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Persistent doubt: An examination of the performance of hedge funds

Abstract

Forming top quintile portfolios on the Sharpe ratio, the alpha, the information ratio, the excess manipulation proof performance measure EMPPM and the doubt ratio; we find that these portfolios persistently outperform similarly constructed mediocre third quintile portfolios throughout the twelve year period from January 31, 2001 to December 31, 2012. However, performance is more modest and less persistent when forming portfolios on the EMPPM. It is clear than when selecting funds according to the ranking by the Sharpe and the information ratio, investors are also selecting funds that have suspicious returns. In contrast, portfolios formed on the alpha and especially the EMPPM has much less excess doubt that more rarely persist.

JEL classification: G11, G12, G23, G24

Keywords: Hedge funds, performance measures, manipulation proof performance measure, doubt ratio

Persistent doubt: An examination of the performance of hedge funds

We test for persistence in superior hedge fund performance by forming portfolios according to five different performance measures that are further stratified by quintile and strategy. Each portfolio is formed monthly from January 31, 2001 until December 31, 2010 using the prior month's performance and each portfolio is held for two years. This ensures that we use only information available on the date that portfolios are formed so that our subsequent examination of the two year out of sample performance for each portfolio mimics the investment activities of portfolio managers. We then test for superior performance through use of bootstrap t-tests.

This testing strategy allows us to address several questions. Was the hedge fund industry able to deliver consistent superior performance on average throughout the sample period and in the bull and bear markets around the December 31, 2006 pivot date? Can top performing hedge funds persist in delivering superior performance? If so, for how long will this superior performance persist? Are the answers to these questions sensitive to the choice of performance measure? Is there any evidence that the hedge fund industry manipulates common performance measures and is the newly developed manipulation proof performance measure resilient to manipulation?

Hedge fund performance and persistence continues as an active topic in the finance literature. Although Ackermann, McEnally and Ravenscraft (1999) find evidence that hedge funds outperform mutual funds, they are unable to find any evidence that hedge funds outperform market indices. While Brown, Goetzmann and Ibbotson (1999) find that Sharpe ratios and Jensen's alphas of hedge portfolios are higher than the S&P 500, they are concerned that survival bias could have

exaggerated the performance of hedge funds. Kosowski, Naik and Teo (2007) find that top performing hedge funds have superior information ratios, but not alphas. Stultz (2007) concludes that, at the very least, hedge funds offer returns commensurate with risk once hedge fund manager compensation is accounted for.

Some research strongly supports persistence, other research is more equivocal. Ammann, Huber and Schmit (2013) and Boyson (2008) find that top performing hedge funds formed on Fung and Hsieh (2004) alphas continue to provide statistically significant performance three and two years later respectively. Ammann, Huber and Schmit (2013) find that strategy distinctiveness as suggested by Wang and Zheng (2013) is the strongest predictor of performance persistence while Boyson (2008) finds that persistence is particularly strong amongst small and relatively young funds with a track record of delivering alpha. Fung et al. (2008) find that fund of funds have statistically significant alpha are more likely to continue to deliver positive alpha. More critically, Kosowski, Naik, and Teo (2007) find evidence that top funds deliver statistically significant out of sample performance when funds are sorted by the information ratio, but not when the funds are sorted by Fung and Hsieh (2004) alphas. Capocci, Corhay and Hübner (2005) find that only funds with prior middling alpha performance continue to deliver middling alphas in both bull and bear markets. In contrast, past top deliverers of alphas continue to deliver positive alphas only during bullish market conditions. More recently, Slavutskaya (2013) finds that alpha sorted bottom performing funds do persist in producing lower returns yet top performing funds do not persist in producing higher returns in the out of sample period. Brandon and Wang (2013) find that superior performance for equity type hedge funds largely disappears once liquidity is accounted for.

Another strand of the hedge fund literature heavily criticizes the use of common performance measures such as the Sharpe ratio, alpha and information ratio. Some papers such as Amin and Kat (2003) question the use of these measures as they assume normally distributed returns and/or linear relations with market risk factors. This strand of research inspired proposals for a wide variety of alternative measures of performance purporting to resolve issues of measuring performance in the face of non-normal returns. However, Eling and Shoemaker (2007) find that the ranking of hedge funds by the Sharpe ratio is virtually identical to twelve alternative performance measures. Goetzmann's et al. (2007) point out that common performance measures such as the Sharp ratio, alpha and information ratio can be subject to manipulation, deliberate or otherwise. These issues imply that the use of these performance measures can obtain misleading conclusions.

A key innovation in this paper is to re-examine the issue of performance persistence using the manipulation proof performance measure developed by Goetzmann's et al. (2007), so called because this measure is robust to the actual return distribution provided by hedge funds and resistant to manipulation. Since the MPPM is a relative performance measure, we benchmark this measure off the corresponding MPPM for the Russell 2000 so we are able to draw conclusions as to whether the candidate hedge fund strategy outperforms a passive buy and hold strategy. Specifically, we subtract the corresponding manipulation proof performance measure of the Russell 2000 total return index from the corresponding measure for each hedge fund. The Russell 2000 index contains many smaller stocks earning illiquidity premiums that a buy and hold investor can accrue in their portfolios so our excess manipulation proof performance measure EMPPM, at least in part, removes the

impact of buy and hold earned liquidity premiums from all of the hedge portfolio's strategies.

We also examine the reliability of our conclusions by examining performance and performance persistence of hedge funds through use of Brown's et al. (2010) doubt ratio. This new performance measure is derived from the MPPM and indicates whether the reported returns from hedge funds are suspicious. We also use the doubt ratio to see if top quintile funds as ranked by the heavily criticized Sharp ratio, alpha and information ratios have suspicious returns. As a control mechanism, we examine top quintile funds as ranked by the EMPPM to see if we detect suspicious performance according to the doubt ratio. The latter is a possibility because the doubt ratio does not detect misdeeds on behalf of hedge fund managers. Instead, the doubt ratio can detect suspicious patterns in hedge fund returns such as consistent positive returns with low risk. These suspicious returns could be the result of dubious trading practices, such as income smoothing, or legitimate trading strategies such as locking in an arbitrage premium that is realizable only at maturity of the position. The latter could be a legitimate reason why top quintile funds formed on the EMPPM can still obtain a high doubt ratio. As Brown et al. (2010) point out, a high doubt ratio, while suspicious, is not necessarily evidence of dubious trading practises but rather should excite further investigation to determine why the doubt ratio is high.

This paper contributes to our understanding of the hedge fund industry by finding that hedge funds can indeed deliver persistent superior performance, even in challenging economic conditions, albeit at a much more modest level and for a shorter time interval that has been previously reported by authors such as Daniel et al. (2005) and Boyson (2008). Importantly, this paper finds that new measures of performance provide a new perspective on the performance of the hedge fund industry.

Specifically, we find that the EMPPM is a much more exacting performance measure than the more traditional Sharpe ratio, alpha and information ratio and it is also less prone to manipulation, deliberate or otherwise. Specifically, we find that top quintile funds as ranked by the Sharpe and the information ratios have larger doubt ratios than the corresponding mediocre third quintile portfolios and this excess doubt persists for two years. In contrast, there is much less evidence of manipulation by top portfolios as ranked by alpha and the EMPPM. Specifically, here is much less excess doubt and persistence of doubt for portfolios formed on alphas and excess and persistent doubt is virtually non-existent for top portfolios as ranked by the EMPPM.

