2. Persistence of Hedge Funds

2.1 Introduction

The persistence of hedge fund performance has been a subject of much debate in the academic literature. The literature on fund performance persistence dates back to the emergence of the mutual fund industry. Sirri and Tufano (1998) study the flow of funds into and out of mutual funds. They find that investors base their fund selection procedure on the fund's prior performance – they invest in the previous year's best performers and withdraw money from the previous year's losers. Capon et al. (1996) analyze the selection criteria of 3,386 mutual fund investors and find that previous performance is the most important selection criteria employed.

Research on performance persistence essentially deals with one question: "Do some hedge fund managers achieve consistently higher returns than their competitors?". This is an important question from the perspective of hedge fund investors, who constantly face selection problems when trying to choose hedge funds in which to invest. Capocci et al. (2005) note, that if performance in hedge fund returns persists, active selection is likely to increase the expected return because one superior average return period is likely to be followed by another superior average return period. In other words, one can regard the measure of performance persistence as a quantitative characteristic of the hedge fund manager's selection process.

Certain characteristics of hedge funds make them an ideal subject for studies of performance persistence in the money management sector. Unlike traditional mutual fund managers, who are limited in terms of the investment strategies at their disposal, hedge fund managers have more flexibility and freedom when it comes to investment decisions and thus have a better chance at displaying their skills.

This chapter looks at the period 2000 to 2010 and investigates whether some Asia-focused hedge fund managers deliver consistently higher returns than their competitors. More specifically, I analyze whether the returns of Asia-focused hedge funds persist at a yearly horizon. In addition to investigating performance persistence over the full sample period, I break the sample into two sub-periods and investigate performance persistence in different market environments. These sub-periods are the same as those used in the Chapter 5: January 2000 to January2007 and February 2007 to December 2010. Therefore, this chapter

investigates Asia-focused hedge fund performance persistence during a period that encompasses both a bullish market (2000 to 2007) and a bearish market (2007 to 2010).

Koh et al. (2003) merge the Eurekahedge and AsiaHedge databases to study the performance persistence of Asia-focused hedge funds from 1999 through 2003. On the basis of nonparametric statistical methods, including a contingency table based test for single-period persistence and a Kolmogorov-Smirnov statistic for a multi-period persistence test, Koh et al. (2003) examine the period from January 1999 until March 2003 and find that Asia-focused hedge funds exhibit persistence in performance at monthly and quarterly horizons but not at the annual horizon. This chapter expands Koh et al.'s (2003) work on hedge fund performance persistence by analyzing Asia-focused hedge funds over a longer investigation period that encompasses both market upswings and market declines. Furthermore, unlike Koh et al. (2003), who use non-parametric methods to investigate hedge fund performance, this dissertation applies a parametric, regression-based framework to analyze performance persistence. In this regard, this study is similar to Capocci et al. (2005), who use the MAR database to analyze the persistence of hedge fund performance during a period that includes both an improving and a declining market. The authors document that most of the predictability of superior performance is to be found during the bull market period. Furthermore, they find limited evidence of performance persistence among average performers.

The rest of this chapter is structured as follows. I begin by presenting extant academic literature on performance persistence. The data set and the methodology are then described before the results are presented and discussed.

2.2 Literature Review

Academic research into the persistence of hedge fund performance is a relatively recent phenomenon, with the first articles on this topic published near the end of 1990s. However, the issue of performance persistence has been widely researched in the context of mutual funds and the results of the main performance persistence studies of mutual funds are relevant in the current context.

Hendricks et al. (1993) study quarterly return data from a sample of open-ended mutual funds covering the period 1974 to 1988 and demonstrate that mutual fund performance exhibits persistence over a short-term horizon of one to three years. They attribute this

persistence to “hot hands” or common investment strategies. Brown and Goetzmann (1995) investigate mutual fund performance persistence using a data sample from 1977 until 1989 and find that the relative risk-adjusted performance of mutual funds persists. However, they also find that such persistence is mostly due to funds that lag the S&P 500 index. Grinblatt and Titman (1992) study mutual fund data over the 1975 to 1984 period and find evidence of performance persistence over a longer horizon (five years). The authors attribute this persistence in returns to managerial skill. Finally, Carhart (1997) investigates mutual fund performance persistence using a sample that covers the period 1962 until 1993. He finds that common factors in stock returns and investment expenses explain persistence in mutual funds’ returns. Furthermore, Carhart (1997) finds that the strongest unexplained persistence among the worst mutual fund performers. In summary, most studies on performance persistence among mutual funds confirm that, on average, mutual funds have inferior performance to passive investment strategies and they find only limited evidence of performance persistence.

Some authors acknowledge that the situation might be different in terms of hedge fund performance persistence. Agarwal and Naik (2000) note that mutual fund managers who successfully outperform passive investment strategies tend to switch into the hedge fund industry. Consequently, the hedge fund arena may be better suited for measurements of performance persistence. Brown et al. (1999) conduct one of the first studies on performance persistence in hedge funds, using the US Offshore Funds Directory over the period 1989 through 1995. They find no performance persistence at the yearly horizon. Agarwal and Naik (2000) use both the traditional two-period framework as well as a multi-period framework (a Kolmogorov-Smirnov test) to study hedge fund performance persistence, and they find persistence to be strongest at the quarterly horizons. Brown and Goetzmann (2003) use the TASS database to study persistence of returns for the period 1989 to 1999. They find no persistence at the yearly horizon. Similarly, Capocci et al. (2005) use the MAR database to investigate hedge fund performance at the yearly horizon over the period 1994 to 2002, a period that includes both bullish and bearish market environments. Furthermore, in the second sub-period, which is characterized by a bearish market environment, the authors find only negative persistence among past losers, suggesting that poor performance is a decisive factor in hedge fund attrition.

Edwards and Caglayan (2001) use the MAR database to study hedge fund performance over the period 1990 to 1998. The authors investigate performance persistence at yearly and bi-yearly horizons using alphas obtained from a six-factor model as a measure of performance, and they apply both parametric and non-parametric statistical tests. The authors find evidence of significant persistence among both winners and losers. Baquero et al. (2005) investigate hedge fund performance persistence in raw returns and find evidence of positive performance persistence at quarterly horizons, especially for the four best deciles. They also find evidence of positive persistence at the annual horizon, although it is statistically insignificant. Kosowski et al. (2007) use bootstrap and Bayesian methods to investigate the persistence of hedge fund performance. The authors rely on the union of the TASS, HFR, CISDM, and MSCI datasets, which provides them with the data for 9,338 hedge funds.[12] They find that the best hedge fund performance cannot be explained by luck and that hedge fund performance persists at the annual horizon.

Sy et al. (2007) use the Eurekahedge database to investigate the performance persistence of 206 Asia-focused long/short equity hedge funds over the period January 2004 to June 2006. They perform performance persistence tests on quarterly raw returns, and use both parametric (regression-based) and non-parametric methods (contingency table) methods. Furthermore, they expand the two independent binomials contingency table into a multinomial contingency table. They find that the independent binomials and the regression analyses show significant evidence of persistence in performance over two consecutive periods. They also find that the persistence in the performance of Asia-focused long/short hedge funds decreases in the third and fourth quarters when compared to performance in the first quarter. Hence, they conclude that although investors can make their investment decisions for the second quarter based on the hedge fund's performance in the first quarter, the fund's performance in the first quarter alone will not provide enough information to predict its performance in the third or fourth quarters.

Boyson (2008) uses the TASS data set for the period 1994 to 2004 to investigate the persistence of hedge fund performance. She finds that a portfolio of young, small, good past performers outperforms a portfolio of old, large, poor past performers by 9.6 percentage points annually. Koh et al. (2003) investigate hedge fund performance persistence using cross-product ratio, chi square and Kolmogorov-Smirnov tests. They find persistence at the monthly and quarterly horizons, but not at the annual horizon.

[12] After various adjustments, the number of hedge funds decreases to 5,544.

Jagannathan et al. (2010) estimate hedge fund performance persistence by comparing the alphas over the 3 year horizons. The authors control for the measurement errors in alphas by applying both weighted least squares approach and a generalized method of moments estimation model. The authors find strong evidence of performance persistence among top hedge funds while they find little evidence of persistence among bottom funds.

Finally, Eling (2009) conducts an extensive literature review on the persistence of hedge fund performance and documents that nearly all studies find short-term (up to six months) persistence and that the significance of persistence decreases with the length of time horizon. Furthermore, he finds that the studies come to conflicting conclusions regarding longer horizons. Eight studies document performance persistence at the annual horizon, while ten studies find no persistence at that horizon. Several authors offer various theories for the occurrence of performance persistence. Getmansky et al. (2004) attribute short-term hedge fund persistence to the illiquidity induced by the type of assets in which hedge funds often invest. For an extensive examination of the literature on the persistence in hedge fund performance, see the updated version of Eling's (2009) literature review in Table 6.1. As this literature review highlights, research on persistence in hedge fund returns has produced conflicting results and there is no consensus on this issue among *academics*.

