Do Momentum Based Strategies Still Work In Foreign Currency Markets?

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Abstract

This paper examines the performance of momentum trading strategies in foreign exchange markets. We find the well-documented profitability of momentum strategies with equities to hold for currencies as well and to have continued throughout the 1980s and the 1990s. Our results indicate that the long/short strategy of buying the most attractive currency and shorting the least attractive currency obtains average excess returns that are significantly positive. Of particular note, the profitability to momentum strategies in foreign exchange markets has been particularly strong during the latter half of the 1990s. The results are insensitive to the specification of the trading rule and the base currency for analysis. We also show that the correlations of the long-short momentum strategies using differing base currencies are very high – typically around 0.90. This would indicate that strong/weak momentum currencies relative to a base currency at a particular time are typically also strong/weak currencies relative to most other base currencies as well. Finally, using a bootstrap methodology we show that the performance is not due to a time-varying risk premium but depends on the underlying autocorrelation structure of the currency returns. In sum, the results lend further support to prior momentum studies on equities. The profitability to momentum-based strategies holds for currencies as well.

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I. Introduction

In recent years investors in foreign exchange markets have failed to agree with the academic belief that price behaviour in financial markets is determined by market fundamentals. While they agree that over the long run exchange rates should revert to their fundamental values, they argue that profitable opportunities exist in the short run due to market inefficiencies. In this paper we examine the profitability of momentum trading strategies in foreign exchange markets. We find the well-documented profitability of momentum strategies during the seventies and eighties to have continued throughout the nineties. Furthermore, we find that this profitability is not due to compensation for bearing time varying risk premium as suggested by some researchers.

It has been argued that foreign exchange markets would be efficient when exchange rates were a true reflection of all the currently available information on domestic and international economic and political environments. In this type of market investors would not be able to use current information to make excessive returns, as any profit potential would be arbitraged away (Neely (1997)). Consequently, exchange rate movements would be random and only occur when new information became available (Fama (1965)). However, past studies have shown that exchange rates do not follow a random walk but rather demonstrate statistically significant trends and show some degree of serial correlation (Taylor (1992). Furthermore, arbitrage in efficient foreign exchange markets should ensure that forward exchange rates reflected international differences in interest rates (Fama (1984)). Unfortunately, forward exchange rates calculated using interest differentials have proven to be poor predictors of future spot exchange rates. Several studies have argued that these forward rate forecasting errors could be caused by unforeseen interest rate movements and time varying risk premiums on foreign exchange (Levich (1989) and Clarida and Taylor (1997)). As most studies have found it impossible to accurately estimate the forward exchange rate bias, forecasting future exchange rates is extremely difficult.

The ability for foreign exchange markets to be efficient may depend on their ability to conform to the assumptions of the EMH. The EMH assumes investors are rational and have a profit motive for trading. However, human nature makes it difficult for investors to act rationally and trade independently of other investors (Banerjee (1992)). For example, in foreign exchange markets short-term market sentiment has not always been justified by market fundamentals. Shleifer and Summers (1990) argue that some traders, who they label as noise traders, may overact to news and generate exchange rate movements which are unfounded by fundamentals. Consequently, exchange rates may be reacting to noise rather than news. The profit motive assumption of the EMH also does not apply in foreign exchange markets as central banks, a major participant, are only interested in ensuring their currency's value is fair and to smooth out exchange rate volatility. Any central bank dampening of a depreciation or appreciation will require the domestic currency to be bought or sold. This type of trading generates non-random exchange rate movements and results in traders earning excessive returns and central banks possibly experiencing losses (Sweeney (1997), Szakmary and Mathur (1997), Neely, Weller and Dittmar (1998), and Lebaron (1999))[1]. The ability for arbitragers to fully counter large exchange rate movements generated by non-rational or non-profit motivated investors tends to be restricted by the loss limits they are prepared to accept when undertaking arbitrage (Shleifer and Summers (1990)). In fact, arbitrageurs may help feed serial correlation of short-term exchange rates if they feel investor sentiment is not going to change immediately. They realise they can profit by trading with the market in the short-term and so help move exchange rates further from their fundamental values (Shleifer and Summers (1990)).

The ability for short-term exchange rates to be influenced by psychological factors, (possibly due to under reaction by investors to new information) rather than observable macroeconomic fundamentals has been used by some investors to develop profit making trading strategies based on technical analysis. Recent studies by Sweeney (1986), Schulmeister (1988), Levich and Thomas (1993), Taylor (1994), Kho(1996), Neely, Weller and Ditmar (1997), Lebaron (1998, 1999), have documented evidence that technical trading strategies have produced profitable returns in managing foreign currency exposure. This non-fundamental analysis uses past price movements to estimate future price trends existing when market participants do not trade randomly. Using technical analysis investors will typically create currency price barriers. They will buy when prices rise past the ceiling barrier and sell when prices fall below the floor barrier. Consequently, investors will trade with the trends and identify signals that indicate when

[1] Sweeney finds that central banks may have made significant profits during intervention. Szakmary and Mathur (1997) and LeBaron (1999) find that moving average trading rules that trade contrary to central bank intervention are significantly profitable, and suggest that central banks lose money. Neely, Weller and Dittmar (1998) on the other hand find that central bank intervention is more likely to be profitable for central banks in the long run.

trend lines will break. Taylor and Allen's (1992) survey on trading strategies adopted by London foreign exchange dealers support the popularity of technical analysis in foreign exchange markets. Dealers indicated that technical analysis rather than fundamental analysis mainly determined their short-term, intraday to one week, forecasting. However, fundamental analysis became significantly more important as the time horizon increased.

The popular measures of price movements used in past studies have been filter and moving average rules. Both these rules have extrapolative buy and sell signals and indicate to buy when exchange rates are increasing and sell when exchange rates are decreasing. Under filter rules investors will buy when exchange rates increase by a certain percent above their most recent trough and sell when the exchange rates decrease by a certain percent below their most recent peak. Moving average rules give a buy signal when a short run moving average cuts a long run moving average from below. A sell signal occurs when a short run moving average cuts a long run moving average from above. A substantial number of studies have shown that both types of trend following rules have proven to be profitable in foreign exchange markets even after adjusting for interest expense and transaction costs For example, Sweeney (1986) reported excess profits using filter based rules over the buy hold strategy for the US/DM for the period 1975-1980. Levich and Thomas (1993) provided further evidence on the profitability of filter rules and moving average based strategies, but used bootstrapping to determine the significance of these excess returns[2]. Taylor (1994) examines the profitability of channel rules, and finds that channel rules can be profitable when market prices are almost random walks. Kho (1996) also reports significant excess returns over the buy hold

[2] For a discussion of bootstrapping see Brock, Lakonishok and Lebaron (1992).

strategy using selected moving average rules, but attributes that a substantial proportion of profitability is due to time varying risk premiums. Neely, Weller and Dittmar (1997), using a genetic programming approach to find attractive technical trading rules, finds evidence of economically significant excess returns trading in and out of sample for six major currencies from 1980-1995. The presence of large exchange rate swings in these studies could explain some of this profitability as once an exchange rate move started it could continue for some time without being interrupted (Schulmeister (1988)). Consequently, investors profit from following the movements of other active investors.

Most of the studies cited above have examined the performance of trading rules using daily foreign exchange data (Dooley and Shafer (1983), Sweeney (1986), Levich and Thomas (1993), Taylor (1994), Osler and Chang (1995), and Neely, Weller and Dittmar (1997)). Kho (1996) on the other hand uses weekly data. Recent studies have also examined the performance of technical trading rules using intra day data (Neely, Weller (2000) and Raj (2000)). The general conclusion is that technical trading rules are able to earn significant excess returns that cannot be easily explained by bearing additional risk when using daily or weekly data[3]. Whereas Neely, Weller (2000) and Raj (2000) have shown that technical trading rules do not produce significant profits using intraday data.

One of the problems with prior research is that most studies have selected a small number of moving average strategies, basing their decisions on moving average combinations that are commonly employed by traders. By choosing a small number of moving average combinations this may bias the results to those strategies that have

[3] The notable exception being Kho (1996).

performed well ex post. Neely, Weller and Dittmar (1997) point out: “ these studies have deliberately concentrated on the most widely used rules, but doubt remains as to whether the reported excess returns could have been earned by a trader who had to make a choice about a rule or combination of rules to use at the beginning of the sample period”.