Additionally, use of the EMPPM results in different conclusions. For example, while the Sharpe ratio, alpha and information ratio typically find that hedge funds performed better in the robust economic conditions that prevailed in the first half of our sample period, the EMPPM finds just the opposite, suggesting that surviving hedge funds actually performed better during the liquidity and credit crunch conditions that prevailed in the second half of our sample period. As another example, while top quintile funds stratified by strategy and formed on Sharpe ratio, alpha and information ratio typically persist in delivering superior performance for two years for the entire sample period, top funds formed on EMPPM typically deliver persistent superior performance for only twelve months during the challenging economic conditions that prevailed in the second half of our sample period.

We describe the data and the performance measures in the next section. The empirical analysis then proceeds in three phases. In section 2, we measure the performance of top quintile hedge fund portfolios formed on five different performance measures. We test whether performance was stronger in either of the two sub periods which were characterized by very different economic environments. In

section 3, we examine persistence of top quintile performance by testing to see whether the fifth (highest) quintile funds have a statistically significant superior performance over mediocre third quintile funds twenty four months after the portfolios were formed. We also check to determine the degree of persistence at three, six, twelve and eighteen months after the portfolio formation date. In section 4, we examine excess return (fifth quintile less third quintile) and persistence in excess return for hedge portfolios formed on the Sharpe ratio, alpha, information ratio and the EMPPM. Section 5 summarizes and concludes.

1. Data and performance measures

We use Credit Suisse/Tremont Advisory Shareholder Services (TASS) database. We select all US dollar funds that have three years of historical performance prior to our start date of January 31, 2001 (January 31, 1998) and up to December 31, 2012. We choose this data so that we have three years of data to estimate historical alphas to later examine twelve years of out of sample performance, six years each before and after the bull and bear market pivoting around December 31, 2006. From this database, we collect all monthly holding period returns net of fees. We adjust for survivorship bias by including all funds both live and dead. We also adjust for backfill bias by including data on a given fund only from the date that the fund was listed in TASS. We estimate the Sharpe ratio as the monthly holding period return of the hedge fund less the one month T-bill return (as reported in the French Data Library) divided by the standard deviation of excess returns calculated over the previous two years.

We combine the hedge fund data with Fung and Hsieh's (2004) seven factors along with an eighth emerging market factor, as described in David Hsieh's data

library. Specifically, the regression model we use to estimate alpha for each hedge fund i α^i and the information ratio is

$$\begin{aligned} HFR_t^i = & \alpha^i + \beta_1^i(S\&P)_t + \beta_2^i(S - L)_t + \beta_3^i(10Y)_t + \beta_4^i(CredSpr)_t + \beta_5^i(BdOpt)_t \\ & + \beta_6^i(FxOpt)_t + \beta_7^i(ComOpt)_t + \beta_8^i(Emerge)_t + \varepsilon_t \end{aligned} \quad (1)$$

where S&P is the Standard and Poor 500 index total monthly return (equity market factor), S-L is the Russell 2000 index total return less the Standard and Poor 500 index total return (Size factor), 10Y is the monthly change in the constant maturity 10 year treasury yield (bond factor), CredSpr is the monthly change in the difference between Moodys Baa yield less the constant maturity 10Y treasury yield (credit risk factor), and the BdOpt, FxOpt and ComOpt are the bond, currency and commodity trend factors estimated by bond, currency and commodity look back straddles and are available from Hsieh's data library. The final factor, Emerge is the total monthly return on the MSCI index (Emerging Market Factor). We run approximately 360,000 constant size thirty-six month rolling regressions of (1) to collect historical alphas for all funds. Alpha (α) is the intercept of (1) and represents the excess return above that justified by systematic risk. Following Kosowski et al. (2007), the information ratio is the t-static of alpha in (1).

We calculate the manipulation proof performance measure (Θ) of Goetzmann et al. (2007) as reported below.

$$\Theta \equiv \left[\frac{1}{(1-A)\Delta t} \ln \left(\frac{1}{T} \sum_{t=1}^T [(1+r_t)/(1+r_{ft})^{(1-A)}] \right) \right] \quad (2)$$

A is the risk aversion parameter, r_t is the monthly holding period return of the hedge fund, r_{ft} is the one month t-bill return, T is the number of observations and Δt is one month. The measure Θ represents the certainty equivalent excess (over the risk free rate) monthly return for an investor with a risk aversion of A employing a utility function similar to the power utility function. This implies that Θ is relevant for risk averse investors who have constant relative risk aversion. We estimate Θ over the previous two years using a risk aversion parameter A of 3.¹ We next calculate the excess manipulation proof performance measure EMPPM which is the monthly Θ of the hedge fund above the corresponding Θ on the Russell 2000 index.

The doubt ratio is calculated as follows.

$$DR = 2 + \frac{\Theta(2)}{\Theta(2) - \Theta(3)}$$

Note that $\Theta(2)$ is the MPPM as calculated from (2) where the risk aversion parameter A is 2 and $\Theta(3)$ is the MPPM when the risk aversion parameter is 3. This ratio employs a linear interpolation of the degree of risk aversion for two investors with different degrees of risk aversion. While the change in the degree of risk aversion is concave, Brown et al. (2010) suggestion a linear interpolation is a good approximation as long as the degree of risk aversion is not very high. Doubt ratios become very large when $\Theta(2) \approx \Theta(3)$. This happens when the returns to investors are

¹ Initially we experimented with a variety of risk aversion parameters from 1 through 10 finding that the rankings by Θ did not change very much. Goetzmann et al. (2007) suggest that the market believes the risk aversion varies between 2 and 4. Since Brown's et al. (2010) doubt ratio is calibrated using a ratio of Θ s calculated using risk aversion parameters of 2 and then 3, we chose a value of 3 so that later we can calculate the Θ using a value of 2. This enables us to compute a doubt ratio comparable to Goetzmann et al. (2007) so that we are able to use Goetzmann et al's. (2007) benchmark of a doubt ratio of 150 as the pivot point for suspicious hedge fund returns.

always positive with very little variation. This is suspicious and merits further investigation.

The results of our data collection are reported in Table 1. A striking fact is the huge attrition rate of hedge funds, less than one half of all of the hedge funds included in our data survive until the end of our sample period. Live funds are smaller, have a shorter history and have better performance than dead funds. The average fund remains in our data for 6 years, longer than the 4 or 5 years reported by Slavutskaya (2013), but in line with Boyson (2008).

Similar to Sakda (2013) and Capocci, Corhay and Hubner (2005), the most popular hedge fund strategy is the fund of fund closely followed by the long short equity hedge. Overall, hedge funds have a 37 (4.5%) basis point monthly (annual) average rate of return that is about 20 basis points less than the monthly means as reported by Slavutskaya (2013), probably because our data incorporates another 43 months of the challenging economic conditions that prevailed since the financial crisis of 2007-08. Dichev and Yu (2011) also document a sharp reduction in buy and hold returns for a very large sample of hedge funds and CTAs, from on average 18.7% for 1980 to 1994, to 9.5% from 1995 to 2008 while Ibbotson et al (2010) report an arithmetic mean of 7.86% from 1995 to 2009. Except for the dedicated short bias strategy; all funds have a positive monthly rate of return on average. Evidently, the EMPPM is more critical than the alpha measure as three strategies fail to generate excess returns according to this measure whereas the average alphas are only negative for the fund of fund strategy. Brown et al. (2010) suggest that a doubt ratio of 150 or more is evidence of a suspicious hedge fund return that should elicit further investigation. By this measure, live funds do not whereas dead funds do trigger

suspicion. Also, several hedge fund strategies look suspicious and the most suspicious of all is the fixed income arbitrage strategy.