Table 6.1 Literature review of studies on hedge fund performance persistence

Authors	Database	Nr. Of funds	Investigation period	Time horizon (in months)	Performance measure	Persistence measure	Results
Agarwal, Daniel and Naik (2009)	CISDM, HFR, MSCI, and TASS	7,535	1994–2002	12	Return	Chi-square, regression	Persistence at yearly horizon
Agarwal and Naik (2000)	HFR	746	1982–1998	3,6,12	Alpha, appraisal ratio	Cross-product ratio, chi-square, regression, Kolmogorov-Smirnov	Persistence at quarterly horizon
Agarwal and Naik (2000c)	HFR	167	1995–1998	3	Alpha, appraisal ratio	Cross-product ratio, regression	Persistence at quarterly horizon
Amenc et al., 2003	CSFB/Tremont indices	9	1994–2000	1	Return	Regression	Persistence at monthly horizon
Ammann et al., 2010	TASS and CISDM	4,311	1994–2008	6,12,24,36	Alpha, returns	Regression	Persistence up to 36m horizon
Baquero et al., 2005	TASS	1,797	1994–2000	3,12,24	Return, alpha	Descriptive comparison of rankings	Persistence at quarterly and yearly horizons, but not at two-year horizon
Bares et al., 2003	Financial Risk Management	4,934	1992–2000	1,3,6,12		Descriptive comparison of rankings	Persistence at monthly and quarterly horizons
Boyson and Cooper, 2004	TASS	1,659	1994–2000	3	Alpha	Regression	Persistence at quarterly horizon
Brown and Goetzmann, 2003	TASS	1,295	1992–1998	12	Return	Regression	No persistence at yearly horizon
Brown et al., 1999	US Offshore Funds Directory	399	1989–1995	12	Return, alpha, appraisal ratio	Regression	No persistence at yearly horizon
Capocci et al., 2005	MAR	2,894	1994–2002	12	Alpha	Regression	No persistence at yearly horizon
Capocci and Huebner, 2004	HFR, MAR	2,796	1988–1995	12	Alpha	Regression	No persistence at yearly horizon
Chen and Passow, 2003	TASS, HFR	76	1990–2002	12	Alpha	Regression	No persistence at yearly horizon
De Souza and Gokcan, 2004	HFR	314	1997–2002	24, 36	Return, standard deviation, Sharpe ratio	Cross-product ratio, regression,	No persistence at two- and three-year horizons with returns, but persistence with risk
Edwards and Caglayan, 2001	MAR	1,665	1990–1998	12, 24	Alpha	Cross-product ratio, regression	Persistence at one- and two-year horizons
Eling, 2009	CISDM	4,314	1996–2005	1, 2, 3, 6, 12, 24	Return, Sharpe ratio, alpha, appraisal ratio	Cross-product ratio, chi-square, rank information coefficient, Spearman, regression, Hurst, Kolmogorov/Smirnov	Persistence at monthly, two-monthly, quarterly, and half-yearly horizons
Gregoriou and Rouah, 2001	Zurich/LaPorte	n/a	1988–1999	12	Alpha	Descriptive comparison of rankings	No persistence at yearly horizon
Harri and Brorsen, 2004	LaPorte	1,209	1977–1998	1, 2, 3, . . . to 24	Return, information ratio, Sharpe ratio, alpha	Spearman, regression	Persistence at all horizons
Henn and Meier, 2005	Eurekahedge	1,217	1994–2004	1, 3, 12	Return	Cross-product ratio	Persistence at monthly, quarterly, and yearly horizons
Herzberg and Mozes, 2003	HedgeFund.net, Altvest, Spring, and Mountain Capital	3,300	1995–2001	12	Return, Sharpe ratio, max. draw, standard deviation, correlation	Rank information coefficient	No persistence at yearly horizon with returns, but persistence with risk
Jagannathan et al., 2010	HFR	1,755	1996–2005	36	Alpha	Regression	Evidence of persistence at three-year horizon among top funds
Kat and Menexe, 2003	TASS	324	1994–2001	36	Return, standard deviation, skewness, kurtosis, correlation	Cross-product ratio, regression	No persistence at three-year horizon with returns, but with the higher mo.
Koh et al., 2003	Eurekahedge, AsiaHedge	3,810	1999–2003	1, 2, 3, 6, 9, 12	Return, alpha	Cross-product ratio, chi square, Kolmogorov- Smirnov	Persistence at monthly and quarterly horizons, but not at yearly horizon
Kosowski et al., 2007	TASS, HFR, CISDM, and MSCI	9,338	1990–2002	12	Alpha	Regression, bootstrap approach, Bayesian approach	Persistence at yearly horizon
Kouwenberg, 2003	MAR	2,614	1995–2000	36	Return, alpha, Sharpe ratio	Chi-square	Persistence at three-year horizon
Malkiel and Saha, 2005	TASS	2,065	1996–2003	12	Return	Chi-square	No persistence at yearly horizon
Navone and Belleri, 2007	Global Hedge Source	3,627	1997–2004	3, 6, 12	Return, alpha	Regression	Persistence at quarterly, half-yearly, and yearly horizons
Park and Staum, 1998	TASS	n/a	1986–1997	12	Appraisal ratio	Chi square, Spearman	Persistence at yearly horizon
Sy et al., 2007	Eurekahedge	206	2004–2006	1,3,9,12	Return, alpha, and appraisal ratio	Regression, contingency table approach	Persistence at quarterly, but not at half-yearly or yearly horizons
This study	Eurekahedge	1.169	2000–2010	12	Alpha	Regression	

Source: Author’s own depiction, based on Eling (2009)

2.3 Data

This study uses the Eurekahedge database covering the period January 2000 to December 2010. This period is of specific importance, as it encompasses the financial crisis of 2007 to 2010. The Eurekahedge Asia Pacific database covers 2,242 hedge funds. However, after adjusting for survivorship, instant history, and selection bias, the data set encompasses 1,169 hedge funds. This constitutes the largest sample of Asia-focused hedge funds used in an academic study to date.

When choosing a period of investigation, several important factors must be considered. First, examination of hedge fund returns before 1994 may not be worthwhile due to survivorship bias, which is an essential characteristic of hedge fund data prior to that year (see Liang, 2000). Second, in the academic literature, most studies measure the performance or performance persistence of the fund rather than the fund manager. In reality, however, it is the performance of the fund manager that interests academics, as performance persistence is related to the particular set of skills possessed by the fund manager. Nonetheless, it is hard to control for changes in fund managers. For that reason, academics usually use data on fund performance. As a result, Eling (2009) recommends that researchers use time periods not longer than 10 years. In that light, the decision to study the period January 2000 to December 2010 seems appropriate.

As mentioned in Chapter 2, there is no universal method for classifying different hedge funds' investment styles and strategies. While Eurekahedge sorts Asia-Pacific hedge funds into 14 different investment strategies, this paper follows Teo (2009) in condensing hedge fund strategies into eight primary investment strategies (equity long/short, relative value, event driven, macro, directional, fixed income, managed futures (CTA) and others).

Hedge fund databases are known to suffer from various biases. One such bias – survivorship bias – is defined in the literature as the difference in performance between the portfolio of live funds and the portfolio of dead funds. (Ackermann et al., 1999), or the difference between the difference in performance between the portfolio of live funds and the portfolio of all funds in the database (Liang, 2000). Using the first definition, I calculate a survivorship bias for the whole sample period of 0.54% per month, while the second definition gives a survivorship bias of 0.16 per month. These values are in line with those found in the extant literature (see Liang, 2000; Eling and Faust, 2010; Xu et al., 2010). In addition, as the database used here covers a recent time period (2000 to 2010), the results should be less affected by survivorship bias than hedge fund studies that focus on older time

periods. In general, hedge fund databases did not include dead funds before 1994 and, for that reason, some authors exclude hedge fund data prior to 1994 (see, e.g., Capocci and Huebner, 2004; Liang and Park, 2007). Hence, as the data sample covers a period starting in 2000 and as Eurekahedge includes both surviving and dissolved funds, survivorship bias should not significantly affect the results.

Apart from survivorship bias, four other relevant biases are known to affect hedge fund databases: selection bias, instant history bias, illiquidity bias, and multi-period sampling bias. Selection bias occurs when well-performing funds have more incentive to report to database providers than poorly performing funds. However, Fung and Hsieh (2000a) find this bias to be negligible as a result of an offsetting effect, in which the best-performing hedge funds do not report to database vendors because they are closed to new money. Instant history bias arises when database vendors backfill the historical returns of newly added funds, which could subsequently lead to upward bias in performance measurement results. To address this bias, I follow Fung and Hsieh (2000a) and Capocci and Huebner (2004) in that I delete the first 12 months of returns for each hedge fund. Illiquidity bias occurs because hedge funds often invest in illiquid or difficult-to-price securities (such as derivatives, small-cap stocks, and emerging markets bonds). These illiquid securities do not have daily prices and are thus not marked-to-market regularly. In that situation, hedge fund managers may be tempted to smooth their returns and systematically understate the volatility of their portfolios. Agarwal and Naik (2000) document that intra-year persistence can be caused by stale valuations as most hedge funds only disclose audited returns on an annual basis. In order to account for this bias, I follow Getmansky et al.'s (2004) desmoothing procedure. Finally, in order to account for multi-period sampling bias, I follow Fung and Hsieh (2000a), and include only funds with a minimum of 36 months of returns.

2.4 Methodology

Performance persistence can be observed from two different perspectives. The first perspective looks at the performance persistence of a fund by measuring the relative returns of that fund. Hedge fund returns are therefore arranged in groups relative to the median return in a given period or classified into deciles according to the previous sub-period’s returns. The second perspective looks at the performance persistence of a fund by measuring it directly without comparing it to the median.

2.4.1 Persistence of Relative Returns

The persistence of relative returns can be analyzed using two approaches, as shown by Agarwal and Naik (2000), who differentiate between the two-period and multi-period statistical approaches to the measurement of performance persistence. In the two-period statistical approach, two consecutive time units are compared, while in the multi-period approach, a series of consecutive time units is considered. One can further divide statistical techniques that build upon the two-period approach into non-parametric and parametric methods.

2.4.1.1 Two Period Approach – Non-parametric Approach

The non-parametric approach centers on the formation of two-way winners and losers contingency tables. Funds that outperform the median return of all funds following the same strategy over the given time period are categorized as winners, while funds that underperform the median returns of all funds following same strategy are categorized as losers. In this approach, persistence refers to those funds that are categorized as winners over two consecutive periods (WW) or losers over two consecutive periods (LL). Funds that are winners in the first period and losers in the second (WL) or losers in the first period and winners in the second (LW) do not exhibit persistence. Agarwal and Naik (2000) use the cross-product ratio (CPR) examine persistence in hedge fund returns. CPR is defined as the ratio of the funds that exhibit performance persistence to those that do not:

$$CPR = \frac{(WW \cdot LL)}{(WL \cdot LW)}. \qquad (25)$$

In the case of the null hypothesis, CPR is equal to 1, which indicates no persistence in performance. This means that each of the four previously mentioned classifications (WW, LL, WL, LW) represent 25% of all the funds. One can test the statistical significance of the CPR by calculating Z statistics, which correspond to the ratio of the natural logarithm of the CPR to the standard error of the natural logarithm of the CPR. This can be written as:

$$Z = \frac{\ln(CPR)}{\alpha_{\ln(CPR)}}, \qquad (26)$$

where $\alpha_{\ln(CPR)}$, the standard error of the natural logarithm of the CPR is computed as:

$$x = \sqrt{\frac{1}{WW} + \frac{1}{WL} + \frac{1}{LW} + \frac{1}{LL}}. \qquad (27)$$

For instance, a Z statistic greater than 1.96 (2.58) indicates significant persistence at the 5% (1%). The cross-product test is used by Agarwal and Naik (2000), Edwards and Caglayan (2001), Kat and Menexe (2002), Koh et al. (2003) and De Souza and Gokcan (2004).

