is no way to determine whether the contract is increasing or decreasing the funds duration. This limited the use of more traditional risk based models.

Note 3. The results are qualitatively the same for the variable average monthly returns.

Note 4. For instance, some mutual funds file jointly and only provide an aggregated amount of derivative notional amount.

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Table 1. Summary Statistics

CRSP FUND CATEGORY	*Number of Funds*	*Number Derivative-Users*	*Mean Total Net Assets, Derivative-Users (millions)*	*Number of Non-Users*	*Mean Total Net Assets, Non-Users (millions)*
BQ (High Quality Corporate – BBB or greater)	181	84 (46%)	855.56	97	839.89
BY (High Yield Corporate – BB or lower)	65	15 (23%)	723.25	50	1041.92
GB (Global – at least 25% outside U.S.)	64	30 (47%)	347.65	34	274.38
GM (Ginnie Mae)	40	13 (33%)	846.65	27	1393.23
GS (Government Securities)	89	29 (33%)	490.07	60	311.71
MQ (High Quality Muni – BBB or greater)	130	44 (34%)	763.22	86	398.19
MS (Muni Single State)	342	123 (36%)	209.75	219	166.22
MY(High Yield Muni – BB or lower)	25	10 (40%)	446.65	15	980.11
ALL FUNDS	936	348 (37%)	522.90	588	483.95

Table 2. Average Monthly Return

CRSP FUND CATEGORY	*Mean Average Monthly Return Derivative Using*	*Mean Average Monthly Return Matching Sample*
BQ (n=84)	.00494602	.00486843 t= 0.32588 p= 0.7453 Sign p= 0.5856 Sign Rank p= 0.6583
BY (n=15)	.00599681	.00689686 t= -1.55093 p= 0.1432 Sign p= 0.4240 Sign Rank p= 0.1531
GB (n=30)	.00687687	***.01004714*** ***t= -3.7535 p= 0.0008*** ***Sign p= 0.0052 Sign Rank p= 0.0023***
GM (n=13)	.0046523	.00417799 t= 1.458307 p= 0.1704 Sign p= 1.0000 Sign Rank p= 0.4143
GS (n=29)	.00457978	.00419672 t= 1.395913 p= 0.1737 Sign p= 0.2649 Sign Rank p= 0.1134
MQ (n=44)	.00444741	.00428675 t= 1.068998 p= 0.2910 Sign p= 0.1742 Sign Rank p= 0.3564
MS (n=123)	.00429647	.00441782 t= -1.89101 p= 0.0610 Sign p= 0.3673 Sign Rank p= 0.0734
MY(n=10)	.00457843	.00449911 t= 0.265211 p= 0.7968 Sign p= 0.7539 Sign Rank p= 0.9219
ALL FUNDS (n=348)	.00481308	**.00507711** **t= -2.31041 p= 0.0215** Sign p= 0.7474 Sign Rank p= 0.2471

Mean average monthly return for funds by category, with t-test and p-values for the difference of the means and distribution free sign and sign rank p-values. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.

Table 3. Total Return on $10,000 Investment

CRSP FUND CATEGORY	*Mean Total Return Derivative Using*	*Mean Total Return Matching Sample*
BQ (n=84)	12660.77	12614.93 t= 0.317446 p= 0.7517 Sign p= 0.7436 Sign Rank p= 0.6744
BY (n=15)	13183.00	13753.01 t= -1.49561 p= 0.1570 Sign p= 0.4240 Sign Rank p= 0.1726
GB (n=30)	13904.51	***16041.70*** ***t= -3.61475 p= 0.0011*** ***Sign p= 0.0052 Sign Rank p= 0.0027***
GM (n=13)	12483.09	12203.98 t= 1.4842207 p= 0.1635 Sign p= 1.0000 Sign Rank p= 0.3757
GS (n=29)	12398.63	12168.10 t= 1.651895 p= 0.1097 Sign p= 0.2649 Sign Rank p= 0.0942
MQ (n=44)	12332.59	12237.11 t= 1.121612 p= 0.2683 Sign p= 0.1742 Sign Rank p= 0.3504
MS (n=123)	12236.71	**12310.55** **t= -1.99413 p= 0.0484** Sign p= 0.2792 Sign Rank p= 0.0630
MY(n=10)	12433.86	12379.54 t= 0.315776 p= 0.7594 Sign p= 0.7539 Sign Rank p= 0.6250
ALL FUNDS (n=348)	12564.12	**12744.6898** **t= -2.41937 p= 0.0161** Sign p= 0.6676 Sign Rank p= 0.2355

Mean total return on a $10,000 investment by category, with t-test and p-values for the difference of the means and distribution free sign and sign rank p values. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.

Table 4. Number of Positive Monthly Returns (out of 48 months)

CRSP FUND CATEGORY	*Mean Positive Monthly Returns Derivative Using*	*Mean Positive Monthly Returns Matching Sample*
BQ (n=84)	36.1666667	35.9761905 t= 0.532237 p= 0.5960 Sign p= 0.4887 Sign Rank p= 0.2337
BY (n=15)	33.5333333	33.9333333 t= -0.53452 p= 0.6014 Sign p= 1.0000 Sign Rank p= 0.5674
GB (n=30)	34.1333333	33.7000000 t= 0.555525 p= 0.5828 Sign p= 0.8555 Sign Rank p= 0.5238
GM (n=13)	38.0000000	37.5384615 t= 0.567369 p= 0.5809 Sign p= 0.7744 Sign Rank p= 0.6509
GS (n=29)	33.9655172	34.1724138 t= -0.35698 p= 0.7238 Sign p= 0.8318 Sign Rank p= 0.7881
MQ (n=44)	33.3636364	32.8409091 t= 1.603844 p= 0.1161 Sign p= 0.7011 Sign Rank p= 0.1305
MS (n=123)	32.8780488	**32.5772358** **t= 2.028886 p= 0.0446** Sign p= 0.2127 Sign Rank p= 0.1317
MY(n=10)	35.2000000	35.000000 t= 0.179605 p= 0.8614 Sign p= 0.7266 Sign Rank p= 1.0000
ALL FUNDS (n=348)	34.2183908	33.9741379 t= 1.672249 p= 0.0954 Sign p= 0.1237 **Sign Rank p= 0.0451**