<<Table 1 about here>>

Our testing strategy is to construct top quintile portfolios formed on the above five measures of performance and compare the performance of these strategies to the performance of similarly formed mediocre third quintile portfolios. We use bootstrapped t-tests of differences in the means of the performance measures to construct one and two tailed tests. All t-tests are based on the stationary bootstrap method of Politis and Romano (1994) with 1,000 iterations. This is a two-step procedure that resamples with random block size from the first block bootstrap procedure to form a stationary pseudo time series. The original block bootstrap and the resampled bootstrap selects a row of observations for each selection of the performance measure for all strategies so that any cross sectional correlation in the performance measure amongst the hedge fund strategies is preserved in the resamples.²

2. A first look: In sample and out of sample performance

To determine the maximum performance, we artificially assume that each month an investor forms and holds for one month an equally weighted portfolio of the top quintile of funds. This implies that investors can anticipate which funds will achieve top quintile performance for each month for 144 months. The monthly average using each performance measure and for each strategy is reported in Panel A

² The stationary bootstrap is used because the underlying data is monthly. With a sample size of 120, the recommendation is to resample with each draw of size $N^{1/3}$ or 5 in our case. However, random samples of 5 months of data can induce weak non-stationary in the artificial time series compiled by the conventional bootstrap procedure. Therefore, we employ the second bootstrap with random sampling size from the first artificial time series to guarantee a stationary bootstrapped times series.

of Table 2. Panel B reports the differences in performance for the two sub-periods, namely 2001-2006, and 2007-2012.

<<Table 2 about here>>

Clearly, hedge fund investment can be extremely lucrative. Throughout the twelve year period, we calculate an average alpha of 1.29% (16.6%) per month (year). Using the Fung and Hsieh (2004) seven factor model, Boyson (2008) reports a somewhat larger monthly alpha of 1.86% for top quintile portfolios formed on alpha, possibly because her data ends in 2002 and so does not include the recent challenging market conditions that characterize the latter half of our sample. Dichev and Yu (2011) employ the same Fung and Hsieh eight factor model and find an average in sample annual alpha of 2.6% for all hedge funds which is similar to our in sample alpha of 21 basis points monthly (2.5% annually) alpha for all funds.³

Sharp ratios and information ratios are also very high. Interestingly, the EMPPM is much more modest, achieving a certainty equivalent of 23 (2.8%) basis points per month (year) and the average doubt ratio of the top quintile of doubt ratios is 991, much higher than the 150 threshold suggested by Brown et al (2010) for funds that start to look suspicious. According to the traditional performance measures, specifically the Sharp ratio, alpha and information ratio, Managed Futures is by far and away the top performing strategy and also the most suspicious strategy according to the doubt ratio.⁴ In contrast, the top performing strategy according to the EMPPM is the Dedicated Short Bias which also has the lowest doubt ratio.

³ For the sake of brevity, we report the in sample top quintile performance statistics in Table 2 and not the average in sample statistics. These are available from the corresponding author upon request.

⁴ It is interesting to speculate why the Managed Futures strategy looks so suspicious according to the doubt ratio. It is hard to believe that such a high level of the doubt ratio for an entire strategy over 12 years can be attributed to dubious trading practises. One possibility is that a common strategy for managed futures could be cost of carry trades where the speculator would lock in risk premiums offered by normal backwardizing futures prices commonly observed on commodity futures. This would result in a series of positive returns with a small variance leading to a high doubt ratio. Clearly, this is an example to bear in mind when we see high doubt ratios.

Looking at panel B we see that the traditional performance measures are higher in the more robust economic conditions that prevailed up to December 31, 2006 than in the challenging economic climate that evolved subsequently. In contrast, the EMPPM is higher in the more challenging second half of the sample period. With the exception of fixed income arbitrage and dedicated short bias strategies, the traditional performance measures show that individual hedge fund strategies perform better in the first half whereas the EMPPM consistently show that individual hedge fund strategies perform better in the second half of the sample period.

While Table 2 shows the most optimistic in sample performance, Table 3 reports a much more realistic out of sample view of hedge fund performance. We form portfolios using information based on the prior month's performance so that portfolios are formed using only information available to investors at the date the portfolios are formed. Specifically, from January 31, 2001, we form portfolios by strategy according to the top quintile by any given measure of performance from the prior month. The portfolios are equally weighted and are held for twenty-four months. Individual funds that were included in the formation portfolio that later disappeared during the twenty-four month valuation period are assumed reinvested in the remaining funds. New formation portfolios are formed each month, from January 31, 2001 until December 31, 2010, based on the prior month's top quintile performance measures so that we have a time series of 120 portfolios reporting monthly average performance for twenty-four months of out of sample from January 31, 2003 to December 31, 2012.

<<Table 3 about here>>

Table 3 reports the resulting out of sample performance. For the traditional performance measures, the overall out of sample performance is more modest but still

quite attractive. For example, out of sample portfolios formed on alpha still return 54 basis points per month on average which is remarkably similar to the 50 basis points reported by Boyson (2008) for similarly constructed portfolios. In contrast, portfolios formed on EMPPM return a mere one basis point per month in certainty equivalent return above the Russell 2000 index. Finally, the doubt ratio for portfolios formed on the top quintile doubt ratio remains about the same as the in sample counterpart.

In contrast to the in sample results, the out of sample EMPPM now suggests that overall, hedge funds performed somewhat better in the first half and this now agrees with most of the traditional measures of performance. However, when broken down by individual strategies, we still find that a clear majority perform better in the second half according to the EMPPM. The doubt ratio still suggests that the top quintile doubtful funds were most suspicious in the first half of the sample period.

In summary, this section finds that top quintile hedge funds performed very well according to the traditional performance measures, specifically the Sharpe, the alpha and the information ratio, both in sample monthly and out of sample twenty-four months later. The EMPPM is more exacting in that it finds that the in and especially the out of sample performance of top quintile hedge funds is more modest. Statistical tests suggest that hedge funds performed better on average in the robust economic conditions that prevailed in the first half of the sample period rather than the more exacting recessionary and slow growth conditions that prevailed in the second half of the sample period. However, the EMPPM suggests that most hedge fund strategies performed better in the more challenging conditions that prevailed in the second half of the sample period.

3. Performance persistence

We measure persistence in performance by comparing the out of sample performance of portfolios formed on the fifth and third quintile according to a given performance measure. We chose to compare the fifth and third quintile portfolios, rather than the fifth and first quintile like Boyson (2008), because it is clear that once formed, there is an attrition rate of hedge funds that is concentrated in the first quintile.⁵ To illustrate, we plot the performance of 120 monthly portfolios and average their out of sample performance according to the EMPPM by month after the formation date up to and including twenty-four months after formation.