Alternatively, the chi-square method can be used to test for persistence in returns. As Géhin (2004) notes, the Chi-square test compares the distribution of the observed frequencies of the four categories (WW, LL, WL, LW) with the expected frequencies of the distribution. The chi-square test can be expressed as:

$$\chi^2 = (WW - D1)^2 / D1 + (WL - D2)^2 / D2 + (LW - D3)^2 / D3 + (LL - D4)^2 / D4, \qquad (28)$$

where $D1 = (WW + WL) \cdot (WW + LW) / N$, $D2 = (WW + WL) \cdot (WL + LL) / N$, $D3 = (LW + WL) \cdot (WW + LW) / N$, and $D4 = (LW + LL) \cdot (WL + Ll) / N$, and where N represents the number of all funds.

In the case of chi-square distribution with one degree of freedom, an χ^2 value greater than 3.84 (6.64) implies the statistically significant persistence of returns at the 5% (1%) confidence level.

Carpenter and Lynch (1999) note that the chi-square test is a more robust method in the presence of survivorship bias inherent to hedge fund data. The chi-square test method has been applied by Park and Staum (1998), Agarwal and Naik (2000), Koh et al. (2003), Malkiel and Saha (2005), and Agarwal Daniel and Naik (2009), among others. One drawback of the CPR and chi-square methods is that these methods categorize funds with similar performance into different tranches, hence incorporating substantial differences in the evaluation of these funds; for instance, they compare the worst funds of the upper decile with the best funds of the lower decile.

The Spearman's rank correlation test (see Park and Staum, 1998) is another non-parametric test. It measures the strength of association between two variables and can thus be used to measure persistence in performance. In a Spearman's rank correlation test, performance rankings are compared for different time intervals. The result of this test is always between 1 (indicating perfect positive correlation and hence perfect positive persistence) and -1 (indicating perfect negative correlation and hence perfect negative persistence). A value of the Spearman's rank correlation test around zero implies no persistence in returns over two periods.

6.4.1.2 Two period approach – parametric approach – cross-sectional regression

One can measure the persistence in fund performance by regressing the current period's measurement value (raw returns, alpha, or another measure) onto the previous periods' measurement value. A positive and statistically significant slope coefficient constitutes evidence of persistence in performance, as it shows that a hedge fund that performed well during the previous period will perform well in the current period. One can test the statistical significance of the parameter using t-statistics, where a t value greater than 1.96 (2.58) indicates persistence in performance, significant at the 5% (1%) confidence level. This act of regressing returns onto lagged returns can be expressed as the following equation:

$$R_{it} - R_{ft} = \alpha_i + \beta \cdot r_{t-1}. \qquad (29)$$

Several authors have used cross-sectional regression including Brown et al. (1999), Brown and Goetzmann (2003), Agarwal and Naik (2000), Edwards and Caglayan (2001), and Boyson and Cooper (2004).

However, as Hendricks et al. (1993) note, the evidence of persistence in performance that is obtained by applying a cross-sectional regression does not necessary imply that economically worthwhile investment strategies are available. Therefore, Hendricks et al. (1993) suggest ranking the portfolios of mutual funds into decile portfolios based on their performance results for the last year. This approach to measuring performance persistence differs from traditional cross-sectional regression insofar as it enables investors to take advantage of potential persistence in performance by replicating this strategy and investing in hedge funds that exhibit potential persistence in performance. For the purpose of this

dissertation, I use this particular approach to examine the performance persistence of Asia-focused hedge funds.

6.4.1.3 Multi-period approach – Kolmogorov-Smirnov goodness-of-fit test

The Kolmogorov-Smirnov test attempts to ascertain whether two data sets differ significantly. In contrast to two-period tests, this multi-period approach delivers more robust results. The researcher records a series of wins and losses for each fund, and accordingly labels the fund as either a winner or a loser. Eling (2009) notes that in the context of hedge fund performance persistence, the Kolmogorov-Smirnov method is employed to investigate whether the distribution of funds labeled as winners or losers is statistically different from the theoretical frequency distribution of two or more consecutive wins or losses. For instance, assuming that there is no persistence in returns, the theoretical probability of three consecutive winning periods (WWW) or losing periods (LLL) is one-eighth, while that of WWWW and LLLL is one-sixteenth. One advantage of the Kolmogorov-Smirnov method, according to Géhin (2004), is that the distribution of the test statistic itself does not depend on the underlying cumulative distribution function that is being tested. Another attractive feature is that its data requirements are low. On the other hand, one important limitation is that the test can only be applied to a continuous distribution. Agarwal and Naik (2000), Koh et al. (2003), and Eling (2009) are among the authors who used the Kolmogorov-Smirnov test in their analyses.

6.4.2 Persistence of Relative Returns

6.4.2.1 The Hurst Exponent

De Souza and Gokcan (2004) introduced the Hurst exponent as an attempt to measure hedge fund performance persistence directly rather than in relation to some other return. The authors define the Hurst exponent as a measure of whether a trend, be it negative or positive, will persist or mean-revert to some historical average. Unlike most other statistical tests for persistence, the Hurst exponent makes no assumptions about the frequency distribution of the underlying data. It can be defined as follows:

$$RS_t \cong (ct)^H \text{ or } \ln RS_t = \ln(c) + H\ln(t),$$

where RS_t is the range of cumulative deviation from the mean divided by the standard deviation and H represents the Hurst exponent, which varies between zero and one. If the value of the Hurst exponent lies between 0 and 0, then that implies reversed persistence. If on the other hand, the value of the Hurst exponent lies between 0.5 and 1, that implies positive persistence in performance. Finally, an exponent of 0.5 indicates random performance. The drawback of the Hurst exponent methodology is that it requires more data points than previously mentioned methods. More details on the Hurst exponent can be found in Couillard (2005).

6.4.3 Performance Measurement

This section briefly describes the two multi-factor performance measurement models used in this paper to examine the performance persistence of Asia-focused hedge funds: the Fung and Hsieh (2004a) seven-factor model and an adjusted Teo's (2009) model of hedge fund performance. The Fung and Hsieh (2004a) model is one of the most widely used multi-factor models in hedge fund literature. The authors use two equity-focused risk factors – an equity market factor (the S&P 500 index excess returns (SNPMRF)) and a factor which proxies the exposure of hedge funds to the spread between returns on large-cap equities and returns on small-cap equities (the Wilshire Small Cap 1750 Index minus the Wilshire Large Cap 750 Index). As mentioned in Chapter 5, since the Wilshire indices stopped reporting in December 2006, as a size proxy I use instead the Russell 2000 index minus the S&P 500 index (SCMLC) as suggested by David Hsieh on his website. Moreover, the authors use two fixed income factors and three trend following factors. The two fixed income factors are the change in the 10-year Treasury yields (BD10RET) as a fixed income factor and the spread of the change in the Moody's Baa yield over the change of the 10-year Treasury yield (BAAMTSY) as a credit spread factor. The three so-called "primitive trend-following strategies" (PTFS) are based on the previously mentioned Fung and Hsieh (2001) paper. They are the bond trend-following factor (PTFSBD), the currency trend-following factor (PTFSFX), and the commodity trend-following factor (PTFSCOM)[13]:

[13] Monthly return data on the PTFS factors can be obtained from the website of David Hsieh: http://faculty.fuqua.duke.edu/~dah7/HFRFData.htm

$$R_{it} - R_{ft} = \alpha_i + \beta_{iSNPMRF} SNPMRF_t + \beta_{iSCMLC} SCMLC_t + \beta_{iBD10\ RET} BD10RET_t + \beta_{iBAAMTSY} BAAMTSY_t + \beta_{iPTFSBD} PTFSBD_t + \beta_{iPTFSFX} PTFSFX_t + \beta_{iPTFSCOM} PTFSCOM_t + \varepsilon_{it}. \quad (17)$$

Teo (2009) augments Fung and Hsieh's seven-factor model (2004a) with additional factors: the excess return on the MSCI All Countries Asia ex Japan equity market index and the excess return on the Nikkei 225 Japan equity market index. Furthermore, he adds two option-based factors to account for the fact that the payoffs of numerous hedge funds resemble those from writing naked out-of-the-money put options. However, in this dissertation I adjust Teo's (2009) model by removing the two option-based equity factors which according to Teo's (2009) analysis do not explain much of the variation of Asia-focused hedge funds returns. His adjusted model is given by:

$$R_{it} - R_{ft} = \alpha_i + \beta_{iSNPMRF} SNPMRF_t + \beta_{iSCMLC} SCMLC_t + \beta_{iBD10RET} BD10RET_t + \beta_{iBAAMTSY} BAAMTSY_t + \beta_{iPTFSBD} PTFSBD_t + \beta_{iPTFSFX} PTFSFX_t + \beta_{iPTFSCOM} PTFSCOM_t + \beta_{ASIAMRF} ASIAMRF_t + \beta_{JAPMRF} JAPMRF + \varepsilon_{it}. \quad (18)$$

Teo (2009) uses principal component analysis to identify additional asset-based styles in the Asian hedge fund space. His model extends the Fung and Hsieh (2004a) seven-factor model to account for specific characteristics of Asia-focused hedge funds by adding two Asia equity-based factors and two option-based factors. Teo (2009) documents that his model does a much better job at explaining the performance of Asia-focused hedge funds. The adjusted R^2 for the augmented model is a considerable 29% higher than for the regular Fung and Hsieh (2004a) model.

6.5 Results

6.5.1 Persistence in One-Year Sorted Returns Over the Full Period

In this section, I analyze the persistence of Asia-focused hedge fund performance. In the first step, I rank all Asia-focused hedge funds based on their total returns for the previous year. In the second step, the performance of these portfolios is estimated using Fung and

Hsieh (2004a) and adjusted Teo's (2009) models. This method has been previously used in the context of mutual funds by Hendricks et al. (1993) and Carhart (1997).

On every January 1, 10 equally weighted portfolios of hedge funds are formed on the basis of the previous year's reported returns, ordered from highest to lowest. The best (portfolio 1) and the worst (portfolios 10) portfolios are further subdivided into thirds using the same criteria. The portfolios are then held until following January 1, at which time the procedure is repeated again. Hedge funds that dissolve during the course of the year are incorporated in the equally weighted average until their dissolution, after which the portfolio weights are readjusted accordingly.