To overcome this criticism we evaluate 354 moving average strategies for eight currencies from January 1980 to June 2000. The approach adopted is that proposed by Jegadeesh and Titman (1993, 2000) where technical indicators are used to rank stocks from best to worst. Their strategy ranks stocks based upon the previous six months return and then form decile portfolios. A long/short strategy is then instigated, the long portfolio consisting of those stocks with the greatest previous six months returns (top decile) and the short portfolio including those stocks with the worst previous six-month returns (worst decile). They find significant excess returns both in sample and out of sample. We employ a similar ranking procedure for currencies, but instead of using the previous six-month return we use various combinations of moving averages. The strategy’s objective is to identify the most attractive and the least attractive currencies using the moving average rules. A long/short position is then instigated by buying the most attractive currency and shorting the least attractive currency. For example, assume a manager in Switzerland, using the moving average strategy, identifies the Japanese yen to be the most unattractive currency and the Australian dollar to be the most attractive currency relative to the Swiss franc. The Swiss manager would sell futures contracts on the

Japanese yen and then buy futures contracts on the Australian dollar[4]. This approach differs from previous studies using technical indicators on foreign exchange markets. In prior studies long/short positions were taken on each individual currency whereas in our case we are taking positions in only the most attractive and most unattractive currencies.

We take the perspective of a long-term investor who has foreign currency exposure in Australia, Canada, France, Germany, Italy, Japan and the United Kingdom and the US. This could be a global equity manager who has purchased stocks in each of the above-mentioned countries. Alternatively, it could be a multinational company that exports to those markets. Once a currency exposure is initiated it is held for one month, at which time the foreign exchange position is reevaluated. The strategy might require only three to four trades a year and would not be concerned with daily exchange rate volatility. Instead, the strategy focuses more on long-run exchange rate movements. While it is true that using daily data may be able to identify changes in market sentiment more effectively, this might also induce a high frequency of noise trading that could prove to be costly in terms of transaction costs.

Our results indicate the moving-average trading rule specification minimally impacts profitability during sub periods or the entire sample period. In fact, the profits can be quite substantial, yielding total returns of about six percent per annum. These results are consistent across the eight base currencies of reference. Furthermore, these profits most likely do not arise as compensation for bearing additional risk. The format of

[4] At the same time a U.S. manager, using the same strategy might also buy the Australian dollar but short the Swiss franc. The strategies identified in this paper all rely on moving averages relative to a *base currency of reference.*

the paper is as follows. Section two describes the data and methodology, while section three outlines the empirical results. Section four concludes with the findings of the paper.

II. Data and Methodology

The data set consists of three-month government interest rates and exchange rates taken from the Global Financial Database. We obtained end-of-month data for Australia, Canada, France, Germany, Japan, Switzerland, the United Kingdom, and the United States for a period spanning January 1975 through June 2000. In addition, we obtained MSCI capitalization weights for the same period from Morgan Stanley. We computed currency returns using each country as the domestic currency. That is, we computed all combinations of currency returns for the eight countries. We will define this return series as base currency returns. The base currency returns from month t – 1 to t are computed as follows:

(1)
$$R_{B,t} = \frac{S_t}{S_{t-1}} - 1,$$

where the base currency return is $R_{B,t}$, the spot exchange rate at month t is S_t and the spot exchange rate at month t – 1 is S_{t-1}. All exchange rates are expressed as the ratio of units of domestic currency per unit of foreign currency.

In addition, we computed a similar series of currency returns adjusted for interest rate differentials. An investor who uses futures to invest in currencies or borrows in one country to invest in another would actually experience these returns. The futures price at month, t – 1, is denoted as F_{t-1}. The interest- adjusted returns from month t – 1 to t are computed as follows:

(2) $$R_{I,t} = \frac{S_t}{F_{t-1}} - 1,$$

where

$$F_{t-1} = S_{t-1} \, \text{Exp}[\, (r - r_f)\, t \,] \, ,$$

$R_{I,t}$ is the interest-adjusted return, r is the domestic interest rate, r_f is the foreign interest rate, and t is one month. Note that:

(3) $$R_{I,t} \approx r_f - r + \frac{S_t}{S_{t-1}} - 1.$$

[Insert Table 1 about here]

Table 1 lists summary statistics for the base currency returns of each country. Table 1 lists each base currency in the far left column and the reference currencies in the subsequent columns. For example, using Australia as the domestic currency the average monthly return to investing in Canadian dollars is 0.192 percent. The MSCI column gives the return to a basket of currencies with the individual country allocation determined by its MSCI weight. The allocations are determined by excluding the MSCI weight of the domestic currency. That is, if we have three currencies, each with an MSCI weight of 33 percent, we would give each of the other two currencies a weight of 50 percent when we determined the MSCI return for each base currency. The Equal benchmark equally weights the other seven currencies for computing a return relative to a base currency.

We can easily observe from Table 1 that the Australian dollar has experienced the greatest depreciation during the previous twenty years. The Japanese yen has had the greatest appreciation. Very little of note can be observed concerning the individual currency returns, with the possible exception for the interaction of the French with German currency and, to a lesser extent, the Swiss with the French and German currency. The French (domestic) – German return series and the German (domestic) – French return series are both highly leptokurtic. The French (domestic) – German return series is highly positively skewed and the German (domestic) – French return series is highly negatively skewed. The Ljung-Box-Pierce (LBP) statistics are presented in the next to last row for each base currency and test the joint significance of the first ten autocorrelations. The p-values for the LBP statistics are given in parentheses in the last row for each base currency. In all cases, the p-values are insignificant with the exception of the French (domestic) – German returns, French (domestic) – Swiss returns, German (domestic) – French returns, German (domestic) – Swiss returns, Swiss (domestic) – French returns, Swiss (domestic) – German returns, and the U.S. (domestic) – Australia returns. One interesting historical pattern is the rather strong eighth and ninth autocorrelation for the French (domestic) – German returns and the German (domestic) – French returns.

[Insert Table 2 about here]

Table 2 provides similar summary statistics for the interest-adjusted currency returns. These are the actual returns that an investor would face when trading in the currency markets. Of particular note, the interest-adjusted returns are much smaller in magnitude than the base currency returns. Any trading strategy relying on these returns would have a much higher hurdle to overcome to exceed a benchmark of simply holding the MSCI or Equal benchmark basket of currencies. Note that on an interest-adjusted basis the rankings of performance differ markedly from Table 1. The Swiss franc is now the worst performing currency, even though it was one of the strongest for base currency returns. The Australian dollar’s interest-adjusted performance is no longer quite so disappointing, and the Japanese yen has an interest-adjusted return very close to zero in magnitude. The relationships identified between the French, German, and Swiss currency continue to hold with interest-adjusted returns, but they are somewhat weaker.

The strategy for the paper is to simulate the performance of a moving-average rule, using the base currency returns to determine the currency allocations and the interest-adjusted currency returns to compute the actual realized returns. Thus, this strategy would mimic the returns an investor would earn through the use of futures contracts or borrowing in one currency to invest in another. The strategy is very simple: use the base currency returns to compute a short-run and long-run moving average applying prior monthly returns for each currency relative to the domestic base, rank the seven non-domestic currencies by the short-run moving average minus long-run moving average difference, then initiate a long position in the currency with the highest rank and short the currency with the lowest rank. The strategy will be repeated using all eight currencies as the base currency of reference.

Of course, we will need to define the moving average rules to be used. At time t the short-run moving average and the long-run moving average using the prior j months of returns are computed as:

(4) $$SR_{j,t} = \frac{R_{B,t} - (j-1)SR_{j,t-1}}{j},$$

(5) $$LR_{k,t} = \frac{R_{B,t} - (k-1)LR_{k,t-1}}{k},$$

where $SR_{j,t}$ is the short-run moving average at month t using the prior j months of returns and $LR_{k,t}$ is the long-run moving average at month t using the prior k months of returns[5].

In the presentation of the results, we will not focus on any one moving average rule. Instead, the strategy will determine the currency allocations using several different short-run – long-run moving average combinations at each month t and then equally weight the strategies to determine a weighted allocation to each currency. In this analysis the short-run moving average values range from one to twelve months, while the long-run moving average values range from two to thirty-six months. For all combinations of short-run, long-run moving average rules, the number of months used to compute the short-run moving average must be less than the number of months used to compute the long-run moving average. For example, using a short-run moving average of one month, we determine the currency positions using:

[5] Return based momentum strategies are preferred as the price momentum strategy would tend to favor currencies with greater price adjustments such as the yen. The largest change in price may not reflect the largest change in percentage terms.