<<Figures 1 and 2 about here>>

Figure 1 shows that the out of sample portfolios formed on the fifth and third quintile have very high (23 basis points) and high (6 basis points) average excess (over the Russell 2000 index) certainty equivalent monthly return respectively one month after formation. This strong performance then gradually falls such that by twenty-four months after formation, the historic fifth and third quintile portfolios now return only one and minus one basis point excess certainty equivalent return respectively. In contrast, the first quintile presents a twenty basis point loss initially, but these losses diminish over time to the extent that after sixteen months they are reduced to zero and after twenty-four months the first quintile is outperforming the third quintile. Figure 2 shows that there is a higher attrition rate in the first quintile as more funds disappear from the out of sample first quintile portfolios than portfolios formed on the historic fifth and third quintiles. Consequently, we suspect that the performance of the first quintile is tainted by survivorship bias and does not form a valid benchmark for determining performance persistence.

⁵ This can be an artefact of our sample period that covered the severe liquidity crisis and the subsequent recessionary and slow growth conditions post 2006.

Therefore, to examine out of sample persistence, we measure the performance of portfolios formed on our five measures of performance each month from January 31, 2001 to December 31, 2010. For each month, two formation portfolios are formed for each hedge fund strategy, one each from the fifth and third quintile of overall performance according to the relevant performance measures from the month prior to the formation date. These portfolios are then held for twenty-four months. This means we have a time series of 120 portfolios, each of which is held for twenty-four months. The difference between the historic fifth and third quintile portfolio's performance measure is then taken twenty-four months later to determine if the top quintile performance portfolio still delivers superior performance two years after the portfolio was formed. We conduct a one tailed bootstrap t-test to determine if the mean of the historic fifth quintile portfolio's performance is statistically superior to the mediocre third quintile portfolio's performance.

Table 4 reports the results of this persistence test. The first panel reports the overall difference in the historic fifth and third quintiles by performance measure and by hedge fund strategy for 120 portfolios formed from January 31, 2001 until December 31, 2010 and held for two years. The second and third panel report the same information for the first and second half of the sample period pivoting from December 31, 2005, representing a time series of 60 portfolios each held for twenty-four months.

<<Table 4 about here>>

Clearly, the top panel of Table 1 shows that overall, top hedge fund performance persists up to two years after top performing funds have been selected. This conclusion is statistically significant for all measures of performance. Ammann, Huber and Schmit (2013) finds three year performance persistence for top decile

hedge portfolios while Boyson (2008) tests for and finds two year persistence for top quintile portfolios formed on Fung and Hsieh (2004) alphas. Also, Capocci, Corhay and Hübner (2010) test for and find alpha persistence for one year throughout their sample period that includes both bull and bear markets. Top funds formed on the alpha and the information ratio appears to report larger improvements in performance than top funds formed on the Sharpe ratio and the EMPPM. Looking at the individual strategies, the alpha and especially the information ratio provide consistent evidence of performance persistence. Meanwhile, the Sharpe ratio and especially the EMPPM provides a more critical assessment of performance persistence as several individual strategies do not have statistically significant persistence in performance according to these performance measures.

The doubt ratio casts a shadow performance persistence. Top suspicious funds, which are funds formed on the fifth quintile of the doubt ratio, have significant excess doubt above similarly constructed mediocre third quintile suspicious funds two years later. The large difference in the doubt ratio between the fifth and third quintile funds suggests that top quintile doubtful funds are suspicious because the difference in the doubt ratio is greater than the 150 threshold suggested by Brown et al. (2010) for suspicious hedge fund returns. Looking at the individual strategies, we again see that several strategies have, to coin a phrase, persistent doubt, and similar to tables 2 and 3, no strategy has more persistently suspicious returns than the Managed Futures strategy.

Examining the sub-period results in the second and third panels, we see that almost all performance measures agree that top performing funds continue to outperform third quintile funds two years later in both the first and second half of the sample period. The exception is the EMPPM, which does not detect any statistically

significance persistence during the challenging economic conditions of the second half of the sample period. Most performance measures suggest that top funds outperform third quintile funds by a greater amount during the more robust economic conditions that prevailed in the first half of the sample period. The exception is alpha, which is higher in the second half of the sample period. Again however, the doubt ratio casts a shadow on these results as the doubt ratio shows evidence of persistence in suspicious returns as the difference between top and third quintile funds formed on the doubt ratio is far about the 150 threshold for suspicious performance in both sub-periods

Looking at the results by strategy, we see that top funds formed on the Sharpe ratio, alpha and the information ratio continue to persist in delivering top performance two years later in both sub periods. Similarly, doubts persist overall and in both periods for most individual strategies. However, the EMPPM finds that the top quintile funds formed on the EMPPM show performance persistence in the first period alone. Moreover, according to the EMPPM, most individual strategies, especially in the second half of the sample period, do not show any evidence of performance persistence two years later.

The later finding leads us to examine for how long performance persist according to the EMPPM. Table 5 reports the difference in performance between the fifth and third quintile of portfolios formed on the EMPPM three, six, twelve, eighteen and twenty four months after formation. The first panel reports performance persistence by time horizon for the overall sample period and the second and third panel report the same information for the two sub sample periods. With very few exceptions, performance persists for six months in the overall sample and in both sub periods. After twelve months however, many individual strategies no longer show

evidence of persistence in performance according to the EMPPM. This decrease in performance persistence is particularly evident in the second half of the sample. After eighteen months there is no evidence of statistically significant persistence in the second sub period. It would appear that the reason why the overall sample shows evidence of performance persistence after twelve months is due to the persistence that prevailed in the first half of the sample period.

<<Table 5 about here>>

In summary, we find that there is performance persistence in hedge funds. Performance persistence is strongest for the traditional measures of performance and this persistence continues for up to two years. Doubt also persists in that strategies that are doubtful to begin with continue to be doubtful two years later. Interestingly, the EMPPM is more critical, and is unable to detect persistence in performance after twelve months for strategies formed in the more challenging economic conditions that prevailed in the second half of the sample period, specifically for portfolios formed from January 31, 2006 until December 31, 2010.

4. Doubtful performance strategies?

We now use the doubt ratio to see if selecting top quintile portfolios on the basis of the previous month's Sharpe ratio, alpha and information ratio generates suspicious out of sample returns. As a control mechanism, we also use the doubt ratio to analyze top quintile funds as ranked by the EMPPM. As in section 3, new portfolios are formed each month, from January 31, 2001 until December 31, 2010 and are held for twenty-four months.

Table 6 is similar to table 3 except that we are employing the doubt ratio to evaluate the portfolios formed on the other four performance measures. The first panel

of Table 6 reports the doubt ratios of the out of sample top quintile funds by strategy for the overall period and the second panel reports the differences in the doubt ratio during the two sub periods.

<<Table 6 about here>>

The first panel reports that portfolios formed by selecting the prior month's top quintile Sharpe ratio, information ratio and EMPPM, have a doubt ratio that is larger than the 150 threshold for suspicious performance. Looking at the doubt ratio by strategy we find that about half of the portfolios formed on the Sharpe and Information ratios have a doubt ratio above 150, whereas only four and three portfolios have doubt ratios above 150 for portfolios formed on the alpha and EMPPM performance ratios respectively. Interestingly, there is a consensus that top performing Event Driven, Fixed Income Arbitrage and Managed Futures strategies have suspicious performance no matter which performance measure is used to form the portfolio. Clearly, this suggests that these strategies do involve some degree of hedging, or income smoothing, or both.

The second panel of Table 6 reports that top performing funds, as selected by all but the alpha measure of performance, return more suspicious performance during the more robust economic conditions that prevailed in the first half of the sample period. Moreover, for all performance measures, the majority of statistically significant differences in the doubt ratio for individual strategies are positive, thereby supporting the conclusion that performance was more suspicious in the first half of the sample period.