The application of this procedure to the entire time period produces a time series of monthly returns on each decile portfolio from January 2001 until December 2010. The portfolios ranked by this methodology show strong variation in monthly mean returns, as shown in Tables 6.2 and 6.3. Portfolio D1 yielded a monthly average return of 0.78%, while portfolio D10 yielded a mean monthly return of 0.98% over the period under investigation. The monthly excess returns decrease monotonically between portfolio D1 and D3 but then increase from portfolio D3 to D10. The monthly return on portfolio D1 (0.78%) is similar to the month return on portfolio D8 (0.77%). Interestingly, the spread between portfolios D1 and D10 is -0.21%, indicating that the portfolio composed of previous year's biggest losers managed to outperform the portfolio composed form previous year's top-performers by 21 basis points. However, when the extreme sub-divided portfolios D1a and D10c are compared, a spread of 0.02% per month is observed.

Cross-sectional variation in monthly performance is substantially larger among the portfolios of previous year's top-performing funds than among the portfolios of previous year's poor performers. The spread between portfolios D1a and D1c is 0.35% per month, while the spread between portfolios D10a and D10c is a modest 0.16% per month.

Table 6.2 Portfolios of hedge funds formed on lagged one-year returns, estimated using Fung and Hsieh (2004) model. January 2001-December 2010

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*).

Portfolio	Excess return	St.dev.	α	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	Adj. R^2
D1a	1.05	6.25	0.92	0.43	0.11	-2.57	-4.38	0.01	0.05	-0.02	0.14
			(1.94)	(2.73)	(0.58)	(-1.10)	(-1.89)	(0.17)	(1.21)	(-0.76)	
D1b	0.55	4.68	0.42	0.46	0.02	-1.57	-3.58	-0.01	0.02	-0.02	0.31
			(1.19)	(4.87)	(0.15)	(-1.02)	(-2.35)	(-0.45)	(0.70)	(-0.83)	
D1c	0.70	3.87	0.66	0.43	-0.02	-1.21	-2.09	0.00	0.05	-0.04	0.36
			(2.28)	(5.69)	(-0.20)	(-0.95)	(-2.00)	(0.21)	(1.85)	(-2.18)	
D1	0.78	4.49	0.67	0.44	0.04	-1.79	-3.35	-0.00	0.04	-0.02	0.30
			(2.01)	(4.53)	(0.31)	(-1.17)	(-2.22)	(-0.03)	(1.37)	(-1.26)	
D2	0.66	3.69	0.61	0.44	-0.00	-1.41	-3.17	0.01	0.03	-0.02	0.44
			(2.36)	(6.80)	(-0.03)	(-1.27)	(-2.58)	(0.59)	(1.23)	(-1.12)	
D3	0.51	3.12	0.40	0.33	0.05	-1.62	-4.08	-0.00	0.02	-0.01	0.46
			(1.89)	(6.27)	(0.74)	(-1.57)	(-3.67)	(-0.33)	(1.15)	(-0.54)	
D4	0.52	2.61	0.41	0.31	0.09	-0.78	-2.88	0.00	0.01	0.00	0.52
			(2.42)	(7.72)	(1.51)	(-1.21)	(-4.61)	(0.13)	(0.36)	(0.41)	
D5	0.53	2.74	0.38	0.34	0.09	-1.20	-2.85	-0.01	0.01	0.01	0.55
			(2.06)	(9.03)	(1.37)	(-1.34)	(-3.65)	(-0.55)	(0.72)	(0.66)	
D6	0.59	2.33	0.51	0.30	0.05	0.41	-2.22	0.00	0.01	0.02	0.57
			(3.36)	(10.43)	(0.76)	(0.76)	(-2.74)	(0.26)	(0.51)	(1.53)	
D7	0.73	2.88	0.67	0.36	0.05	0.22	-2.29	0.02	-0.02	0.02	0.51
			(3.43)	(8.83)	(0.68)	(0.23)	(-1.68)	(1.24)	(-1.30)	(1.33)	
D8	0.77	3.10	0.70	0.38	0.12	1.13	-1.62	0.02	-0.02	0.02	0.49
			(3.17)	(7.70)	(1.35)	(1.00)	(-0.90)	(1.39)	(-0.94)	(0.98)	
D9	0.80	3.65	0.70	0.44	0.09	0.12	-3.15	0.01	-0.00	0.01	0.48
			(2.49)	(6.33)	(0.79)	(0.11)	(-1.64)	(0.49)	(-0.05)	(0.72)	
D10	0.98	4.78	0.91	0.51	0.10	1.15	-4.61	0.03	-0.02	0.03	0.43
			(2.39)	(5.48)	(0.65)	(0.86)	(-1.66)	(0.98)	(-0.79)	(1.08)	
D10a	0.87	4.18	0.81	0.48	0.03	0.60	-4.07	0.02	-0.02	0.02	0.46
			(2.51)	(6.63)	(0.25)	(0.43)	(-1.73)	(0.95)	(-0.79)	(0.99)	
D10b	1.06	4.88	0.99	0.52	0.09	2.60	-2.09	0.02	-0.00	0.03	0.33
			(2.42)	(5.14)	(0.57)	(1.70)	(-0.69)	(0.69)	(-0.02)	(1.13)	
D10c	1.03	6.28	0.94	0.56	0.17	0.17	-8.01	0.05	-0.04	0.04	0.39
			(1.84)	(4.31)	(0.79)	(0.11)	(-2.39)	(1.11)	(-1.22)	(0.98)	
1-10 spread	-0.21	5.14	-0.41	-0.07	-0.07	-2.96	1.18	-0.03	0.06	-0.06	0.02
			(-0.85)	(-0.53)	(-0.33)	(-1.53)	(0.34)	(-0.79)	(1.68)	(-1.67)	
1a-10c spread	0.02	7.50	-0.19	-0.13	-0.07	-2.75	3.54	-0.04	0.09	-0.06	0.02
			(-0.29)	(-0.63)	(-0.23)	(-1.09)	(0.82)	(-0.75)	(2.03)	(-1.35)	
1-2 spread	0.11	1.89	-0.11	-0.00	0.04	-0.39	-0.27	-0.01	0.01	-0.01	-0.04
			(-0.70)	(-0.09)	(0.60)	(-0.57)	(-0.50)	(-0.75)	(0.93)	(-0.79)	
9-10 spread	-0.18	1.93	-0.39	-0.07	-0.01	-1.04	1.37	-0.02	0.02	-0.02	0.09
			(-2.19)	(-1.75)	(-0.14)	(-1.68)	(1.24)	(-1.27)	(1.38)	(-1.34)	

Table 6.3 Portfolios of hedge funds formed on lagged one-year returns, estimated using to adjusted Teo's (2009) model. January 2001-December 2010

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*); MSCI Asia ex Japan index return minus the risk-free rate (*ASIA*); and Nikkei 225 index return minus the risk-free rate (*JAP*).

Portfolio	Exc. return	St.dev.	A	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	ASIA	Jap.	Adj. R^2
D1a	1.05	6.25	1.00	-0.12	-0.10	-2.39	-2.63	-0.01	0.04	0.00	0.23	0.47	0.27
			(1.85)	(-0.68)	(-0.67)	(-1.12)	(-1.27)	(-0.23)	(1.21)	(0.02)	(1.28)	(2.52)	
D1b	0.55	4.68	0.30	-0.12	-0.11	-0.86	-1.94	-0.02	0.01	-0.01	0.38	0.26	0.51
			(0.94)	(-1.08)	(-0.88)	(-0.73)	(-1.22)	(-0.92)	(0.62)	(-0.34)	(4.38)	(3.26)	
D1c	0.70	3.87	0.54	-0.05	-0.12	-0.55	-0.76	-0.00	0.04	-0.03	0.33	0.18	0.55
			(2.33)	(-0.58)	(-1.21)	(-0.58)	(-0.73)	(-0.20)	(2.12)	(-2.08)	(4.79)	(3.16)	
D1	0.78	4.49	0.62	-0.09	-0.11	-1.29	-1.78	-0.01	0.03	-0.01	0.31	0.30	0.49
			(2.00)	(-0.91)	(-1.03)	(-1.11)	(-1.24)	(-0.52)	(1.49)	(-0.68)	(3.21)	(3.47)	
D2	0.66	3.69	0.52	-0.04	-0.12	-0.85	-1.80	0.00	0.02	-0.01	0.31	0.22	0.66
			(2.55)	(-0.51)	(-1.30)	(-1.18)	(-1.48)	(0.14)	(1.46)	(-0.61)	(5.23)	(4.94)	
D3	0.51	3.12	0.29	-0.13	-0.05	-1.02	-2.79	-0.01	0.02	0.00	0.31	0.18	0.74
			(1.95)	(-2.57)	(-0.76)	(-1.65)	(-3.00)	(-1.19)	(1.63)	(0.02)	(8.01)	(5.04)	
D4	0.52	2.61	0.35	-0.05	0.00	-0.40	-1.85	-0.00	0.00	0.01	0.22	0.18	0.78
			(2.92)	(-1.06)	(0.10)	(-0.89)	(-3.59)	(-0.45)	(0.17)	(1.83)	(6.71)	(5.23)	
D5	0.53	2.74	0.33	-0.00	-0.00	-0.82	-1.84	-0.01	0.01	0.01	0.22	0.18	0.77
			(2.43)	(-0.07)	(-0.08)	(-1.28)	(-3.60)	(-1.07)	(0.77)	(1.89)	(5.28)	(5.06)	
D6	0.59	2.33	0.44	-0.03	-0.03	0.84	-1.29	-0.00	0.00	0.02	0.22	0.14	0.84
			(4.82)	(-0.92)	(-0.73)	(1.90)	(-2.75)	(-0.34)	(0.43)	(3.69)	(8.87)	(5.74)	
D7	0.73	2.88	0.51	-0.03	-0.01	0.91	-1.25	0.01	-0.02	0.02	0.31	0.08	0.75
			(3.73)	(-0.68)	(-0.14)	(0.97)	(-1.06)	(1.09)	(-1.95)	(2.11)	(9.33)	(2.38)	
D8	0.77	3.10	0.59	0.00	0.05	1.70	-0.59	0.02	-0.02	0.02	0.28	0.12	0.68
			(3.51)	(0.02)	(0.71)	(1.50)	(-0.36)	(1.47)	(-1.41)	(1.59)	(6.31)	(2.58)	
D9	0.80	3.65	0.53	-0.04	0.01	0.89	-1.86	0.00	-0.00	0.02	0.36	0.13	0.70
			(2.69)	(-0.67)	(0.13)	(0.83)	(-1.19)	(0.30)	(-0.24)	(1.25)	(6.51)	(2.47)	
D10	0.98	4.78	0.74	-0.08	-0.01	2.01	-2.99	0.02	-0.02	0.04	0.43	0.20	0.62
			(2.64)	(-0.89)	(-0.06)	(1.49)	(-1.31)	(0.91)	(-1.15)	(1.73)	(5.13)	(2.81)	
D10a	0.87	4.18	0.64	0.01	-0.04	1.39	-2.81	0.02	-0.02	0.03	0.37	0.12	0.62
			(2.62)	(0.13)	(-0.37)	(1.12)	(-1.45)	(0.86)	(-1.07)	(1.45)	(5.54)	(1.87)	
D10b	1.06	4.88	0.83	-0.04	-0.01	3.42	-0.57	0.01	-0.00	0.04	0.40	0.18	0.49
			(2.44)	(-0.39)	(-0.08)	(2.03)	(-0.22)	(0.56)	(-0.17)	(1.65)	(3.82)	(1.89)	
D10c	1.03	6.28	0.76	-0.21	0.01	1.19	-5.83	0.03	-0.04	0.05	0.53	0.32	0.59
			(1.97)	(-1.62)	(0.04)	(0.71)	(-2.17)	(1.03)	(-1.67)	(1.68)	(4.96)	(3.52)	
1-10 spread	-0.21	5.14	-0.29	-0.01	-0.10	-3.32	1.11	-0.03	0.05	-0.05	-0.12	0.10	0.01
			(-0.59)	(-0.06)	(-0.46)	(-1.61)	(0.33)	(-0.82)	(1.57)	(-1.47)	(-0.74)	(0.77)	
1a-10c spread	0.02	7.50	0.07	0.10	-0.11	-3.59	3.10	0.01	0.08	0.05	0.30	0.15	0.02
			(0.09)	(0.44)	(-0.36)	(-1.22)	(0.76)	(-0.74)	(1.92)	(-1.14)	(-1.27)	(0.66)	
1-2 spread	0.11	1.89	-0.08	-0.06	0.01	-0.45	-0.08	-0.01	0.01	-0.00	0.00	0.08	-0.03
			(-0.40)	(-0.96)	(0.13)	(-0.60)	(-0.15)	(-0.81)	(0.84)	(-0.36)	(0.02)	(1.25)	
9-10 spread	-0.18	1.93	-0.38	0.04	0.02	-1.14	1.03	-0.01	0.02	-0.02	-0.07	-0.07	0.13
			(-2.29)	(0.69)	(0.29)	(-1.82)	(1.00)	(-1.11)	(1.54)	(-1.62)	(-1.41)	(-1.52)	