$SR_{1,t} - LR_{2,t}$, $SR_{1,t} - LR_{3,t}$, . . . , $SR_{1,t} - LR_{36,t}$. Using a short-run moving average of two months, we determine the currency positions using: $SR_{2,t} - LR_{3,t}$, $SR_{2,t} - LR_{4,t}$, . . . , $SR_{2,t} - LR_{36,t}$. In total we evaluate 354 moving average combinations.

At the end of each month, the seven non-domestic currencies are ranked from best to worst by using the return based momentum indicator, which is equal to the short-run moving average less the long-run moving average. The currency that has the largest positive deviation is the most attractive and is given a rank 1, the currency that is second most attractive is ranked 2, and so on for other rankings. The currency determined to be the most unattractive is ranked 7. These rankings are determined using each of the moving average rules. Each short-run, long-run moving average rule will determine a rank 1 and a rank 7 currency. Our strategy is to give equal weight to each of the short-run, long-run moving average combinations, and therefore to determine a weighted allocation to each of the non-domestic currencies. Positions are then taken through futures and held for a month. On a monthly basis the rankings are reevaluated and new positions are taken if warranted

We will focus on four possible strategies using short-run, long-run moving average combinations. First, as described above we will consider a strategy that provides equal weight to all momentum strategies where the short-run moving average rules range from one to twelve months and the long-run moving average rules range from two to thirty-six months. In all cases, the number of months used to compute the short-run moving average must be less than the number of months used to compute the long-run moving average. *Strategy one* will consist of 354 equally weighted moving average combinations. This strategy will invest in the currency with the highest rank determined by the difference between the short-run and long-run moving average and will short the currency with the lowest rank. *Strategy two* will use the same moving average rules as *strategy one*, but instead of investing in only the rank 1 currency will give a one-third weight to each of the top three ranks and continue to short the lowest rank. *Strategy three* is identical to *strategy one* except that it will only consider moving average combinations with the short-run moving average months ranging from four to six, and the long-run moving average months ranging from five to thirty-six. In total, *strategy three* will consist of 93 equally weighted moving average combinations. *Strategy four* is identical to *strategy two* with the exception that it also will only consider moving average combinations with short-run months ranging from four to six and long-run months ranging from five to thirty-six. With all the strategies, many of the individual moving average rules will rank the currencies in exactly the same order.

As specified in equations (4) and (5), the moving average rules will use *base currency returns* when determining the short-run, long-run moving average ranks.[6] The actual realized returns, however, will depend upon the *interest-adjusted returns*. As can be seen from Table II, the interest-adjusted returns differ substantially from the base currency returns. The tests are repeated using each currency as the base currency.

III. Results

Table 3 presents summary statistics regarding the performance of *strategy one* and *strategy two* over the entire period of the study and for all base currencies. The

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[6] The tests were repeated using *interest-adjusted returns* to determine the currency ranks. The results were almost exactly identical to those presented here.

results using *strategy three* and *strategy four* are similar in nature and slightly stronger. We can quickly see that the moving average rules perform quite well over the entire sample period, no matter which base currency is considered. For all base currencies, the mean monthly return to the moving average strategies is about 50 to 60 basis points each month. In all cases these mean monthly returns are significantly different from zero.[7] The mean return for *strategy one*, [Rank 1 – Rank 7], is slightly greater than that for *strategy two*, [Rank(1, ,2, 3) – Rank 7]. However, *strategy one* in all cases has a higher level of risk than does *strategy two*. Examination of the individual rank returns reveals that in all cases outside of the U.S., the mean return to Rank 2 is greater than the mean return to Rank 1.

[Insert Table 3 about here]

No consensus exists regarding the appropriate benchmark for risk-adjusting the strategies. If currency returns are unpredictable, one might argue the appropriate benchmark is a zero expected return. On the other hand, an appropriate benchmark might be to maintain a currency exposure with the same composition as a broad international index such as the MSCI. However, using the MSCI currency index may likewise be an inappropriate benchmark to use to evaluate currency performance. The MSCI has, at times, given excessive weight to one individual currency – most recently, the U.S. dollar. As a basis of comparison, a benchmark that equally weights currency exposure should

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[7] We did not include a transactions cost in the analysis. Most studies use a ten basis point round-trip transactions cost for trading in currency futures markets.

also be relevant. These benchmarks are computed using the base currency returns presented in Table 1.[8]

The paired t-tests presented in Table 3 measure the statistical significance of excess returns for the short-run, long-run moving average strategies against the MSCI and Equal benchmarks.[9] The Wilcoxon test is a nonparametric test of the statistical significance of the excess returns. Related to an examination of excess returns, Table 3 also provides the percentage of months the strategies had a positive return, a return greater than the MSCI benchmark, and a return greater than the Equal benchmark.

For all base currencies, the short-run, long-run moving average strategies had a positive return in about 60 percent of the months. The probabilities that the returns were greater than the MSCI and Equal benchmarks were also greater than 50 percent for all base currencies, and for most currencies were above 55 percent. For most base currencies, either the paired t-test or the Wilcoxon test also showed the strategies to yield statistically significant excess returns. However, the statistical significance of the short-run, long-run moving average returns was, in general, not as great with the MSCI and Equal benchmark as they were with the zero benchmark.

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[8] An additional benchmark not tested might be a policy of completely hedging currency exposure through the use of futures contracts. In this case, the benchmark expected return would be the interest rate differential between the two countries. Table 2 gives the returns to this benchmark in the MSCI and Equal columns. Because these returns are much lower in magnitude than the base currency returns identified in Table 1, any test which shows significance relative to the base currency returns would likely have even greater significance using the interest-adjusted returns.

[9] This test is identical to the standard t-test for statistical significance on excess returns.

Direct examination of the individual rank returns, reveals that the excess performance of the short-run, long-run moving average returns is either due to the high rank returns or the low rank returns, but rarely to both. The currencies shorted appear to provide the bulk of the excess return relative to the MSCI in all countries with the exception of Japan and Switzerland. Using the Equal benchmark, we can see that for four of the base currencies the excess returns are due to the short side and for the other four the excess returns are due to the long side.

In addition to considering the returns to the strategies, we examine the proportion of the 354 individual moving average strategies that have average returns greater than the three individual benchmarks. We can see that for all base currencies, nearly all if not all of the strategies outperform all of the benchmarks. We may therefore strongly state that the exact parameterization of the moving average rule matters little. The results we present are robust to the technical trading rule employed. In fact, the excess returns generated by the strategies are due to pure momentum.

Finally, for *strategy one* and *strategy two* both the first and the fourth autocorrelation are negative. In many of the cases, the results are statistically significant. The result is noteworthy in that both the base currency returns and the interest-adjusted currency returns do not possess this characteristic. Positive returns to the moving average strategies tend to be followed by negative realizations and vice-versa.

In sum, the short-run, long-run moving average strategies clearly outperform a benchmark of zero over the entire sample period. Relative to the MSCI and Equal benchmarks, the results are less conclusive but continue to provide evidence of outperformance. Clearly, if it is believed that expected interest-adjusted currency returns are zero the moving average strategies should provide an excess return of about five to six percent per year.

[Insert Table 4 about here]

Table 4 provides subperiod analysis for *strategy one* and *strategy two* across all base currencies. The analysis is divided into five year intervals. Because of the relatively high standard deviation of the strategies and the limited number of months in each subperiod, the results are, in general, not statistically significant. In spite of the high standard deviation, *strategy one* and *strategy two* have positive mean returns in all subperiods for all base currencies. The results appear to be the strongest during 1985 – 1989 and 1995 – 2000 for most of the base currencies. The outcomes during 1990 – 1994 appear to have been the weakest. We can also see that using *strategy two*, which invests across the top three ranks, appears to provide the most promising results. Finally, the results are not sensitive to the moving average rules employed. Nearly all of the rules exceeded the returns of the three benchmarks in all subperiods.[10]

[Insert Table 5 about here]

While the overall results are insensitive to the exact specification of the moving average strategy, direct examination of the average performance with the

[10] With the most notable exception being France, Germany, Switzerland, and the U.K. relative to the MSCI benchmark during 1980 – 1984.

parameterizations does reveal some to be more reasonable than others. Table 5 presents summary measures for *strategy three* and *strategy four*. Examination of the individual results revealed these strategies to generally outperform alternative parameterizations.[11] In all cases, limiting the moving average rules to a tighter range increases the performance of the strategies by 5 to 10 basis points on average. That is, by tightening the specification, the additional return gained would likely cover the total transactions cost to the moving average strategies.