We now examine whether suspicious returns from top funds persist. Table 7 is similar to Table 4, except that the we are employing the doubt ratio to evaluate the portfolios formed using the other four performance measures. We measure persistence

in the doubt ratio by comparing the out of sample doubt ratio of portfolios formed on the fifth and third quintile according to the Sharpe ratio, the alpha, the information ratio and the EMPPM. The first panel reports the overall difference in the doubt ratios between the fifth and third quintiles by performance measure and by hedge fund strategy for 120 portfolios formed and held for two years from January 31, 2001 until December 31, 2010. The second and third panel reports the same information for the first and second half of the sample, with December 31, 2005 as the pivot date.

<<Table 7 about here>>

Clearly, doubts persist two years later for top quintile funds formed on the Sharpe and the information ratios but not, at least overall, for portfolios formed on the alpha and the EMPPM. All but the Dedicated Short Bias and Global Marco hedge fund strategies have a doubt ratio that is greater for top quintile portfolios than for mediocre performing funds that are formed on the Sharpe and information ratios and these extra doubts persist two years after the portfolio has been formed. In contrast, individual top performing strategies formed on the alpha and the EMPPM show much less excess doubt (over the mediocre third quintile performing strategies) that more rarely persists. Comparing the alpha and the EMPPM formed strategies it is clear that excess doubt and persistence in excess doubt is lower for EMPPM formed portfolios.

Looking at the second and third panels it is clear that the overall period results carry forward to the first and second half sub periods for top performing funds formed on the traditional performance measures. Specifically, top funds formed on the Sharpe and information ratios usually have an excess doubt ratio that persists two years after the portfolios have been formed while top performing funds formed on the alpha and especially the EMPPM have much less excess doubt and persistent doubt for both sub periods. Additionally, the EMPPM reveals an interesting exception. While overall and

in the first sub period there is no persistent doubt according to the EMPPM, there is a large and highly significant degree of persistent doubt for the Fixed Income Strategy during the more tumultuous second half of the sample period. Clearly, this suggests that hedge funds in this category adjusted their strategy in response to these challenging economic conditions.

In summary, we find that there is evidence that top performing hedge fund portfolios tend to have high doubt ratios no matter what performance measure is used to form top quintile portfolios. It is clear that top portfolios have more doubt in the more robust economic conditions that prevailed in the first half of the sample period. However, when looking at the persistence of doubt, we see that top performing funds formed on the Sharpe and information ratios usually have excess doubt which persists over mediocre performing funds. This suggests that when selecting funds according to the ranking by the Sharpe and the information ratio, investors are also selecting funds that have suspicious returns. In contrast, portfolios formed on the alpha and the EMPPM has much less excess doubt that more rarely persist.

5. Summary and conclusions

In response to the questions raised in the introduction, we find that indeed by all measures of performance, top quintile funds are able to deliver persistent superior performance out of sample. However, the magnitude of this performance is more modest than has been reported in the literature by other authors. Moreover, the EMPPM reports even more modest and less persistent superior performance. The EMPPM finds persistence of no longer than twelve months during the more recent challenging economic conditions rather than the two years of persistence observed based on top quintile portfolios formed on traditional performance measures of

performance. Conclusions vary depending on which performance measure is used to form the top quintile portfolios. For example, top quintile funds formed on the Sharpe ratio, alpha and information ratio perform better on average in the robust economic conditions that prevailed in the first half of the sample period while most top quintile portfolios formed on EMPPM performed better in the more exacting recessionary and slow growth conditions that prevailed in the second half of the sample period.

It is clear that top performing funds tend to have high doubt ratios, particularly during the first half of the sample period regardless of the performance measure that is employed to select the top quintile funds. However, when looking at the persistence of doubt, we see that top performing funds formed on the Sharpe and information ratios generally exhibit excess doubt over mediocre performing funds and this doubt persists over time. This suggests that when selecting funds according to the ranking by Sharpe and information ratio, investors are also selecting funds that have persistently suspicious returns. In contrast, portfolios formed on the alpha and especially the EMPPM has much less excess doubt that more rarely persist.

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Table 1*Summary of the Sample of Hedge Funds*

The table reports the basic sample statistics and the performance of hedge funds from January 31, 2001 until December 31, 2012. Statistics are compiled only from the date that they were listed in the TASS database. All returns are in percent. SR is the Sharpe ratio, Alpha is estimated from an eight factor version of the Fung and Hsieh (2004) model, IR is the information ratio, EMPPM is the excess manipulation proof performance measure of Goetzmann et al. (2007) and DR is the doubt ratio of Brown et al. (2010). EMPPM reveals the monthly excess risk adjusted return above the corresponding Russell 2000 return.

<i>Strategy</i>	<i>Number</i>	<i>Assets</i>	<i>Age</i>	<i>Rf</i>	<i>RoR</i>	<i>SR</i>	<i>Alpha</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
Convertible Arbitrage	124	\$251.47	6.44	0.18	0.32	0.45	0.15	1.49	-0.02	868.21
Dedicated Short Bias	24	\$25.73	6.05	0.17	-0.08	-0.06	0.15	0.68	-0.07	-4.69
Emerging Markets	417	\$196.34	5.94	0.10	0.59	0.18	0.26	0.77	0.00	78.25
Equity Market Neutral	182	\$170.66	5.79	0.15	0.36	0.25	0.25	1.20	-0.03	531.01
Event Driven	347	\$375.06	6.67	0.15	0.48	0.30	0.28	1.45	0.04	148.10
Fixed Income Arbitrage	114	\$302.15	6.29	0.17	0.37	0.69	0.31	2.89	0.01	1321.50
Fund of Funds	1273	\$206.00	5.97	0.12	0.12	0.10	-0.02	0.10	0.01	42.92
Global Macro	158	\$550.54	5.89	0.13	0.42	-1.03	0.31	0.66	0.04	-183.48
Long/Short Equity Hedge	1265	\$155.44	6.27	0.14	0.44	0.10	0.14	0.30	0.01	-51.59
Managed Futures	295	\$257.77	6.43	0.12	0.56	0.26	0.58	1.17	0.01	841.68
Multi-Strategy	266	\$437.17	5.86	0.12	0.43	0.23	0.27	1.23	0.03	72.38
Options Strategy	12	\$92.53	7.70	0.13	0.55	0.48	0.36	2.57	0.06	658.53
Other	123	\$273.05	5.74	0.11	0.60	0.41	0.49	2.23	0.04	302.45
Grand Total	4600	\$238.48	6.14	0.13	0.37	0.15	0.18	0.70	0.01	161.20
Live Funds	1922	\$185.27	3.01	0.10	0.91	0.34	0.30	0.95	0.02	108.83
Dead Funds	2678	\$239.02	8.27	0.13	0.37	0.14	0.18	0.70	0.01	161.77

Assets are in millions, age is in years, returns are in basis points per month and returns are net of fees

Table 2
In Sample Performance

Using perfect foresight, each portfolio is formed monthly from the top quintile funds according to the performance measure depicted in the heading of the column. Portfolios are held for one month from January 31, 2001 until December 31, 2012. Sharpe is the Sharpe ratio, ALPHA is the alpha from the Fung and Hsieh (2004) 8 factor model, IR is in information ratio, EMPPM is the excess (over the Russell 2000 index return) manipulation proof performance measure and DR is the doubt ratio. Alphas and EMPPM are in percent. The first half consists of portfolios formed from January 31, 2001 until December 31, 2006 and the second half consists of portfolios formed from January 1, 2007 until December 31, 2012. A two tailed T-test for differences in the means of first and second period performance measures are conducted via a bootstrap simulation.