The standard deviation of average monthly return is substantially higher for the previous year's best- and worst-performing funds than for the middle-decile portfolios. D1a and D10c show standard deviations of 6.25% and 6.28%, respectively, while portfolios D4, D5, and D6 have standard deviations of 2.61%, 2.74%, and 2.33%, respectively.

I then use the Fung and Hsieh (2004a) and adjusted Teo's (2009) models to control for the risk factors, explain the relative returns on these portfolios, and analyze whether the returns among these hedge fund portfolios demonstrate persistence. Table 6.2 shows the portfolios' performance as estimated using the Fung and Hsieh (2004a) model. After controlling for risk factors, the spread between D1a and D10c falls from 0.02% to -0.19%, although the latter is insignificant. Furthermore, the spread between D9 and D10 moves from -0.18% to -0.39%, which is significant at the 5% level. Column 5 of Table 6.2 suggests that all portfolios have significant exposure to the US equity factor. Column 7 indicates that top-decile hedge funds have negative exposure to the bond factor, while the opposite is true for the lower-decile funds. However, these exposures to the bond factor are statistically insignificant. The exposure of all hedge fund portfolios to primitive trend-following strategies is negligible and statistically insignificant. The inability of primitive trend-following factors to explain Asia-focused hedge fund performance can be explained by the fact that Fung and Hsieh (2004a) constructed these primitive trend-following strategies based on US-centric hedge funds. The credit-spread factor is negative and significant for portfolios D1 through D6, and for the sub-portfolios D1b and D1c.

Column 4 of Table 6.2 contains the most important information for the purpose of persistence analysis. A statistically significant alpha would provide evidence of persistence in performance among portfolios ranked based on their previous year's performance. Sub-portfolios D1a and D10c have the highest alpha values at 0.92% and 0.94%, respectively. However, neither of these alphas is statistically significant, which indicates no persistence among the extreme-best and the extreme-worst-performing hedge funds. Portfolios D1 and D2 exhibit a positive alpha value that is significant at the 5% level, while portfolio D3 has an insignificant alpha. Portfolios D6, D7, and D8 are the only portfolios with positive alphas significant at the 1% level, which indicates persistence in performance among the middle-lower decile funds.

Table 6.3 estimates the performance of the same ten portfolios relative to the adjusted Teo's (2009) model. This model adds two equity factors that are relevant when attempting to explain the Asia-focused hedge funds' performance – the MSCI Asia ex Japan index and the

Nikkei 225 index. The values of adjusted R^2, which are significantly higher than those produced in the previous model, confirm that the adjusted Teo's (2009) model is better able to explain the performance of Asia-focused hedge funds. The adjusted R^2 values are highest for middle-decile portfolios (D3 to D7). As a result of the addition of two Asia-focused equity factors, the exposure of portfolios to the US equity factor decreases to a negligible level, as does the statistical significance (*t* statistics) of that exposure. The two Asian equity factors explain most of the spread and pattern in these portfolios, which have significant exposure to both of these factors. Portfolio D1a is the only portfolio with non-significant exposure to the MSCI Asia ex Japan index, while all other portfolios exhibit positive and statistically significant exposure at 1%. The upper-decile portfolios (D1-D6) have positive exposure to the Nikkei 225 index, which is statistically significant at the 1% level, while portfolios D7 to D10 have positive exposure to the same factor but with significance at only the 5% level. The sensitivities to primitive trend-following strategies remain negligible when using the adjusted Teo's (2009) model. The middle-decile portfolios (D3 to D6) show strong negative exposure to the credit spread factor, which is significant at the 1% level. A further examination of the pattern of loading to risk premia proposes that top-decile portfolios have negative, albeit insignificant, sensitivities to the bond factor, while lower-decile portfolios have positive, insignificant sensitivities to the same factor.

Column 4 is of most interest in this analysis, as it contains information on alpha and its significance. The results show that the strongest evidence of performance persistence is again found among the middle- and bottom-decile performers. Significant alpha values are found in almost all portfolios except D1b, with the most significant values (at the 1% level) evident in portfolios D6 to D10. In these lower-decile portfolios, where I find evidence of persistence, after accounting for risk in both models, the Asia-focused hedge fund strategies are characterized by strong, positive exposure to Asian equity factors. This strong Asian equity exposure might be the source of their sustained performance.

6.5.2 Persistence in One-Year Sorted Returns in Sub-period 1

I perform the same analyses for the two sub-periods identified by testing for the presence of structural breaks in Asian hedge fund data using multiple Chow (1960) tests. I find a structural break in February 2007, which is used in this paper as the start of financial crisis (Khandani and Lo, 2008, propose August 2007 as the beginning of financial crisis). Tables 6.4 and 6.5 present the results of the persistence analyses for the period January 2001 to

January 2007 estimated using both the Fung and Hsieh (2004a) and the adjusted Teo's (2009) models. Tables 6.4 displays the results estimated using the Fung and Hsieh (2004a) model. The results are similar to those obtained for the full period, although there are some important differences. The monthly excess returns over the first sub-period decrease monotonically between portfolio D1 and D6 but then increases again from portfolio D7 to D10. Portfolio 1 yielded a monthly average return of 1.32%, while portfolio 10 yielded 1.27% over the first sub-period. The spread between portfolios D1a and D10c is a modest 0.06% per month, while the spread between portfolios D1 and D10 is 0.05% per month. The standard deviation of average monthly returns is substantially higher for the top- and bottom-decile portfolios than for the middle-decile portfolios, with D1a and D10c showing standard deviations of 5.74% and 4.77%, respectively, and portfolio D6 showing a standard deviation of only 1.99%. Again, cross-sectional variation in monthly performance is greater among the portfolios of previous year's top-performing funds than among previous year's poor performers. Similar to the analysis of the full period, most of the portfolios show a positive, significant exposure to the US equity factor during the first sub-period when portfolio performance is estimated using the Fung and Hsieh (2004a) model. In addition, some portfolios display positive and significant exposure to the size factor. More specifically, portfolios D3, D4, D5, and D8 exhibit positive exposure to the size factor, which is significant at the 1% level. The credit spread factor is mostly negative and is significant only for portfolio 9 at the 1% level. Hedge fund portfolios do not display any significant exposure to the bond factor in this sub-period. As in the full-period analysis, exposure to primitive trend-following strategies is negligible and generally insignificant in this sub-period. After controlling for the risk factors using the Fung and Hsieh (2004a) model, I find the highest alpha values among the top-decile funds.

Table 6.4 Portfolios of hedge funds formed on lagged one-year returns, estimated using Fung and Hsieh (2004) model. January 2001-January 2007

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*).