It could be argued that the strong performance of the strategies are driven by the strong appreciation of the yen relative to the other currencies over this time period. While the base currency return to the yen has been remarkable over this twenty year period, its interest-adjusted return is much more in alignment with the seven other currencies. Since the actual returns generated by the strategies depend upon the interest-adjusted returns to the currencies, it is not at all clear the results are yen driven. Nevertheless, the tests have been replicated excluding Japan from the analysis and are presented in Table 6. Table 6 clearly shows the results continue to hold, though less strongly, when Japan is excluded from consideration.

[Insert Table 6 and Table 7 about here]

Table 7 presents the correlations of the returns to the four different strategies across the eight base currencies. We can easily see that the correlations are quite high for

[11] We should note that the specifications for strategies three and four were determined after direct examination of the results and may not be optimal for future periods.

the moving average results – in many cases over 0.90. The strategies in each of the base currencies are clearly going long and short in the same currencies at about the same time. As such, the tests in the individual countries are not truly independent, and it is not clear that conducting tests on an international basis adds any value over an examination with one base currency.

We have found that a very simple moving average strategy can generate positive excess returns across multiple time periods and also multiple countries. Papers such as Kho (1996) suggest that the performance of such strategies in currency markets could be due to a time-varying risk premium. Kho's paper, in particular, tests a moving average strategy using weekly currency data.

While a time-varying risk premium could, in fact, explain the performance of technical trading strategies with intra-day, daily, or weekly data, many reasons exist to doubt the validity of that explanation for the results in this study. First, most of the studies test for the existence of time-varying risk premia through the use of univariate or multivariate GARCH models. It is well known that monthly return data, in general, does not possess GARCH characteristics. Second, Kho in particular shows his result to be due to a time-varying covariance with the broad world market index. Most long-short strategies have a near zero covariance with the market. Finally, as we will show no evidence exists that large returns in magnitude are correlated with future large returns in magnitude for the short-run, long-run moving average strategies.

[Insert Table 8 about here]

Table 8 presents the autocorrelations of squared interest-adjusted returns. Limited evidence exists of some autocorrelation in the magnitude for some of these returns. However, for some base currencies such as the yen, little evidence exists to suggest that currency returns are autocorrelated in magnitude. Since the earlier results were consistent across base currencies, it is not likely that this autocorrelation can explain the earlier results.

[Insert Table 9 about here]

Table 9 presents the autocorrelations to the squared moving average strategies. While some evidence does exist that the magnitude of monthly returns may be autocorrelated for individual ranks, in all cases the moving average strategies have autocorrelations very close to zero and statistically insignificant. Large returns in magnitude for the individual strategies are not followed by subsequent large returns in magnitude. The likelihood that a time-varying risk premium can explain the results is indeed remote.

Table 8 reveals that the squared interest-adjusted returns are weakly autocorrelated at the first lag. Table 9 reveals that the squared moving average returns have no autocorrelation. Table 10 attempts to fit a GARCH model to the returns from which the moving average strategy returns are derived – the interest-adjusted returns. At a minimum, if a time-varying risk premium is a determinant of the results, we would expect this return series to exhibit time-varying volatility.

[Insert Table 10 about here]

The following model is used for the univariate GARCH estimation:

$$\tilde{r}_t = c + g\, s_{t-1} + \tilde{e}_t, \qquad (6)$$

where

$$\tilde{e}_t = \tilde{z}_t\, s_t,$$

$$\tilde{z}_t \sim \mathrm{N}[0, 1],$$

$$s_t^2 = w + a_1 e_{t-1}^2 + a_2 \mathrm{I}(e_{t-1}) + b\, s_{t-1}^2,$$

$$\mathrm{I}(e_{t-1}) = e_{t-1} \text{ if } e_{t-1} > 0$$

$$= 0 \quad \text{if } e_{t-1} < 0.$$

Table 10 reveals no evidence of GARCH effects for the interest-adjusted currency returns. In nearly all cases the GARCH parameter, b, is statistically insignificant and in many of the estimations is very close to zero[12]. In sum, there is no evidence that either the interest-adjusted currency returns or the actual returns to the strategies themselves are due to a time-varying risk premium. Large magnitude returns are not followed by large magnitude returns for the strategies defined in this paper.

We can be fairly confident that time-varying risk cannot explain the results. We now wish to further narrow the possible explanations. Since the strategies use multiple currencies, it is possible that the performance is due to the cross correlations among the currencies. In addition, the differential mean return of the currencies might explain the

[12] A GARCH model was also fitted directly to the returns generated from the moving average strategies. All GARCH parameters were insignificant for this estimation.

significant moving average results. Some currencies have tended to fall in relative value over the testing period while others have generally appreciated. It is possible that the strategies defined are simply taking advantage of this general trend. Another theory is that the returns to the strategies might be due to a complicated function of the autocorrelation process underlying the interest-adjusted return series. Finally, the performance of the moving average strategy might be explained by the most basic reason of all: higher overall risk.

[Insert Table 11 about here]

A bootstrap methodology was employed to determine if the correlations across currency returns or the differential mean return could explain the performance of the moving average strategy with each of the base currencies. The bootstrap method randomly selected with replacement a row of base currency returns and interest-adjusted returns from the 246 rows of data available. In this way, a new data set was generated possessing all the original characteristics of the original data with the exception of the original autocorrelation structure. From this new data set, the results to the short-run, long-run moving average returns were generated in exactly the same fashion as with Table 3. One completion of this cycle constituted one simulation. This process was repeated 1,000 times for each base currency.

Table 11 presents summary results for *strategy one*. Similar results were found with the other three strategies. For various measures of performance, Table 11 gives the mean from the simulation and the count of the number of simulations that were less than the actual value from Table 3. For example, 1,000 out of 1,000 simulations for the moving average strategy had a mean return less than the actual mean return of 0.601 percent in Australia. For Canada, 999 of the 1,000 simulations had a mean return to the moving average strategy less than the actual mean return of 0.532 percent. Table 11 clearly shows that the results depend upon the autocorrelation structure in the original interest-adjusted returns data. Maintaining the correlation structure and the mean for the interest-adjusted currency returns is not sufficient to remove the statistical significance of the moving average returns. While an examination of Table 2 shows no obvious pattern in the monthly autocorrelations that could explain the generated returns, the bootstrap results clearly demonstrate the original autocorrelation structure is a necessary precondition to generating the results.

[Insert Figure1 about here]

In addition to the autocorrelation structure, another possible reason these strategies have continued to persist during the previous two decades is that they are not risk-free. Figure 1 presents rolling 12-month returns and excess returns with respect to the MSCI benchmark for all base currencies. The results in Figure 1 use *strategy one* returns, but the results are very similar for the other three strategies. Figure 1 reveals that strictly following the strategy identified in this paper would lead to significant time periods where performance could be negative or seriously underperform the MSCI benchmark. Examination of Table 3 reveals that with the notable exception of Australia and possibly Japan, the moving average strategies have higher standard deviations than the MSCI and the Equal benchmarks. However, we should emphasize that the tests in Table 3 showed risk-adjusted returns to be, in most instances, significantly positive. The strategies may have higher risk, but this alone does not appear to explain the higher returns to the momentum strategies.

At this stage we have eliminated the differential mean returns across currencies, the correlation structure across currencies, and, most likely, time-varying risk premia as possible explanations for the performance of the short-run, long-run moving average strategies. We have also determined that the autocorrelation structure in the original data is a necessary precondition to the findings of the paper. Perhaps most importantly and most basically, the strategies may also have higher returns because they have higher risk. Higher risk, however, is not a sufficient condition to the findings of this paper.

IV. Conclusion

The results in this paper indicate that the potential exists for investors to generate excess returns in foreign exchange markets by adopting a momentum strategy using the moving average rules identified in this paper. It is not at all apparent that foreign exchange markets operate in an efficient manner and that returns are determined entirely by fundamental information. In fact, very simple technical rules can generate quite significant returns beyond that which can be explained by transactions costs or risk.

The strategies identified are robust to the time-period of analysis, the base currency of reference, and the benchmark of comparison. Little evidence exists that the performance is due to risk. The long-short returns do not possess any of the risk characteristics we would expect of an asset impacted by time-varying risk premia. We have determined the results are not driven by the the long-term drift of the currencies, the cross-correlation structure across the currencies, nor by the differential risk levels of the currencies. While risk may explain a portion of the long-short returns, it is not sufficient to generate the levels of returns witnessed in this paper. We do know that the autocorrelation structure in the underlying currency return data is necessary to the success of the long-short strategy.