Mean number of positive monthly returns (out of 48 months) by category, with t-test and p-values for the difference of the means and distribution free sign and sign rank p values. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.

Table 5. Monthly Return Spread

CRSP FUND CATEGORY	*Mean Return Spread Derivative Using*	*Mean Return Spread Matching Sample*
BQ (n=84)	0.05388812	0.05317691 t= 0.19074 p= 0.8492 Sign p= 0.7436 Sign Rank p= 0.7874
BY (n=15)	0.12797969	0.12464722 t= 0.274843 p= 0.7875 Sign p= 0.7975 Sign Rank p= 0.7609
GB (n=30)	0.07560997	***0.11039523*** ***t= -3.67523 p= 0.0010*** ***Sign p= 0.0052 Sign Rank p= 0.0008***
GM (n=13)	0.03828027	0.03989848 t= -0.2754 p= 0.7877 Sign p= 1.0000 Sign Rank p= 0.8926
GS (n=29)	0.06209753	0.05858049 t= 0.31907 p= 0.7520 Sign p= 0.7111 Sign Rank p= 0.3906
MQ (n=44)	0.05883567	0.06184789 t= -0.90684 p= 0.3695 Sign p= 0.8804 Sign Rank p= 0.4136
MS (n=123)	0.06183821	0.0627523 t= -0.62212 p= 0.5350 Sign p= 0.0709 Sign Rank p= 0.2037
MY(n=10)	0.04240147	0.04621092 t= -0.62072 p= 0.5502 Sign p= 0.7539 Sign Rank p= 0.6250
ALL FUNDS (n=348)	0.06216078	0.06542497 t= -1.79284 p= 0.0739 Sign p= 0.1072 Sign Rank p= 0.1412

Mean of difference between the high return and low return for each fund (out of 48 months) by category with t-test and p-values for the difference of the means and distribution free sign and sign rank p values. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.

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Table 6. Total Return Distributional Differences

CRSP FUND CATEGORY	*Total Return Distribution Difference Matching Sample*		
BQ (n=84)	KS p = 0.2668	AB p = 0.0972	ST p = 0.1005
BY (n=15)	KS p = 0.6604	AB p = 0.3855	ST p = 0.3777
GB (n=30)	***KS p = 0.0011***	AB p = 0.1955	ST p = 0.2018
GM (n=13)	KS p = 0.2914	AB p = 0.2359	ST p = 0.2692
GS (n=29)	KS p = 0.1224	AB p = 0.3778	ST p = 0.3720
MQ (n=44)	KS p = 0.3161	AB p = 0.3630	ST p = 0.3614
MS (n=123)	**KS p = 0.0271**	AB p = 0.1644	ST p = 0.1633
MY(n=10)	KS p = 0.4005	AB p = 0.0646	ST p = 0.0606
ALL FUNDS (n=348)	KS p = 0.5507	AB p = 0.4337	ST p = 0.4323

Kolmogorov-Smirnov (KS) p-values for the difference in the distribution of total returns (location and dispersion) between derivative using funds and non-using funds. Ansari-Bradley (AB) and Siegel-Tukey (ST) p-values for the difference in dispersion of the total return distributions between derivative using funds and non-using funds. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.

Table 7. Total Return on $10,000 Investment (Heavy Users)

CRSP FUND CATEGORY	*Mean Total Return Derivative Using*	*Mean Total Return Matching Sample*
BQ (n=29)	12685.71	12723.56 t = -0.16549 p= 0.8697 Sign p= 1.0000 Sign Rank p= 0.9412 KS p = 0.3668 AB p = 0.1450 ST p = 0.1416
GB (n=13)	14496.83	15975.14 t = -1.74314 p= 0.1068 Sign p= 0.5811 Sign Rank p= 0.1677 KS p = 0.1254 AB p = 0.3036 ST p = 0.3040
GS (n=14)	12492.44	**12157.42** t = 1.381871 p= 0.1903 Sign p= 0.0574 **Sign Rank p= 0.0419** KS p = 0.3338 AB p = 0.5000 ST p = 0.4908
MS (n=41)	12098.17	**12250.18** **t = -2.18548 p= 0.0348** Sign p= 0.0596 **Sign Rank p= 0.0195** **KS p = 0.0168** AB p = 0.2208 ST p = 0.1140
ALL FUNDS (n=113)	12637.23	12824.19 t = -1.43623 p= 0.1537 Sign p= 0.7069 Sign Rank p= 0.6497 KS p = 0.7681 AB p = 0.2681 ST p = 0.2728

T-test, sign, sign rank, Kolmogorov-Smirnov (KS), Ansari-Bradley (AB), and Siegel-Tukey (ST) tests for total returns of funds which report derivative use in 5 or more semi-annual periods against the matched sample of non-users. Bold indicates significance at the 5% level, bold italics indicates significance at the 1% level.