Portfolio	Excess return	St.dev.	α	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	Adj. R^2
D1a	1.80	5.74	1.62	0.16	0.37	0.76	1.42	0.01	0.07	0.02	-0.00
			(2.38)	(0.73)	(1.41)	(0.27)	(0.19)	(0.39)	(1.55)	(0.81)	
D1b	1.15	3.21	0.93	0.32	0.27	-0.05	1.26	0.00	0.02	-0.00	0.17
			(2.68)	(3.42)	(2.07)	(-0.03)	(0.38)	(0.05)	(0.79)	(-0.01)	
D1c	0.96	3.08	0.81	0.35	0.14	-0.36	-0.84	-0.00	0.04	-0.03	0.25
			(2.51)	(3.40)	(1.15)	(-0.25)	(-0.23)	(-0.04)	(1.87)	(-1.69)	
D1	1.32	3.22	1.13	0.27	0.26	0.13	0.65	0.00	0.04	-0.00	0.14
			(3.13)	(2.42)	(1.90)	(0.08)	(0.18)	(0.20)	(1.77)	(-0.20)	
D2	1.07	2.48	0.92	0.36	0.15	-1.27	-1.42	0.01	0.03	-0.00	0.39
			(3.94)	(5.74)	(1.72)	(-1.02)	(-0.57)	(0.95)	(1.94)	(-0.20)	
D3	0.93	2.05	0.69	0.23	0.20	-1.01	-2.04	-0.01	0.03	0.01	0.36
			(3.68)	(4.95)	(3.21)	(-1.01)	(-1.07)	(-0.59)	(2.03)	(0.67)	
D4	0.86	2.03	0.60	0.24	0.23	-1.34	-2.76	-0.00	0.01	0.01	0.44
			(2.93)	(5.62)	(3.73)	(-1.40)	(-1.23)	(-0.06)	(0.63)	(0.63)	
D5	0.81	2.34	0.51	0.34	0.21	-1.51	-1.26	-0.01	0.02	0.01	0.46
			(2.30)	(6.15)	(2.74)	(-1.13)	(-0.59)	(-0.79)	(1.24)	(1.18)	
D6	0.68	1.99	0.50	0.29	0.14	0.06	-0.46	-0.00	0.02	0.01	0.42
			(2.64)	(6.06)	(2.34)	(0.05)	(-0.21)	(-0.07)	(1.33)	(1.49)	
D7	0.74	2.58	0.54	0.38	0.12	-1.96	-3.99	0.02	-0.00	0.02	0.47
			(2.44)	(6.82)	(1.78)	(-1.32)	(-1.63)	(1.70)	(-0.30)	(1.28)	
D8	0.81	2.82	0.57	0.39	0.20	-0.89	-4.20	0.02	-0.01	0.00	0.49
			(2.23)	(7.17)	(2.80)	(-0.56)	(-1.54)	(1.43)	(-0.39)	(0.03)	
D9	0.93	3.18	0.59	0.39	0.17	-2.20	-7.92	0.00	0.02	0.00	0.43
			(1.90)	(4.64)	(1.46)	(-1.48)	(-2.59)	(0.04)	(1.25)	(0.19)	
D10	1.27	3.97	0.88	0.41	0.17	-0.93	-9.87	0.00	0.02	0.02	0.36
			(2.34)	(3.92)	(1.66)	(-0.50)	(-2.05)	(0.05)	(0.84)	(0.93)	
D10a	0.96	3.54	0.66	0.39	0.08	-0.85	-9.15	0.01	0.00	0.01	0.37
			(1.84)	(4.59)	(0.86)	(-0.42)	(-1.96)	(0.41)	(0.13)	(0.81)	
D10b	1.13	4.63	0.78	0.45	0.11	-1.31	-10.81	0.00	0.04	0.01	0.26
			(1.61)	(3.38)	(0.82)	(-0.64)	(-1.93)	(0.15)	(1.38)	(0.38)	
D10c	1.74	4.77	1.22	0.41	0.32	-0.65	-9.72	-0.01	0.02	0.03	0.29
			(2.64)	(3.06)	(2.05)	(-0.27)	(-1.79)	(-0.26)	(0.65)	(1.14)	
1-10 spread	0.05	4.09	0.03	-0.14	0.08	0.97	10.23	0.00	0.02	-0.02	0.04
			(0.07)	(-0.89)	(0.48)	(0.54)	(1.87)	(0.12)	(0.86)	(-0.92)	
1a-10c spread	0.06	7.06	0.18	-0.24	0.04	1.32	10.84	0.02	0.05	-0.01	-0.02
			(0.22)	(-0.85)	(0.14)	(0.52)	(1.15)	(0.44)	(1.19)	(-0.19)	
1-2 spread	0.25	2.04	-0.00	-0.09	0.11	1.30	1.78	-0.01	0.02	-0.00	-0.03
			(-0.00)	(-1.11)	(1.06)	(1.26)	(0.69)	(-0.55)	(0.99)	(-0.08)	
9-10 spread	-0.34	1.82	-0.51	-0.02	-0.01	-1.37	1.66	0.00	0.00	-0.01	-0.02
			(-2.25)	(-0.28)	(-0.14)	(-1.36)	(0.58)	(0.05)	(0.08)	(-1.07)	

Table 6.5 Portfolios of hedge funds formed on lagged one-year returns, estimated using adjusted Teo's (2009) model. January 2001-January 2007

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*); MSCI Asia ex Japan index return minus the risk-free rate (*ASIA*); and Nikkei 225 index return minus the risk-free rate (*JAP*).

Portfolio	Exc. return	St.dev.	α	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	ASIA	Jap.	Adj. R^2
D1a	1.80	5.74	1.74	0.04	0.20	0.00	-2.10	0.01	0.04	0.04	-0.20	0.51	0.10
			(2.37)	(0.16)	(0.79)	(0.00)	(-0.33)	(0.29)	(1.13)	(1.50)	(-0.71)	(2.65)	
D1b	1.15	3.21	0.88	-0.01	0.10	0.27	0.54	-0.00	0.00	0.01	0.15	0.28	0.33
			(2.65)	(-0.07)	(0.82)	(0.17)	(0.13)	(-0.18)	(0.08)	(0.30)	(1.75)	(2.97)	
D1c	0.96	3.08	0.73	0.05	0.01	0.06	-1.02	-0.00	0.03	-0.03	0.18	0.20	0.37
			(2.55)	(0.36)	(0.04)	(0.05)	(-0.36)	(-0.21)	(1.37)	(-1.69)	(2.07)	(2.92)	
D1	1.32	3.22	1.13	0.03	0.10	0.10	-0.87	0.00	0.02	0.01	0.04	0.33	0.31
			(3.27)	(0.21)	(0.80)	(0.07)	(-0.26)	(0.01)	(1.27)	(0.33)	(0.30)	(3.84)	
D2	1.07	2.48	0.87	0.09	0.01	-1.00	-1.99	0.01	0.01	0.00	0.13	0.23	0.59
			(4.67)	(1.10)	(0.10)	(-1.11)	(-0.99)	(0.75)	(1.25)	(0.20)	(2.33)	(5.18)	
D3	0.93	2.05	0.61	-0.08	0.06	-0.51	-1.99	-0.01	0.02	0.01	0.21	0.18	0.66
			(4.29)	(-1.41)	(1.36)	(-0.75)	(-1.11)	(-1.06)	(2.05)	(1.11)	(4.79)	(4.60)	
D4	0.86	2.03	0.53	-0.03	0.10	-0.99	-3.03	-0.00	-0.00	0.01	0.15	0.19	0.69
			(3.48)	(-0.46)	(2.43)	(-1.36)	(-1.58)	(-0.38)	(-0.20)	(1.57)	(3.19)	(5.05)	
D5	0.81	2.34	0.46	0.09	0.08	-1.20	-1.58	-0.02	0.01	0.02	0.14	0.19	0.63
			(2.51)	(1.08)	(1.31)	(-1.12)	(-0.88)	(-1.01)	(0.66)	(1.83)	(2.12)	(4.13)	
D6	0.68	1.99	0.40	-0.04	0.01	0.63	-0.26	-0.00	0.01	0.02	0.23	0.17	0.76
			(3.38)	(-0.83)	(0.12)	(0.97)	(-0.21)	(-0.51)	(0.94)	(2.69)	(4.98)	(5.30)	
D7	0.74	2.58	0.39	-0.02	-0.02	-1.08	-3.05	0.02	-0.01	0.02	0.34	0.12	0.75
			(2.41)	(-0.34)	(-0.44)	(-1.02)	(-1.89)	(1.42)	(-0.97)	(1.52)	(7.44)	(3.09)	
D8	0.81	2.82	0.43	-0.05	0.03	-0.07	-3.68	0.01	-0.02	0.00	0.32	0.19	0.77
			(2.60)	(-0.98)	(0.51)	(-0.07)	(-2.64)	(1.77)	(-1.51)	(0.26)	(6.58)	(3.75)	
D9	0.93	3.18	0.41	-0.12	-0.03	-1.13	-6.95	-0.01	0.01	0.00	0.41	0.18	0.73
			(1.86)	(-1.97)	(-0.34)	(-1.29)	(-3.08)	(-0.37)	(0.83)	(0.29)	(6.66)	(3.17)	
D10	1.27	3.97	0.66	-0.23	-0.07	0.37	-8.76	-0.01	0.01	0.02	0.50	0.23	0.66
			(2.50)	(-2.59)	(-0.71)	(0.29)	(-2.68)	(-0.37)	(0.50)	(1.42)	(5.50)	(3.12)	
D10a	0.96	3.54	0.49	-0.10	-0.10	0.20	-8.13	0.00	-0.01	0.01	0.40	0.16	0.59
			(1.80)	(-1.14)	(-0.96)	(0.14)	(-2.20)	(0.14)	(-0.36)	(1.09)	(5.76)	(2.17)	
D10b	1.13	4.63	0.53	-0.28	-0.17	0.19	-9.46	-0.00	0.03	0.01	0.58	0.25	0.54
			(1.46)	(-2.52)	(-1.33)	(0.11)	(-2.44)	(-0.21)	(1.33)	(0.55)	(4.15)	(2.33)	
D10c	1.74	4.77	0.98	-0.32	0.04	0.78	-8.64	-0.02	0.00	0.03	0.56	0.29	0.55
			(2.45)	(-2.06)	(0.25)	(0.37)	(-2.20)	(-0.58)	(0.09)	(1.43)	(4.43)	(3.18)	
1-10 spread	0.05	4.09	0.25	0.26	0.17	-0.37	7.59	0.01	0.02	-0.01	-0.47	0.10	0.18
			(0.53)	(1.62)	(0.97)	(-0.21)	(1.61)	(0.25)	(0.72)	(-0.51)	(-2.60)	(0.81)	
1a-10c spread	0.06	7.06	0.54	0.36	0.16	-0.88	6.23	0.03	0.04	0.01	-0.77	0.23	0.10
			(0.59)	(1.23)	(0.50)	(-0.30)	(0.82)	(0.55)	(0.97)	(0.39)	(-2.12)	(0.96)	
1-2 spread	0.25	2.04	0.05	-0.06	0.09	1.00	0.82	-0.01	0.01	0.00	-0.10	0.10	-0.01
			(0.17)	(-0.72)	(0.82)	(0.92)	(0.34)	(-0.53)	(0.66)	(0.31)	(-0.99)	(1.43)	
9-10 spread	-0.34	1.82	-0.47	0.11	0.04	-1.61	1.50	0.00	0.00	-0.01	-0.09	-0.05	0.00
			(-2.11)	(1.10)	(0.49)	(-1.61)	(0.60)	(0.14)	(0.32)	(-1.07)	(-1.34)	(-0.84)	

For example, portfolios D1b, D1, D2, D3, D4, and D6 have positive alpha values that are significant at the 1% level. In addition, the portfolio of previous year's worst-performing funds (D10c) displays a very high alpha of 1.22%, which is significant at the 1% level. These results indicate that there is persistence in performance among most of the Asia-focused hedge funds during the first, bullish sub-period.