Unlike many of the prior studies of technical trading rules in foreign exchange markets, the strategies we have identified do not require frequent trading. We have simply applied the Jegadeesh and Titman technique to a small sample of eight assets – the eight currencies. These strategies would be most appropriate for an international fund manager who wishes to generate additional returns for the base portfolio. In addition, a manager in a large multi-national might also wish to make use of the techniques identified to more effectively allocate foreign exchange exposures.

Beyond refuting the hypothesis of a time-varying risk premium and determining that the performance is due to the original structure in the data, we have made no attempt to explain the strong results in this paper. Our results are largely consistent with that in Sweeney (1986), Schulmeister (1988), Levich and Thomas (1993), Taylor (1994), Kho (1996), Neely, Weller, and Ditmar (1997), and Lebaron (1998, 1999). We have documented that the type of momentum strategy used in Jegadeesh and Titman (1993, 2000) in equity markets is effective in foreign exchange markets as well. While central bank intervention might explain a portion of the results for foreign exchange, the fact that this strategy is profitable in equities as well forces us to examine additional explanations. Future papers might wish to examine the economic or behavioral rationale to the underlying structure of the foreign exchange data. Perhaps the returns to the long-short strategy are due to the economic cycle. Perhaps they are due to underreaction or overreaction to the release of news. Perhaps trend chasing and noise traders determine the short-term direction of the foreign exchange market. What we do know is that a very simple momentum strategy has been profitable for the previous twenty years.

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Table 1
Descriptive Statistics
Base Currency Returns

The dataset consists of monthly returns for individual currencies from January, 1980 through June, 2000. The period consists of 246 months. The base currency is denoted on the far left and the columns to the right give the return statistics of the seven other currencies with respect to the base currency. MSCI and Equal returns are calculated relative to the base currency. The MSCI column is calculated using the MSCI weights excluding the base currency. The Equal column calculates the currency return assuming an equal proportion allocated to the seven currencies. The Ljung and Box Q-statistic is denoted as LBP(10) and tests whether the 10 autocorrelations are jointly significant. The p-value for the Q-statistic is given in the last row for each base currency. ** and * indicate significance at the 1 and 5 percent levels.

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Australia	Mean Ret (%)	n.a.	0.192	0.112	0.268	0.675*	0.336	0.165	0.292	0.392*	0.291
	Median Ret (%)	n.a.	-0.031	-0.230	0.107	0.005	-0.007	0.066	0.113	0.021	–0.088
	Std Dev (%)	n.a.	2.790	4.044	4.229	4.344	4.428	3.824	2.913	3.086	3.290
	t-stat	n.a.	1.081	0.434	0.993	2.436	1.192	0.679	1.570	1.991	1.390
	Skewness	n.a.	0.852	0.728	0.781	1.086	0.885	0.519	1.097	1.391	1.180
	Kurtosis	n.a.	3.197	1.386	1.786	2.298	2.163	1.399	4.201	4.599	3.178
	Autocorrelations										
	1	n.a.	0.001	0.059	0.065	0.009	0.089	0.115	0.048	0.031	0.067
	2	n.a.	-0.013	0.037	0.041	0.064	0.026	-0.023	0.032	0.036	0.019
	3	n.a.	-0.022	0.010	-0.013	-0.089	-0.011	-0.084	-0.003	-0.073	-0.052
	4	n.a.	-0.133*	-0.037	-0.062	-0.002	-0.064	-0.062	-0.159*	-0.119	-0.097
	5	n.a.	-0.054	0.028	0.022	-0.046	0.009	-0.008	-0.072	-0.046	-0.014
	6	n.a.	0.046	-0.033	-0.027	-0.075	-0.060	-0.093	0.054	-0.003	-0.024
	7	n.a.	0.011	0.079	0.077	0.060	0.041	0.034	-0.010	0.053	0.054
	8	n.a.	0.109	0.024	0.020	0.025	0.010	-0.010	0.122	0.030	0.037
	9	n.a.	-0.010	0.070	0.064	0.096	0.097	0.085	0.082	0.117	0.089
	10	n.a.	-0.093	0.052	0.048	0.031	0.003	-0.069	-0.040	-0.022	0.002
	LBP (10)	n.a.	10.829	5.525	5.862	8.366	6.730	11.307	14.640	10.193	7.307
	p-value	n.a.	(0.629)	(0.146)	(0.173)	(0.407)	(0.249)	(0.666)	(0.854)	(0.576)	(0.304)
Canada	Mean Ret (%)	-0.116	n.a.	-0.067	0.084	0.500*	0.155	-0.010	0.105	0.210	0.093
	Median Ret (%)	0.031	n.a.	-0.220	-0.189	-0.091	-0.163	-0.341	0.059	0.096	-0.149
	Std Dev (%)	2.731	n.a.	3.309	3.406	3.796	3.698	3.193	1.325	1.853	2.331
	t-stat	-0.666	n.a.	-0.319	0.388	2.064	0.656	-0.048	1.239	1.778	0.625
	Skewness	-0.500	n.a.	0.062	0.064	0.769	0.247	0.149	0.356	0.068	0.097
	Kurtosis	2.401	n.a.	-0.023	0.039	1.996	0.120	1.875	1.130	0.562	0.350
	Autocorrelations										
	1	-0.005	n.a.	0.038	0.035	-0.015	0.059	0.026	-0.072	-0.056	-0.002
	2	-0.022	n.a.	0.108	0.083	0.076	0.047	-0.004	-0.007	0.025	0.060
	3	-0.019	n.a.	0.058	0.033	-0.014	0.021	-0.005	-0.021	-0.006	0.022
	4	-0.139*	n.a.	0.029	0.002	0.024	0.018	0.099	-0.015	0.023	0.021
	5	-0.056	n.a.	0.055	0.040	-0.014	0.008	0.007	-0.028	0.016	0.022
	6	0.059	n.a.	-0.061	-0.057	-0.098	-0.087	-0.103	-0.073	-0.081	-0.062
	7	0.005	n.a.	0.064	0.058	-0.015	0.048	0.021	0.093	0.029	0.024
	8	0.111	n.a.	-0.030	-0.029	0.023	-0.036	-0.080	0.083	-0.044	-0.041
	9	-0.002	n.a.	0.053	0.028	0.084	0.047	-0.036	0.126	0.063	0.019
	10	-0.091	n.a.	0.034	0.024	-0.005	-0.023	-0.128	0.085	-0.018	-0.051
	LBP (10)	11.590	n.a.	8.034	4.751	5.975	4.966	11.225	12.460	4.446	3.410
	p-value	(0.687)	n.a.	(0.375)	(0.093)	(0.183)	(0.107)	(0.660)	(0.745)	(0.075)	(0.030)
France	Mean Ret (%)	0.047	0.177	n.a.	0.152**	0.605**	0.222*	0.095	0.272	0.346*	0.224
	Median Ret (%)	0.230	0.220	n.a.	0.012	0.321	0.109	0.206	0.100	0.256	0.095
	Std Dev (%)	3.952	3.321	n.a.	0.894	3.288	1.603	2.595	3.275	2.411	1.882
	t-stat	0.188	0.837	n.a.	2.676	2.885	2.170	0.576	1.301	2.250	1.870
	Skewness	-0.411	0.137	n.a.	3.447	0.790	0.958	-0.054	0.299	0.407	0.404
	Kurtosis	0.689	0.068	n.a.	19.742	1.805	4.472	1.275	0.513	0.914	0.562
	Autocorrelations										
	1	0.048	0.035	n.a.	-0.028	-0.013	0.109	0.078	0.046	0.026	0.035
	2	0.041	0.106	n.a.	0.057	0.129*	-0.071	-0.012	0.083	0.125	0.102
	3	0.017	0.059	n.a.	0.033	0.000	0.001	0.074	0.073	0.091	0.092
	4	-0.040	0.028	n.a.	0.040	0.139*	0.125	-0.013	0.007	0.059	0.061
	5	0.019	0.052	n.a.	0.049	0.037	-0.068	-0.062	0.062	0.089	0.071
	6	-0.034	-0.067	n.a.	0.075	-0.064	-0.095	-0.135*	-0.081	-0.055	-0.058
	7	0.080	0.063	n.a.	0.028	0.018	0.030	0.117	0.079	0.108	0.112
	8	0.023	-0.031	n.a.	0.255**	0.076	0.113	-0.017	0.007	0.009	0.026
	9	0.068	0.049	n.a.	0.193*	0.054	0.089	-0.036	0.070	0.048	0.055
	10	0.056	0.033	n.a.	0.043	0.033	0.026	0.093	0.029	0.072	0.116
	LBP (10)	5.405	7.806	n.a.	29.465**	12.557	16.651	14.127	8.933	14.131	15.115
	p-value	(0.137)	(0.352)	n.a.	(0.999)	(0.751)	(0.918)	(0.833)	(0.462)	(0.833)	(0.872)