<i>Strategy</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
<i>January 31, 2001 to December 31, 2012</i>					
Convertible Arbitrage	3.25	0.98	6.85	0.19	7214.39
Dedicated Short Bias	1.36	1.05	2.82	0.34	48.52
Emerging Markets	1.48	1.42	3.89	0.25	605.84
Equity Market Neutral	1.70	1.23	4.72	0.20	4108.23
Event Driven	1.57	1.12	4.03	0.19	492.27
Fixed Income Arbitrage	2.55	1.07	6.64	0.24	2943.52
Fund of Funds	1.35	1.16	3.38	0.21	188.80
Global Macro	1.44	1.29	2.86	0.23	153.36
Long/Short Equity Hedge	1.40	1.25	3.12	0.22	169.36
Managed Futures	4.06	1.59	10.08	0.24	21117.66
Multi-Strategy	1.49	1.09	3.65	0.21	226.23
Average	1.62	1.29	4.09	0.23	991.35
<i>First Half less Second half</i>					
Convertible Arbitrage	2.82***	0.18***	3.79***	-0.01	9944.18***
Dedicated Short Bias	-0.13	-0.05***	-0.30	-0.05***	113.78***
Emerging Markets	0.06	0.50***	0.66***	-0.03**	-759.21***
Equity Market Neutral	0.21***	0.25***	2.08***	-0.04***	7022.01***
Event Driven	0.11**	0.28***	1.31***	-0.06***	-218.02
Fixed Income Arbitrage	-0.99***	-0.05***	-1.66	-0.03	-2794.13***
Fund of Funds	0.26***	0.10***	1.47***	-0.05***	115.32***
Global Macro	0.18***	-0.04***	0.52***	-0.07***	56.68***
Long/Short Equity Hedge	0.18***	0.23***	1.04***	-0.04***	72.41***
Managed Futures	2.78***	0.15***	13.95***	-0.09***	21334.15***
Multi-Strategy	0.25***	-0.10***	1.15***	-0.09***	150.38***
Average	0.25***	0.18***	1.56***	-0.05***	558.92

***, ** Significant at the 1% and 5% respectively

Table 3*Out of Sample Performance*

Each equally weighted portfolio is formed from the previous month's top quintile funds. These portfolios are formed monthly from January 31, 2001 until December 31, 2010 and is held for twenty-four months. The performance ratios are as defined in Table 2. The first half consists of portfolios formed from January 31, 2001 until December 31, 2005 and the second half consists of portfolios formed from January 1, 2006 until December 31, 2010. A two tailed T-test for differences in the means of first and second period performance measures are conducted via a bootstrap simulation.

<i>Strategy</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
<i>January 31, 2001 to December 31, 2010</i>					
Convertible Arbitrage	0.68	0.38	3.49	-0.04	2285.90
Dedicated Short Bias	-0.18	0.22	1.19	-0.28	-14.24
Emerging Markets	0.35	0.63	3.69	0.05	363.28
Equity Market Neutral	0.39	0.80	3.96	0.01	3666.49
Event Driven	0.52	0.54	2.81	0.04	340.12
Fixed Income Arbitrage	1.41	0.55	4.75	-0.04	2195.22
Fund of Funds	0.21	0.38	1.36	0.00	106.56
Global Macro	0.24	0.74	2.32	0.05	13.99
Long/Short Equity Hedge	0.15	0.31	1.24	0.00	44.16
Managed Futures	3.89	0.95	11.97	0.08	26956.67
Multi-Strategy	0.28	0.34	1.98	0.00	128.88
Average	0.40	0.54	2.35	0.01	967.84
<i>First Half less Second half</i>					
	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
Convertible Arbitrage	0.61 ^{***}	0.18 ^{***}	1.16 ^{***}	0.03 ^{**}	2681.53 ^{***}
Dedicated Short Bias	0.40 ^{***}	-0.02 ^{***}	0.61	0.13 ^{***}	14.24
Emerging Markets	0.35 ^{***}	0.01 ^{***}	1.20 ^{***}	0.15 ^{***}	-453.34 ^{***}
Equity Market Neutral	0.46 ^{***}	0.16 ^{***}	2.55 ^{***}	-0.12 ^{**}	7013.00 ^{***}
Event Driven	0.58 ^{***}	0.26 ^{***}	2.03 ^{***}	-0.03 ^{***}	201.89 ^{***}
Fixed Income Arbitrage	-0.36 ^{**}	-0.25 ^{***}	-2.12 ^{***}	-0.23 ^{***}	-905.53 ^{***}
Fund of Funds	0.54 ^{***}	-0.08 ^{**}	1.61 ^{**}	0.01 ^{**}	175.71 ^{**}
Global Macro	0.28 ^{**}	-0.74 ^{***}	0.58 ^{***}	-0.07 ^{**}	-24.70 ^{**}
Long/Short Equity Hedge	0.33 ^{***}	-0.05 ^{***}	0.56 ^{***}	0.00	76.41 ^{**}
Managed Futures	4.45 ^{***}	-0.50 ^{***}	19.24 ^{***}	-0.09 ^{***}	20327.98 ^{***}
Multi-Strategy	0.35 ^{***}	-0.39 ^{***}	0.54 ^{***}	-0.04 ^{***}	167.81 ^{***}
Average	0.46 ^{***}	-0.13 ^{***}	1.40 ^{***}	0.01 ^{**}	775.25 ^{***}

^{***}, ^{**} Significant at the 1% and 5% respectively

Table 4
Performance Persistence

Each original portfolio is formed monthly from January 31, 2001 until December 31, 2010 and the performance of these portfolios is sorted by quintile and strategy. Portfolios are then formed on the first and third quintile by performance measure and are held for twenty-four months. The difference between the out of sample performance of the first and the third quintile are reported below. All performance measures are defined in Table 2. A one tailed T-test for differences in the means of the first and third quintile performance measures are conducted via a bootstrap.