I then estimate the performance of these portfolios by applying the adjusted Teo's (2009) model, which is better suited for explaining the performance of Asia-focused hedge funds. This is immediately evident in the significantly higher values of adjusted R^2 that are obtained using this model, as shown in Table 6.5. As expected, most portfolios exhibit positive, significant exposure to the two Asian equity factors. Fund exposures to primitive trend-following strategies are negligible and mostly insignificant. Lower-decile funds have negative, significant exposure to the credit factor, while their exposure to the bond factor is low and insignificant. With the exception of portfolio D4, which manifests small, positive exposure to size, no portfolio displays significant loadings to that factor. Column 4 suggests that most portfolios exhibit persistence in performance. In fact, portfolios D1, D2, D3, D4, D6, and D8 have positive alphas that are statistically significant at the 1% level. Other portfolios have positive, significant alphas at the 5% level, while portfolios D10a and D10b are the only portfolios with positive but statistically insignificant alphas.

6.5.3 Persistence in One-Year Sorted Returns in Sub-period 2

Tables 6.6 and 6.7 display the results of the performance persistence analysis for Asia-focused hedge funds during the sub-period that encompasses the global financial crisis. Table 6.6 shows the performance results obtained using the Fung and Hsieh (2004a) model and Table 6.7 estimates hedge fund performance using the Teo's (2009) model.

The figures for monthly excess returns over the second sub-period reveal some interesting information. Somewhat surprisingly, the monthly excess return of portfolio D1 is the same as that for D10c, implying that previous year's best-performing funds (located in portfolio D1) had the same monthly excess returns as previous year's worst-performing funds. Cross-sectional variation in returns exhibits a pattern similar to that seen in sub-period 1, as it is considerably larger for the top- and bottom-decile funds than for middle-decile funds.

Table 6.6 Portfolios of hedge funds formed on lagged one-year returns, estimated using Fung and Hsieh (2004) model. February 2007 – December 2010

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*).

Portfolio	Excess return	St.dev.	α	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	Adj. R^2
D1a	-0.10	6.81	1.62	0.16	0.37	0.76	1.42	0.01	0.07	0.02	-0.00
			(2.38)	(0.73)	(1.41)	(0.27)	(0.19)	(0.39)	(1.55)	(0.81)	
D1b	-0.37	6.24	0.93	0.32	0.27	-0.05	1.26	0.00	0.02	-0.00	0.17
			(2.68)	(3.42)	(2.07)	(-0.03)	(0.38)	(0.05)	(0.79)	(-0.01)	
D1c	0.29	4.85	0.81	0.35	0.14	-0.36	-0.84	-0.00	0.04	-0.03	0.25
			(2.51)	(3.40)	(1.15)	(-0.25)	(-0.23)	(-0.04)	(1.87)	(-1.69)	
D1	-0.06	5.87	1.13	0.27	0.26	0.13	0.65	0.00	0.04	-0.00	0.14
			(3.13)	(2.42)	(1.90)	(0.08)	(0.18)	(0.20)	(1.77)	(-0.20)	
D2	0.03	4.99	0.92	0.36	0.15	-1.27	-1.42	0.01	0.03	-0.00	0.39
			(3.94)	(5.74)	(1.72)	(-1.02)	(-0.57)	(0.95)	(1.94)	(-0.20)	
D3	-0.13	4.23	0.69	0.23	0.20	-1.01	-2.04	-0.01	0.03	0.01	0.36
			(3.68)	(4.95)	(3.21)	(-1.01)	(-1.07)	(-0.59)	(2.03)	(0.67)	
D4	0.00	3.26	0.60	0.24	0.23	-1.34	-2.76	-0.00	0.01	0.01	0.44
			(2.93)	(5.62)	(3.73)	(-1.40)	(-1.23)	(-0.06)	(0.63)	(0.63)	
D5	0.11	3.23	0.51	0.34	0.21	-1.51	-1.26	-0.01	0.02	0.01	0.46
			(2.30)	(6.15)	(2.74)	(-1.13)	(-0.59)	(-0.79)	(1.24)	(1.18)	
D6	0.45	2.78	0.50	0.29	0.14	0.06	-0.46	-0.00	0.02	0.01	0.42
			(2.64)	(6.06)	(2.34)	(0.05)	(-0.21)	(-0.07)	(1.33)	(1.49)	
D7	0.71	3.30	0.54	0.38	0.12	-1.96	-3.99	0.02	-0.00	0.02	0.47
			(2.44)	(6.82)	(1.78)	(-1.32)	(-1.63)	(1.70)	(-0.30)	(1.28)	
D8	0.70	3.48	0.57	0.39	0.20	-0.89	-4.20	0.02	-0.01	0.00	0.49
			(2.23)	(7.17)	(2.80)	(-0.56)	(-1.54)	(1.43)	(-0.39)	(0.03)	
D9	0.61	4.28	0.59	0.39	0.17	-2.20	-7.92	0.00	0.02	0.00	0.43
			(1.90)	(4.64)	(1.46)	(-1.48)	(-2.59)	(0.04)	(1.25)	(0.19)	
D10	0.54	5.81	0.88	0.41	0.17	-0.93	-9.87	0.00	0.02	0.02	0.36
			(2.34)	(3.92)	(1.66)	(-0.50)	(-2.05)	(0.05)	(0.84)	(0.93)	
D10a	0.73	5.02	0.66	0.39	0.08	-0.85	-9.15	0.01	0.00	0.01	0.37
			(1.84)	(4.59)	(0.86)	(-0.42)	(-1.96)	(0.41)	(0.13)	(0.81)	
D10b	0.95	5.23	0.78	0.45	0.11	-1.31	-10.81	0.00	0.04	0.01	0.26
			(1.61)	(3.38)	(0.82)	(-0.64)	(-1.93)	(0.15)	(1.38)	(0.38)	
D10c	-0.06	7.99	1.22	0.41	0.32	-0.65	-9.72	-0.01	0.02	0.03	0.29
			(2.64)	(3.06)	(2.05)	(-0.27)	(-1.79)	(-0.26)	(0.65)	(1.14)	
1-10 spread	-0.61	6.46	0.03	-0.14	0.08	0.97	10.23	0.00	0.02	-0.02	0.04
			(0.07)	(-0.89)	(0.48)	(0.54)	(1.87)	(0.12)	(0.86)	(-0.92)	
1a-10c spread	-0.04	8.16	0.18	-0.24	0.04	1.32	10.84	0.02	0.05	-0.01	-0.02
			(0.22)	(-0.85)	(0.14)	(0.52)	(1.15)	(0.44)	(1.19)	(-0.19)	
1-2 spread	-0.09	1.57	-0.00	-0.09	0.11	1.30	1.78	-0.01	0.02	-0.00	-0.03
			(-0.00)	(-1.11)	(1.06)	(1.26)	(0.69)	(-0.55)	(0.99)	(-0.08)	
9-10 spread	0.06	2.07	-0.51	-0.02	-0.01	-1.37	1.66	0.00	0.00	-0.01	-0.02
			-2.25	-0.28	-0.14	-1.36	0.58	0.05	0.08	-1.07	

Table 6.7 Portfolios of hedge funds formed on lagged one-year returns, estimated using adjusted Teo's (2009) model. February 2007 – December 2010

Hedge funds are ranked on January 1 each year according to their performance in the previous calendar year. The portfolios are equally weighted monthly so that the weights are readjusted whenever a fund disappears. Funds with the highest past annual performance comprise decile 1 and funds with the lowest comprise decile 10. The factors are: S&P 500 return minus the risk-free rate (*SNPMRF*); Russell 2000 minus the S&P (*SMCL*); bond factor (BD10RET); credit spread factor (BAAMTSY) bond PTFS (*PTFSBD*); currency (*PTFSFX*); and commodities (*PTFSCOM*); MSCI Asia ex Japan index return minus the risk-free rate (*ASIA*); and Nikkei 225 index return minus the risk-free rate (*JAP*).