Table 1 - *continued*
Descriptive Statistics
Base Currency Returns

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Germany	Mean Ret (%)	-0.094	0.032	-0.145**	n.a.	0.457*	0.069	-0.051	0.125	0.196	0.056
	Median Ret (%)	-0.107	0.190	-0.012	n.a.	-0.003	-0.033	0.097	0.114	0.143	0.097
	Std Dev (%)	4.111	3.409	0.866	n.a.	3.326	1.328	2.667	3.349	2.500	1.979
	t-stat	-0.359	0.146	-2.619	n.a.	2.154	0.818	-0.301	0.588	1.231	0.445
	Skewness	-0.418	0.147	-3.196	n.a.	0.861	0.090	-0.154	0.200	0.215	0.161
	Kurtosis	0.919	0.162	17.780	n.a.	1.967	0.691	0.889	0.378	0.689	0.183
	Autocorrelations										
	1	0.053	0.030	-0.028	n.a.	-0.035	0.137*	0.052	0.043	0.011	0.019
	2	0.048	0.079	0.058	n.a.	0.098	-0.107	0.010	0.066	0.087	0.075
	3	-0.009	0.033	0.031	n.a.	-0.009	-0.025	0.099	0.039	0.050	0.043
	4	-0.065	0.001	0.041	n.a.	0.119	0.036	0.009	-0.031	0.014	-0.006
	5	0.015	0.036	0.051	n.a.	0.034	-0.142*	-0.053	0.053	0.080	0.051
	6	-0.026	-0.060	0.077	n.a.	-0.066	-0.098	-0.059	-0.067	-0.032	-0.022
	7	0.080	0.055	0.028	n.a.	0.009	-0.029	0.111	0.081	0.103	0.097
	8	0.023	-0.027	0.249**	n.a.	0.072	0.015	-0.014	0.005	-0.001	0.012
	9	0.065	0.021	0.185*	n.a.	0.047	-0.038	-0.068	0.042	0.020	0.001
	10	0.055	0.023	0.046	n.a.	0.002	-0.063	0.099	0.025	0.052	0.085
	LBP (10)	5.963	4.346	28.156**	n.a.	9.233	16.531	11.253	6.051	7.685	6.787
	p-value	(0.182)	(0.07)	(0.998)	n.a.	(0.490)	(0.915)	(0.662)	(0.189)	(0.340)	(0.255)
Japan	Mean Ret (%)	-0.492	-0.358	-0.497*	-0.348	n.a.	-0.288	-0.425	-0.267	-0.286	-0.382*
	Median Ret (%)	-0.005	0.091	-0.320	0.003	n.a.	-0.111	0.040	0.066	0.101	-0.019
	Std Dev (%)	4.136	3.682	3.185	3.224	n.a.	3.227	3.493	3.566	3.155	2.886
	t-stat	-1.867	-1.526	-2.448	-1.694	n.a.	-1.401	-1.908	-1.174	-1.422	-2.077
	Skewness	-0.707	-0.416	-0.509	-0.572	n.a.	-0.301	-0.864	-0.504	-0.747	-0.769
	Kurtosis	1.457	1.214	0.970	1.096	n.a.	0.964	2.445	0.867	1.715	1.822
	Autocorrelations										
	1	0.008	-0.009	-0.004	-0.027	n.a.	0.001	0.059	0.046	0.035	-0.012
	2	0.072	0.068	0.132*	0.096	n.a.	0.072	0.045	0.038	0.054	0.092
	3	-0.086	-0.006	0.008	-0.004	n.a.	0.036	-0.031	0.018	0.002	-0.030
	4	-0.004	0.026	0.140*	0.120	n.a.	0.128*	0.107	0.018	0.059	0.110
	5	-0.052	-0.008	0.041	0.035	n.a.	-0.002	-0.044	-0.043	-0.035	-0.025
	6	-0.073	-0.098	-0.062	-0.066	n.a.	-0.090	-0.102	-0.124	-0.111	-0.101
	7	0.072	-0.007	0.020	0.010	n.a.	0.020	-0.038	-0.017	-0.027	-0.010
	8	0.031	0.025	0.083	0.078	n.a.	0.048	0.067	0.089	0.098	0.083
	9	0.100	0.076	0.046	0.041	n.a.	0.022	0.121	0.060	0.074	0.086
	10	0.029	-0.006	0.029	-0.005	n.a.	-0.001	-0.005	-0.016	-0.010	0.007
	LBP (10)	9.191	5.301	12.832	9.210	n.a.	8.302	12.407	8.210	9.094	11.395
	p-value	(0.486)	(0.130)	(0.767)	(0.488)	n.a.	(0.401)	(0.741)	(0.392)	(0.477)	(0.672)
Swiss	Mean Ret (%)	-0.147	-0.019	-0.196	-0.052	0.396	n.a.	-0.106	0.074	0.138	-0.007
	Median Ret (%)	0.007	0.163	-0.109	0.033	0.111	n.a.	0.095	0.115	0.147	0.077
	Std Dev (%)	4.279	3.674	1.576	1.326	3.297	n.a.	2.851	3.586	2.666	2.275
	t-stat	-0.539	-0.081	-1.952	-0.611	1.882	n.a.	-0.584	0.322	0.811	-0.050
	Skewness	-0.487	-0.017	-0.713	0.018	0.592	n.a.	-0.481	-0.048	-0.111	-0.228
	Kurtosis	1.099	0.139	3.384	0.780	1.508	n.a.	1.180	0.187	0.444	0.243
	Autocorrelations										
	1	0.074	0.054	0.104	0.136*	-0.012	n.a.	0.077	0.090	0.079	0.089
	2	0.036	0.045	-0.075	-0.107	0.074	n.a.	0.034	0.050	0.061	0.030
	3	-0.007	0.025	0.001	-0.029	0.029	n.a.	0.077	0.015	0.034	0.033
	4	-0.065	0.017	0.118	0.034	0.132*	n.a.	0.003	-0.026	0.016	0.010
	5	0.004	0.008	-0.075	-0.143*	-0.001	n.a.	-0.016	0.014	0.032	-0.003
	6	-0.064	-0.091	-0.097	-0.099	-0.090	n.a.	-0.048	-0.114	-0.098	-0.096
	7	0.048	0.044	0.027	-0.030	0.021	n.a.	0.033	0.054	0.053	0.039
	8	0.021	-0.026	0.106	0.016	0.049	n.a.	-0.071	-0.008	-0.041	-0.021
	9	0.098	0.041	0.088	-0.037	0.024	n.a.	-0.029	0.068	0.040	0.049
	10	0.007	-0.027	0.030	-0.059	0.002	n.a.	0.074	-0.025	-0.007	-0.001
	LBP (10)	6.741	4.680	16.096	16.549	8.589	n.a.	6.865	8.017	6.813	5.706
	p-value	(0.250)	(0.088)	(0.903)	(0.915)	(0.428)	n.a.	(0.262)	(0.373)	(0.257)	(0.161)