<i>January 31, 2001 to December 31, 2010</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
Convertible Arbitrage	0.54***	0.28***	2.90***	-0.04	2248.34***
Dedicated Short Bias	-0.01	-0.01	0.50***	-0.35	5.81
Emerging Markets	0.13***	0.53***	3.32***	0.02	343.35***
Equity Market Neutral	0.07	0.64***	3.30***	0.81**	3632.09***
Event Driven	0.20***	0.32***	1.89***	0.01	273.03***
Fixed Income Arbitrage	1.12***	0.49***	3.91***	-0.03	2201.15***
Fund of Funds	-0.01	0.36***	1.21***	-0.01	63.58
Global Macro	0.11**	0.56***	1.71***	0.02	-2.06
Long/Short Equity Hedge	-0.01	0.26***	1.09***	-0.01	25.98
Managed Futures	3.55***	0.58***	11.13***	0.03***	26943.67***
Multi-Strategy	0.01	0.16***	1.30***	-0.03	84.92
Average	0.19***	0.43***	1.93***	0.03**	938.81***
<i>January 31, 2001 to December 31, 2005</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
Convertible Arbitrage	0.74***	0.45***	3.55***	0.00	3542.26***
Dedicated Short Bias	-0.15	0.16***	1.28***	-0.18	26.22
Emerging Markets	0.12***	0.64***	3.58***	0.10***	91.77***
Equity Market Neutral	0.17**	0.72***	4.69***	0.01**	7205.81***
Event Driven	0.34***	0.43***	2.77***	0.05***	346.61***
Fixed Income Arbitrage	0.89***	0.20***	1.64***	-0.09	1834.52***
Fund of Funds	0.05**	0.28***	2.05***	0.03***	125.33***
Global Macro	0.23***	0.28***	2.15***	0.05***	-18.55
Long/Short Equity Hedge	0.02	0.26***	1.39***	0.02***	54.02
Managed Futures	5.88***	0.40***	21.39***	0.08***	37411.03***
Multi-Strategy	0.11***	-0.02	1.64***	0.01***	146.09***
Average	0.27***	0.35***	2.63***	0.05***	1313.62***
<i>January 31, 2006 to December 31, 2010</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>	<i>DR</i>
Convertible Arbitrage	0.31***	0.11***	2.26***	-0.09	853.23***
Dedicated Short Bias	0.05	-0.26	-0.10**	-0.57	-2.63
Emerging Markets	0.14***	0.87***	3.11***	-0.06	561.81***
Equity Market Neutral	-0.02	0.57***	1.93***	1.57***	177.98***
Event Driven	0.06**	0.20***	1.01***	-0.03	198.08***
Fixed Income Arbitrage	1.35***	0.77***	5.97***	0.02	2585.69***
Fund of Funds	-0.07	0.43***	0.37***	-0.05	1.84
Global Macro	0.01	0.84***	1.34***	0.00	11.80**
Long/Short Equity Hedge	-0.04	0.26***	0.80***	-0.05	-2.06
Managed Futures	1.50***	0.76***	1.78***	0.01**	17080.31***
Multi-Strategy	-0.09	0.33***	0.95***	-0.07	22.61***
Average	0.10***	0.51***	1.24***	0.02	564.01***

***, ** Significant at the 1% and 5% respectively

Table 5*Performance Persistence of the EMPPM*

Each portfolio is formed monthly from January 31, 2001 until December 31, 2010 and the in sample performance of these portfolios is sorted by quintile and strategy. The out of sample performance of the original first and third quintile portfolios by strategy is then measured three, six, twelve, eighteen and twenty-four months. Then the difference between the out of sample performance of the first and the third quintile are reported below. A one tailed T-test for differences in the means of the first and third quintile performance measures are conducted via a bootstrap.

<i>January 31, 2001 to December 31, 2010</i>	<i>3m</i>	<i>6m</i>	<i>12m</i>	<i>18m</i>	<i>24m</i>
Convertible Arbitrage	0.11***	0.04***	0.03***	0.03	-0.04
Dedicated Short Bias	0.29***	0.26	0.03	-0.11	-0.35
Emerging Markets	0.18***	0.13***	0.05***	0.03***	0.02
Equity Market Neutral	0.00	0.11***	0.46***	0.53***	0.81**
Event Driven	0.13***	0.08***	0.01***	0.00	0.01
Fixed Income Arbitrage	0.22***	0.17***	0.01	-0.06	-0.03
Fund of Funds	0.14***	0.09***	0.02***	0.01	-0.01
Global Macro	0.16***	0.10***	0.02***	0.03***	0.02
Long/Short Equity Hedge	0.14***	0.10***	0.01***	0.00	-0.01
Managed Futures	0.17***	0.07***	-0.06	0.01	0.03***
Multi-Strategy	0.14***	0.10***	0.03***	-0.01	-0.03
Average	0.14***	0.10***	0.04***	0.05***	0.03**
<i>January 31, 2001 to December 31, 2005</i>					
Convertible Arbitrage	0.16***	0.12***	0.07***	0.07***	0.00
Dedicated Short Bias	0.18***	0.15***	0.03	0.05	-0.18
Emerging Markets	0.17***	0.15***	0.10***	0.11***	0.10***
Equity Market Neutral	0.14***	0.09***	0.00	-0.05	0.01**
Event Driven	0.12***	0.09***	0.04***	0.04***	0.05***
Fixed Income Arbitrage	0.21***	0.15***	-0.03	-0.15	-0.09
Fund of Funds	0.14***	0.10***	0.05***	0.05***	0.03***
Global Macro	0.15***	0.07***	0.01**	0.06***	0.05***
Long/Short Equity Hedge	0.14***	0.11***	0.04***	0.03***	0.02***
Managed Futures	0.16***	0.06	-0.06	0.06***	0.08***
Multi-Strategy	0.10***	0.08***	0.02***	0.00	0.01***
Average	0.14***	0.10***	0.04***	0.05***	0.05***
<i>January 31, 2006 to December 31, 2010</i>					
Convertible Arbitrage	0.06***	0.04***	-0.01	-0.01	-0.09
Dedicated Short Bias	0.41***	0.36	-0.21	-0.43	-0.57
Emerging Markets	0.18***	0.11**	0.01	-0.04	-0.06
Equity Market Neutral	-0.12	0.12***	0.90***	1.09***	1.57***
Event Driven	0.14***	0.08***	-0.02	-0.05	-0.03
Fixed Income Arbitrage	0.23***	0.18***	0.03	0.02	0.02
Fund of Funds	0.14***	0.08***	0.00	-0.04	-0.05
Global Macro	0.16***	0.11***	0.03***	0.00	0.00
Long/Short Equity Hedge	0.14***	0.09***	-0.01	-0.03	-0.05
Managed Futures	0.19***	0.10**	-0.04	-0.01	0.01**
Multi-Strategy	0.17***	0.12***	0.03***	-0.02	-0.07
Average	0.14***	0.11***	0.03***	-0.01	0.02

***, ** Significant at the 1% and 5% respectively

Table 6
Doubtful Performance

Each equally weighted portfolio is formed from the previous month's top quintile funds. These portfolios are formed monthly according to the top quintile candidate measure of performance from January 31, 2001 until December 31, 2010 and is held for twenty-four months. The doubt ratios of these funds are then measured as reported and reported in this table. The first half consists of portfolios formed from January 31, 2001 until December 31, 2005 and the second half consists of portfolios formed from January 1, 2006 until December 31, 2010. A two tailed T-test for differences in the means of first and second period performance measures are conducted via a bootstrap simulation.

<i>January 31, 2001 to December 31, 2010</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>
Convertible Arbitrage	2616.11	948.41	2267.32	104.64
Dedicated Short Bias	-9.18	-2.05	-3.23	-20.65
Emerging Markets	250.15	0.19	246.12	46.00
Equity Market Neutral	3431.50	123.18	3553.17	92.09
Event Driven	313.83	189.54	289.97	201.88
Fixed Income Arbitrage	2590.66	352.86	1764.10	975.49
Fund of Funds	76.66	35.76	102.86	41.21
Global Macro	16.18	30.10	16.23	17.40
Long/Short Equity Hedge	19.42	9.42	30.58	18.46
Managed Futures	18730.92	444.05	14853.42	2453.94
Multi-Strategy	99.89	72.75	120.34	71.89
Average	823.48	108.76	820.98	255.25
<i>Compare 2001 to 2005 with 2006 to 2012</i>				
Convertible Arbitrage	3135.64 ^{***}	-116.80	1919.79 ^{***}	107.84 ^{***}
Dedicated Short Bias	-0.04	-8.68 ^{**}	-2.29 ^{**}	-7.52 ^{***}
Emerging Markets	-387.52 ^{***}	86.77 ^{***}	-266.46 ^{***}	24.27 ^{***}
Equity Market Neutral	6545.77 ^{***}	68.39 ^{***}	6515.44 ^{***}	21.02 ^{**}
Event Driven	222.81 ^{***}	-58.10 ^{**}	201.74 ^{***}	-37.14
Fixed Income Arbitrage	-1473.89 ^{***}	-40.98 ^{***}	-1108.81 ^{***}	-1515.80 ^{**}
Fund of Funds	106.15 ^{***}	43.88 ^{***}	153.76 ^{***}	67.87 ^{***}
Global Macro	9.40 ^{***}	36.03 ^{***}	4.92	16.98 ^{***}
Long/Short Equity Hedge	40.78 ^{***}	43.08 ^{***}	80.42 ^{***}	26.87 ^{***}
Managed Futures	21737.66 ^{***}	284.54 ^{**}	29950.85 ^{***}	4219.03 ^{***}
Multi-Strategy	105.50 ^{***}	49.83 ^{***}	132.41 ^{***}	82.82 ^{***}
Average	512.43 ^{***}	19.48	899.39 ^{***}	140.55 ^{***}