Portfolio	Exc. return	St.dev.	α	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSCOM	PTFSFX	ASIA	Jap.	Adj. R^2
D1a	-0.10	6.81	-0.11	-0.07	-0.50	-2.85	-0.32	-0.02	0.07	-0.09	0.51	0.26	0.64
			(-0.19)	(-0.34)	(-1.76)	(-1.18)	(-0.16)	(-0.32)	(1.29)	(-1.80)	(3.53)	(1.67)	
D1b	-0.37	6.24	-0.55	-0.09	-0.37	-0.82	-1.04	-0.04	0.05	-0.05	0.53	0.14	0.61
			(-0.99)	(-0.51)	(-1.37)	(-0.37)	(-0.50)	(-0.81)	(0.95)	(-1.00)	(3.61)	(1.14)	
D1c	0.29	4.85	0.20	-0.12	-0.24	-1.13	-0.63	-0.01	0.06	-0.04	0.44	0.16	0.66
			(0.50)	(-0.92)	(-1.21)	(-0.73)	(-0.42)	(-0.18)	(1.36)	(-1.16)	(4.31)	(1.47)	
D1	-0.06	5.87	-0.15	-0.09	-0.37	-1.60	-0.65	-0.02	0.06	-0.06	0.49	0.19	0.66
			(-0.31)	(-0.59)	(-1.51)	(-0.84)	(-0.36)	(-0.48)	(1.27)	(-1.40)	(3.99)	(1.51)	
D2	0.03	4.99	0.01	-0.08	-0.26	-0.44	-0.79	-0.01	0.05	-0.04	0.43	0.18	0.72
			(0.03)	(-0.71)	(-1.42)	(-0.29)	(-0.48)	(-0.16)	(1.41)	(-1.23)	(4.47)	(1.92)	
D3	-0.13	4.23	-0.14	-0.08	-0.21	-0.72	-2.02	-0.00	0.03	-0.03	0.37	0.14	0.81
			(-0.55)	(-1.04)	(-1.54)	(-0.66)	(-1.85)	(-0.08)	(1.10)	(-1.19)	(5.71)	(1.98)	
D4	0.00	3.26	0.08	0.02	-0.19	0.23	-1.28	0.00	0.01	-0.00	0.24	0.15	0.86
			(0.46)	(0.32)	(-2.13)	(0.30)	(-1.96)	(0.20)	(0.56)	(-0.08)	(6.52)	(2.54)	
D5	0.11	3.23	0.13	-0.03	-0.13	-0.36	-1.65	-0.00	0.01	-0.00	0.26	0.14	0.91
			(0.84)	(-0.65)	(-1.75)	(-0.51)	(-2.96)	(-0.24)	(0.65)	(-0.00)	(7.85)	(3.45)	
D6	0.45	2.78	0.45	0.04	-0.05	1.76	-1.71	0.01	-0.02	0.03	0.24	0.05	0.93
			(3.72)	(1.02)	(-1.14)	(3.45)	(-4.09)	(1.37)	(-2.34)	(3.44)	(10.49)	(1.51)	
D7	0.71	3.30	0.61	0.01	-0.02	2.38	-1.20	0.01	-0.04	0.03	0.31	0.01	0.76
			(2.58)	(0.11)	(-0.14)	(1.97)	(-1.10)	(0.54)	(-2.21)	(1.59)	(5.15)	(0.16)	
D8	0.70	3.48	0.65	0.05	0.05	2.65	-1.19	0.02	-0.05	0.06	0.26	0.04	0.63
			(2.06)	(0.55)	(0.32)	(1.82)	(-0.76)	(0.73)	(-1.80)	(1.79)	(3.17)	(0.51)	
D9	0.61	4.28	0.58	0.06	-0.03	2.16	-1.85	0.04	-0.06	0.05	0.33	0.06	0.68
			(1.66)	(0.61)	(-0.14)	(1.34)	(-1.12)	(1.00)	(-1.69)	(1.33)	(3.45)	(0.65)	
D10	0.54	5.81	0.68	0.08	-0.00	3.64	-3.26	0.09	-0.13	0.09	0.39	0.09	0.63
			(1.26)	(0.50)	(-0.01)	(1.53)	(-1.24)	(1.77)	(-2.28)	(1.46)	(2.70)	(0.69)	
D10a	0.73	5.02	0.73	0.11	-0.03	2.04	-2.86	0.05	-0.08	0.06	0.35	0.05	0.63
			(1.58)	(0.78)	(-0.16)	(1.04)	(-1.29)	(1.08)	(-1.46)	(1.10)	(2.79)	(0.47)	
D10b	0.95	5.23	1.02	0.19	0.04	5.39	-0.87	0.06	-0.12	0.12	0.29	0.06	0.55
			(1.83)	(1.17)	(0.15)	(2.27)	(-0.32)	(1.22)	(-2.08)	(1.74)	(2.04)	(0.54)	
D10c	-0.06	7.99	0.32	-0.03	-0.04	3.57	-6.34	0.18	-0.19	0.11	0.55	0.16	0.64
			(0.45)	(-0.12)	(-0.09)	(1.10)	(-1.91)	(2.60)	(-2.85)	(1.44)	(2.81)	(0.86)	
1-10 spread	-0.61	6.46	-0.95	-0.17	-0.36	-5.21	2.53	-0.11	0.18	-0.15	0.10	0.10	0.01
			(-1.03)	(-0.60)	(-0.73)	(-1.37)	(0.62)	(-1.32)	(2.08)	(-1.51)	(0.38)	(0.43)	
1a-10c spread	-0.04	8.16	-0.55	-0.04	-0.46	-6.40	5.94	-0.19	0.26	-0.19	-0.04	0.09	0.07
			(-0.49)	(-0.10)	(-0.70)	(-1.27)	(1.25)	(-1.84)	(2.61)	(-1.74)	(-0.14)	(0.31)	
1-2 spread	-0.09	1.57	-0.28	-0.01	-0.10	-1.14	0.06	-0.01	0.01	-0.01	0.07	0.01	0.01
			(-1.22)	(-0.14)	(-1.10)	(-1.42)	(0.10)	(-0.75)	(0.26)	(-0.83)	(1.24)	(0.17)	
9-10 spread	0.06	2.07	-0.22	-0.02	-0.02	-1.46	1.33	-0.06	0.07	-0.04	-0.07	-0.03	0.29
			(-0.76)	(-0.20)	(-0.14)	(-1.46)	(1.13)	(-2.41)	(2.48)	(-1.51)	(-0.92)	(-0.44)	

Previous year's best-performing funds, which are grouped in portfolios D1a and D1b, delivered monthly excess returns of -0.10% and -0.37%, respectively, while the largest monthly excess returns were delivered by the so-called 'extreme-loser' portfolios D10a and D10b, which had monthly excess returns of 0.73% and 0.95%, respectively. This implies that, overall, previous year's worst-performing portfolios delivered the highest monthly excess returns. Portfolios in the middle decile exhibited solid positive monthly excess returns with a considerably lower standard deviation than in the top- and bottom-decile portfolios. Portfolios D3, D4, D5, and D8 display positive and significant (at 1%) exposure to the size factor, while the portfolios generally do not display any exposure to the bond and primitive trend-following factors. Portfolios D9, D10, and D10a show negative, significant exposure to the credit factor. Alphas estimated using the Fung and Hsieh (2004a) model are positive and significant in most cases, and the same is true for portfolio sensitivities to the equity factor. Portfolios D1b, D2, D3, D4, D6, and D10c display positive and significant alphas at the 1% level. Portfolios D9, D10a, and D10b exhibit positive but insignificant alphas, while the rest of the portfolios exhibit positive and significant alphas at the 5% level.

While Table 6.6 offers strong evidence of persistence in performance, the situation is significantly different when the adjusted Teo's (2009) model is used to estimate portfolio performance. Table 6.7 shows that only portfolios D6, D7, and D8 have positive, statistically significant alphas, indicating that the evidence of performance persistence is weak and that such evidence only applies to the middle-decile portfolio. Portfolios D6 and D8, which had positive, significant alphas in the first sub-period, managed to sustain persistence in performance during the financial crisis. The fact that these portfolios also had significant alphas in the first sub-period indicates that their superior performance was predictable irrespective of the market environment. Portfolio D6, which is the only portfolio to display a positive and significant alpha at the 1% level, also exhibits positive and significant (at 1%) exposure to the bond factor, and negative, high, and significant (at 1%) exposure to credit factor. Furthermore, portfolio D6 exhibits small, but significant, negative exposure to the primitive-trend following strategy on commodities and a small positive, but highly significant, exposure to the primitive trend-following strategy on foreign exchange. Finally, portfolio D6, for which the high adjusted R^2 of 93% indicates the ability of the adjusted Teo's (2009) model to almost fully explain the portfolio's returns, has positive exposure to the MSCI Asia ex Japan index that is highly significant at the 1% level. This portfolio has insignificant exposure to the Nikkei 225 index. I find no evidence of

persistence in poor (negative) performance. Although portfolios D1a, D1b, D1, and D3 have negative alphas, they are insignificant.

6.6 Conclusion

The issue of persistence in hedge fund performance has been widely discussed in the academic literature, with widely differing and often conflicting results. From the perspective of the hedge fund investor, this issue is extremely important, as performance often serves as the basis for hedge fund investment decisions. Furthermore, Asia-focused hedge funds have grown rapidly over the last ten years in terms of the number of funds and the amount of assets under management.

The main goal of this chapter, therefore, has been to shed some light on this issue by investigating a relatively large database of Asia-focused hedge funds during the period January 2000 until December 2010, a period that encompasses the global financial crisis of 2007 to 2010. I follow Capocci et al. (2005) and divide the sample into two sub-periods in order to analyze persistence in hedge fund performance in two distinctively different market environments. The contribution of this chapter is that it examines the largest data sample of Asia-focused hedge funds over a period that includes both bullish and bearish market periods using a parametric methodology. Investors can take advantage of potential persistence in performance by replicating this strategy and investing in those hedge funds that exhibit potential persistence in performance.

This chapter investigates persistence at the annual horizon using the methodology previously used by Hendricks et al. (1993), Carhart (1997), and Capocci et al. (2005), in which 10 portfolios are constructed at the beginning of every year based on the funds' performance in the previous year. This procedure is then repeated for the whole time period, which subsequently yields a time series of portfolio returns. Portfolio returns are then estimated using two multi-factor performance measurement models: the Fung and Hsieh (2004a) model and an adjusted version of Teo's (2009) model.

Previous research has shown that survivorship and backfilling bias, as well as illiquidity-induced return smoothing, can influence the measure of performance persistence and overstate persistence. It would then be unclear whether persistence is a result of managerial skill or a result of these biases. To alleviate this threat, I account for the possibility of survivorship and backfilling bias. As the data sample covers the period from 2000 onwards,

and as the Eurekahedge database includes both surviving and dissolved funds, survivorship bias should not significantly affect the results. To account for backfilling bias, I delete the first 12 months of returns for every hedge fund. Finally, to account for illiquidity-induced return smoothing, I follow Getmansky et al.'s (2004) desmoothing procedure, which was also used in Chapter 5.

For the full sample period, I find only limited evidence of persistence in hedge fund performance. My analysis of the full sample period indicates that superior performance is more predictable among medium and poor performers. When using Teo's (2009) model for the full sample period, I find positive, highly significant alphas (at 1%) only among the middle and bottom deciles. The same is true when the Fung and Hsieh (2004a) model is used. My results are similar to those of Capocci et al. (2005), as I also find that most of the persistence in performance is found in the first, bullish sub-period. Both performance measurement models indicate that most of the portfolios display positive performance persistence in the first sub-period. In the second sub-period, the results differ depending on the performance model used. When I use the Fung and Hsieh (2004a) model, I find that most of the portfolios exhibit positive, statistically significant persistence in performance. However, the situation changes significantly when I use Teo's (2009) model to explain performance. In this case, only three portfolios, all of which are located in the middle decile, exhibit significant persistence in performance. As the adjusted Teo's (2009) model is better
for explaining Asia-focused hedge fund persistence, as proven by its considerably higher adjusted R^2 statistics, one can conclude that there is only weak evidence of performance persistence during the second sub-period.

Furthermore, I find no conclusive evidence of persistence in performance for the best- and worst-performing funds. One can explain this phenomenon in the following way: even though some hedge fund managers take on a considerable amount of risk, which subsequently leads them to experience significantly superior or inferior returns for a short period of time, many hedge fund managers apply less risky strategies and are therefore able to outperform the market for a longer period of time.

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