Table 1 - *continued*
Descriptive Statistics
Base Currency Returns

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
UK	Mean Ret (%)	-0.022	0.112	-0.028	0.123	0.555*	0.189	n.a.	0.209	0.304	0.163
	Median Ret (%)	-0.066	0.342	-0.206	-0.097	-0.040	-0.095	n.a.	0.152	0.180	0.100
	Std Dev (%)	3.767	3.200	2.604	2.691	3.664	2.909	n.a.	3.233	2.643	2.354
	t-stat	-0.090	0.547	-0.167	0.717	2.376	1.020	n.a.	1.012	1.805	1.083
	Skewness	-0.177	0.225	0.313	0.387	1.280	0.744	n.a.	0.245	0.432	0.607
	Kurtosis	1.005	2.140	1.549	1.140	3.863	1.775	n.a.	2.171	3.426	2.789
	Autocorrelations										
	1	0.110	0.031	0.081	0.059	0.056	0.082	n.a.	0.084	0.092	0.106
	2	-0.023	-0.004	-0.013	0.008	0.048	0.030	n.a.	-0.002	0.003	-0.035
	3	-0.083	0.003	0.072	0.100	-0.035	0.078	n.a.	0.008	-0.012	0.005
	4	-0.061	0.092	-0.012	0.011	0.099	0.003	n.a.	0.030	0.091	0.047
	5	-0.010	0.008	-0.062	-0.052	-0.044	-0.019	n.a.	-0.017	-0.016	-0.048
	6	-0.099	-0.108	-0.132*	-0.058	-0.100	-0.048	n.a.	-0.135*	-0.121	-0.127
	7	0.038	0.021	0.118	0.117	-0.039	0.034	n.a.	0.029	0.020	0.029
	8	-0.010	-0.079	-0.021	-0.016	0.062	-0.076	n.a.	0.026	0.010	-0.043
	9	0.086	-0.037	-0.042	-0.072	0.122	-0.038	n.a.	0.005	0.025	-0.015
	10	-0.072	-0.134	0.086	0.097	-0.001	0.072	n.a.	-0.074	-0.064	-0.042
	LBP (10)	11.435	11.640	13.922	11.804	11.872	7.274	n.a.	8.182	8.958	9.182
	p-value	(0.675)	(0.69)	(0.823)	(0.702)	(0.706)	(0.301)	n.a.	(0.389)	(0.464)	(0.485)
US	Mean Ret (%)	-0.209	-0.087	-0.165	-0.014	0.399	0.055	-0.105	n.a.	0.152	-0.018
	Median Ret (%)	-0.113	-0.059	-0.100	-0.114	-0.066	-0.115	-0.152	n.a.	0.001	-0.141
	Std Dev (%)	2.826	1.317	3.241	3.334	3.675	3.607	3.218	n.a.	2.678	2.272
	t-stat	-1.159	-1.038	-0.799	-0.066	1.702	0.241	-0.510	n.a.	0.888	-0.124
	Skewness	-0.698	-0.238	-0.070	0.028	0.802	0.282	0.148	n.a.	0.262	0.105
	Kurtosis	2.929	1.024	0.310	0.248	1.618	0.280	2.177	n.a.	0.021	0.352
	Autocorrelations										
	1	0.049	-0.075	0.048	0.046	0.045	0.094	0.073	n.a.	0.074	0.072
	2	0.020	-0.007	0.090	0.075	0.041	0.055	-0.005	n.a.	0.024	0.047
	3	0.003	-0.020	0.070	0.038	0.010	0.010	0.002	n.a.	0.032	0.041
	4	-0.163*	-0.015	0.011	-0.025	0.013	-0.020	0.042	n.a.	-0.029	-0.043
	5	-0.073	-0.026	0.065	0.056	-0.048	0.013	-0.023	n.a.	-0.005	0.003
	6	0.069	-0.075	-0.076	-0.064	-0.123	-0.111	-0.132*	n.a.	-0.130*	-0.094
	7	-0.012	0.095	0.084	0.086	-0.025	0.058	0.031	n.a.	0.017	0.038
	8	0.130	0.085	0.007	0.004	0.083	-0.019	0.024	n.a.	0.057	0.057
	9	0.088	0.122	0.073	0.050	0.065	0.075	0.004	n.a.	0.060	0.068
	10	-0.041	0.085	0.025	0.021	-0.013	-0.025	-0.072	n.a.	-0.028	-0.033
	LBP (10)	16.136	12.553	9.358	6.708	8.168	8.503	7.773	n.a.	7.973	7.355
	p-value	(0.904)	(0.750)	(0.502)	(0.247)	(0.388)	(0.42)	(0.349)	n.a.	(0.369)	(0.308)

Table 2
Descriptive Statistics
Interest-Adjusted Currency Returns

The dataset consists of interest-adjusted monthly returns for individual currencies from January, 1980 through June, 2000. The period consists of 246 months. The base currency is denoted on the far left and the columns to the right give the return statistics of the seven other currencies with respect to the base currency. MSCI and Equal returns are calculated relative to the base currency. The MSCI column is calculated using the MSCI weights excluding the base currency. The Equal column calculates the currency return assuming an equal proportion allocated to the seven currencies. The Ljung and Box Q-statistic is denoted as LBP(10) and tests whether the 10 autocorrelations are jointly significant. The p-value for the Q-statistic is given in the last row for each base currency. ** and * indicate significance at the 1 and 5 percent levels.

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Australia	Mean Ret (%)	n.a.	0.076	-0.007	-0.104	0.145	-0.145	0.105	0.021	0.084	0.013
	Median Ret (%)	n.a.	-0.162	-0.290	-0.363	-0.618	-0.671	-0.081	-0.183	-0.242	-0.366
	Std Dev (%)	n.a.	2.800	4.017	4.193	4.334	4.414	3.837	2.931	3.085	3.274
	t-stat	n.a.	0.426	-0.029	-0.388	0.525	-0.517	0.430	0.111	0.426	0.062
	Skewness	n.a.	0.722	0.695	0.738	1.044	0.862	0.509	0.957	1.264	1.113
	Kurtosis	n.a.	2.837	1.280	1.621	2.206	1.999	1.334	3.675	4.161	2.939
	Autocorrelations										
	1	n.a.	0.007	0.049	0.056	0.014	0.090	0.118	0.063	0.035	0.062
	2	n.a.	-0.010	0.026	0.031	0.070	0.023	-0.024	0.046	0.038	0.012
	3	n.a.	-0.023	-0.002	-0.024	-0.086	-0.019	-0.085	0.008	-0.073	-0.062
	4	n.a.	-0.133*	-0.050	-0.075	-0.001	-0.071	-0.064	-0.145*	-0.119*	-0.108
	5	n.a.	-0.055	0.016	0.012	-0.045	0.001	-0.011	-0.058	-0.044	-0.023
	6	n.a.	0.043	-0.046	-0.039	-0.074	-0.069	-0.096	0.063	-0.003	-0.034
	7	n.a.	0.008	0.067	0.067	0.060	0.032	0.029	0.001	0.054	0.045
	8	n.a.	0.101	0.013	0.008	0.024	0.002	-0.015	0.128	0.029	0.028
	9	n.a.	-0.018	0.060	0.053	0.096	0.090	0.079	0.086	0.114	0.080
	10	n.a.	-0.100	0.041	0.038	0.031	-0.004	-0.077	-0.034	-0.024	-0.007
	LBP (10)	n.a.	10.722	4.377	5.017	8.345	6.789	11.755	14.546	10.145	7.353
	p-value	n.a.	(0.620)	(0.071)	(0.110)	(0.405)	(0.255)	(0.698)	(0.851)	(0.572)	(0.308)
Canada	Mean Ret (%)	0.001	n.a.	-0.069	-0.169	0.088	-0.209	0.048	-0.050	0.018	-0.051
	Median Ret (%)	0.162	n.a.	-0.225	-0.362	-0.415	-0.482	-0.290	-0.095	-0.057	-0.295
	Std Dev (%)	2.756	n.a.	3.325	3.419	3.814	3.724	3.244	1.359	1.876	2.357
	t-stat	0.006	n.a.	-0.325	-0.775	0.361	-0.880	0.231	-0.572	0.148	-0.342
	Skewness	-0.380	n.a.	0.072	0.060	0.744	0.238	0.167	0.341	0.047	0.107
	Kurtosis	2.176	n.a.	-0.044	-0.010	1.873	-0.043	1.724	0.926	0.486	0.229
	Autocorrelations										
	1	0.003	n.a.	0.046	0.045	0.003	0.075	0.051	-0.028	-0.032	0.019
	2	-0.016	n.a.	0.115	0.091	0.091	0.062	0.018	0.019	0.041	0.078
	3	-0.018	n.a.	0.063	0.042	0.002	0.033	0.014	-0.004	0.009	0.039
	4	-0.137*	n.a.	0.034	0.010	0.037	0.029	0.112	-0.001	0.034	0.035
	5	-0.055	n.a.	0.059	0.047	-0.001	0.018	0.019	-0.014	0.029	0.036
	6	0.057	n.a.	-0.057	-0.050	-0.085	-0.075	-0.092	-0.054	-0.067	-0.047
	7	0.004	n.a.	0.067	0.064	-0.006	0.057	0.027	0.112	0.042	0.035
	8	0.105	n.a.	-0.027	-0.023	0.031	-0.025	-0.077	0.101	-0.028	-0.030
	9	-0.008	n.a.	0.055	0.032	0.091	0.057	-0.034	0.146*	0.075	0.028
	10	-0.095	n.a.	0.038	0.031	0.004	-0.012	-0.123	0.105	-0.002	-0.037
	LBP (10)	11.236	n.a.	8.925	5.684	6.373	5.983	11.572	14.708	4.266	4.131
	p-value	(0.661)	n.a.	(0.461)	(0.159)	(0.217)	(0.183)	(0.685)	(0.857)	(0.065)	(0.059)
France	Mean Ret (%)	0.165	0.180	n.a.	-0.100	0.193	-0.141	0.154	0.119	0.157	0.082
	Median Ret (%)	0.291	0.225	n.a.	-0.135	-0.114	-0.207	0.219	-0.132	-0.005	-0.023
	Std Dev (%)	3.940	3.336	n.a.	0.876	3.272	1.588	2.624	3.287	2.410	1.867
	t-stat	0.659	0.845	n.a.	-1.784	0.927	-1.397	0.921	0.569	1.019	0.685
	Skewness	-0.383	0.125	n.a.	3.030	0.796	0.716	-0.081	0.273	0.386	0.378
	Kurtosis	0.647	0.030	n.a.	16.213	1.922	3.690	1.231	0.417	0.850	0.487
	Autocorrelations										
	1	0.038	0.043	n.a.	-0.068	-0.016	0.096	0.093	0.060	0.032	0.023
	2	0.031	0.113	n.a.	0.016	0.126*	-0.095	0.001	0.095	0.129*	0.091
	3	0.005	0.064	n.a.	-0.020	-0.003	-0.030	0.082	0.082	0.092	0.079
	4	-0.053	0.033	n.a.	-0.011	0.134*	0.098	-0.004	0.017	0.059	0.047
	5	0.010	0.055	n.a.	0.003	0.030	-0.094	-0.052	0.068	0.087	0.058
	6	-0.046	-0.064	n.a.	0.035	-0.073	-0.123*	-0.124	-0.078	-0.062	-0.075
	7	0.070	0.065	n.a.	-0.024	0.007	-0.002	0.122	0.079	0.101	0.096
	8	0.012	-0.029	n.a.	0.209**	0.066	0.080	-0.011	0.009	0.003	0.010
	9	0.059	0.050	n.a.	0.139	0.042	0.062	-0.033	0.071	0.041	0.039
	10	0.046	0.038	n.a.	-0.006	0.019	-0.005	0.096	0.032	0.066	0.104
	LBP (10)	4.419	8.695	n.a.	17.241	11.387	15.248	14.365	10.359	13.830	11.718
	p-value	(0.074)	(0.439)	n.a.	(0.931)	(0.672)	(0.877)	(0.843)	(0.590)	(0.819)	(0.696)