^{***}, ^{**} Significant at the 1% and 5% respectively

Table 7
Persistent Doubt

Each portfolio is formed monthly from January 31, 2001 until December 31, 2010 and the in sample performance of these portfolios is sorted by quintile and strategy. The out of sample performance of the original first and third quintile portfolios by strategy is then measured two years later. Then the difference between the out of sample performance of the first and the third quintile are reported below. All performance measures are defined in Table 3. A one tailed T-test for differences in the means of the first and third quintile performance measures are conducted via a bootstrap.

<i>January 31, 2001 to December 31, 2010</i>	<i>Sharpe</i>	<i>ALPHA</i>	<i>IR</i>	<i>EMPPM</i>
Convertible Arbitrage	2555.46 ^{***}	903.10 ^{***}	2203.66 ^{***}	-1396.52
Dedicated Short Bias	-0.90	2.33	4.31	-16.50
Emerging Markets	221.39 ^{***}	-44.05	220.65 ^{***}	-89.05
Equity Market Neutral	2053.48 ^{***}	-1282.61	3521.59 ^{***}	-3021.56
Event Driven	214.15 ^{***}	62.23 ^{***}	224.36 ^{***}	58.28 ^{***}
Fixed Income Arbitrage	2413.68 ^{***}	-587.14	1607.29 ^{***}	49.12
Fund of Funds	12.57 ^{***}	-46.79	49.29 ^{***}	-35.19
Global Macro	2.36	21.51 ^{***}	1.34	-1.73
Long/Short Equity Hedge	16.47 ^{**}	1.79	23.95 ^{***}	-9.01
Managed Futures	18656.62 ^{***}	-8553.14	14524.42 ^{***}	-357.04
Multi-Strategy	12.95 ^{**}	-32.08	52.47 ^{***}	-16.37
Average	733.12 ^{***}	-197.83	755.99 ^{***}	-65.97
<i>January 31, 2001 to December 31, 2005</i>				
Convertible Arbitrage	4060.70 ^{***}	820.47 ^{***}	3123.77 ^{***}	-2236.86
Dedicated Short Bias	-4.58	8.24	13.38	-18.64
Emerging Markets	15.13 ^{***}	-8.04	67.32 ^{***}	13.37 ^{***}
Equity Market Neutral	4083.54 ^{***}	-2513.98	6763.99 ^{***}	-6119.97
Event Driven	273.59 ^{***}	-58.17	292.52 ^{***}	-20.69
Fixed Income Arbitrage	1549.07 ^{***}	-1334.04	939.60 ^{***}	-898.70
Fund of Funds	23.40 ^{***}	-72.91	99.57 ^{***}	-45.86
Global Macro	9.20 ^{***}	44.80 ^{***}	2.18	1.82
Long/Short Equity Hedge	6.54 ^{***}	-9.69	39.66 ^{***}	-9.38
Managed Futures	30155.05 ^{***}	-15713.59	31174.34 ^{***}	531.87
Multi-Strategy	3.04	-79.26	80.92 ^{***}	-32.95
Average	917.75 ^{***}	-391.10	1213.17 ^{***}	-134.60
<i>January 31, 2006 to December 31, 2010</i>				
Convertible Arbitrage	938.13 ^{***}	984.35 ^{***}	1279.58 ^{***}	-517.91
Dedicated Short Bias	1.78 ^{**}	-10.57	-10.40	-16.04
Emerging Markets	421.08 ^{***}	-80.06	357.48 ^{***}	-191.48
Equity Market Neutral	56.53	-171.24	279.19 ^{***}	25.96 ^{***}
Event Driven	154.71 ^{***}	182.62 ^{***}	156.21 ^{***}	137.25 ^{***}
Fixed Income Arbitrage	3242.83 ^{***}	235.39	2262.67 ^{***}	1055.73 ^{***}
Fund of Funds	1.73	-20.67	-0.99	-24.53
Global Macro	-3.93	-1.53	1.48	-5.63
Long/Short Equity Hedge	26.40 ^{***}	13.27 ^{***}	8.24 ^{***}	-8.64
Managed Futures	8314.75 ^{***}	-1636.12	618.17 ^{**}	-1419.75
Multi-Strategy	22.85 ^{***}	15.10 ^{***}	22.76 ^{***}	0.91
Average	548.50 ^{***}	-4.56	298.81 ^{***}	2.66

^{***}, ^{**} Significant at the 1% and 5% respectively

Figure 1: EMPPM3 by Quintile and Out of Sample Month

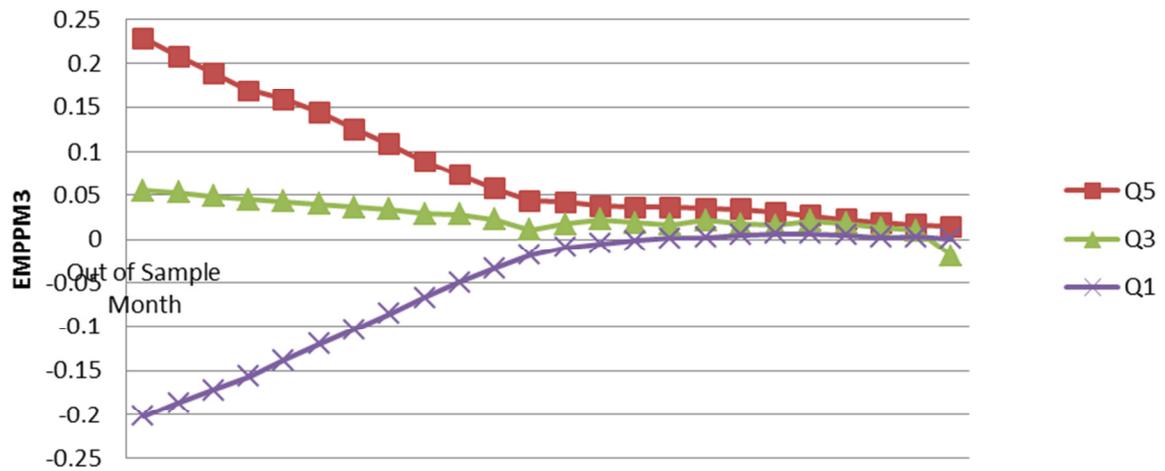


Figure 2: Number of Hedge Funds by Quintile and Out of Sample Month