Table 2 - *continued*
Descriptive Statistics
Interest-Adjusted Currency Returns

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Germany	Mean Ret (%)	0.276	0.287	0.107*	n.a.	0.299	-0.042	0.260	0.226	0.268	0.202
	Median Ret (%)	0.364	0.363	0.135	n.a.	-0.152	-0.134	0.391	0.116	0.259	0.239
	Std Dev (%)	4.114	3.439	0.856	n.a.	3.329	1.338	2.704	3.376	2.515	1.981
	t-stat	1.053	1.308	1.965	n.a.	1.407	-0.489	1.507	1.049	1.669	1.598
	Skewness	-0.384	0.147	-2.805	n.a.	0.836	0.033	-0.104	0.210	0.255	0.198
	Kurtosis	0.857	0.099	14.565	n.a.	1.890	0.752	0.982	0.280	0.701	0.257
	Autocorrelations										
	1	0.044	0.039	-0.067	n.a.	-0.030	0.142*	0.063	0.058	0.021	0.014
	2	0.040	0.088	0.017	n.a.	0.101	-0.106	0.018	0.080	0.096	0.071
	3	-0.020	0.042	-0.023	n.a.	-0.006	-0.032	0.103	0.051	0.057	0.038
	4	-0.076	0.009	-0.010	n.a.	0.121	0.032	0.014	-0.019	0.020	-0.012
	5	0.008	0.043	0.004	n.a.	0.036	-0.145*	-0.050	0.063	0.086	0.047
	6	-0.036	-0.053	0.037	n.a.	-0.066	-0.102	-0.056	-0.058	-0.027	-0.027
	7	0.071	0.061	-0.023	n.a.	0.006	-0.037	0.114	0.085	0.104	0.092
	8	0.012	-0.023	0.201**	n.a.	0.067	0.006	-0.012	0.010	-0.001	0.004
	9	0.055	0.024	0.132	n.a.	0.040	-0.047	-0.067	0.045	0.018	-0.009
	10	0.046	0.031	-0.003	n.a.	-0.005	-0.075	0.099	0.029	0.052	0.079
	LBP (10)	5.212	5.255	16.075	n.a.	9.106	17.874	11.765	7.339	8.556	6.027
	p-value	(0.123)	(0.127)	(0.903)	n.a.	(0.478)	(0.943)	(0.699)	(0.307)	(0.425)	(0.187)
Japan	Mean Ret (%)	0.035	0.054	-0.089	-0.190	n.a.	-0.241	0.043	-0.009	0.012	-0.057
	Median Ret (%)	0.621	0.416	0.114	0.152	n.a.	-0.143	0.492	0.271	0.388	0.284
	Std Dev (%)	4.176	3.733	3.195	3.239	n.a.	3.260	3.535	3.612	3.191	2.914
	t-stat	0.133	0.228	-0.436	-0.922	n.a.	-1.158	0.190	-0.039	0.061	-0.305
	Skewness	-0.664	-0.396	-0.507	-0.550	n.a.	-0.272	-0.837	-0.464	-0.702	-0.740
	Kurtosis	1.410	1.123	1.055	1.040	n.a.	0.927	2.389	0.753	1.598	1.744
	Autocorrelations										
	1	0.014	0.009	-0.008	-0.022	n.a.	0.017	0.070	0.068	0.054	0.000
	2	0.079	0.085	0.129*	0.099	n.a.	0.086	0.055	0.059	0.072	0.103
	3	-0.081	0.011	0.005	0.000	n.a.	0.045	-0.020	0.038	0.019	-0.019
	4	-0.002	0.039	0.134*	0.122	n.a.	0.137*	0.114	0.037	0.074	0.118
	5	-0.046	0.006	0.034	0.037	n.a.	0.004	-0.037	-0.026	-0.021	-0.016
	6	-0.071	-0.084	-0.072	-0.066	n.a.	-0.085	-0.095	-0.108	-0.098	-0.094
	7	0.075	0.003	0.009	0.008	n.a.	0.022	-0.032	-0.004	-0.017	-0.006
	8	0.031	0.034	0.072	0.074	n.a.	0.048	0.069	0.098	0.104	0.084
	9	0.101	0.083	0.033	0.034	n.a.	0.023	0.122	0.068	0.079	0.087
	10	0.031	0.003	0.015	-0.011	n.a.	-0.005	-0.003	-0.004	-0.002	0.008
	LBP (10)	9.268	5.874	11.536	9.162	n.a.	9.435	12.840	9.112	10.105	11.879
	p-value	(0.493)	(0.174)	(0.683)	(0.483)	n.a.	(0.509)	(0.767)	(0.479)	(0.569)	(0.707)
Swiss	Mean Ret (%)	0.336	0.348	0.167	0.060	0.350	n.a.	0.316	0.286	0.323	0.266
	Median Ret (%)	0.676	0.484	0.208	0.134	0.143	n.a.	0.517	0.348	0.329	0.302
	Std Dev (%)	4.310	3.726	1.578	1.340	3.324	n.a.	2.901	3.639	2.709	2.306
	t-stat	1.221	1.465	1.657	0.698	1.650	n.a.	1.711	1.233	1.869	1.810
	Skewness	-0.474	-0.024	-0.487	0.079	0.562	n.a.	-0.421	-0.039	-0.072	-0.209
	Kurtosis	1.027	-0.027	2.855	0.884	1.444	n.a.	1.175	0.005	0.262	0.108
	Autocorrelations										
	1	0.074	0.070	0.092	0.141*	0.002	n.a.	0.094	0.113	0.102	0.102
	2	0.036	0.061	-0.097	-0.106	0.088	n.a.	0.048	0.074	0.086	0.043
	3	-0.013	0.036	-0.029	-0.035	0.038	n.a.	0.082	0.032	0.048	0.037
	4	-0.072	0.029	0.093	0.030	0.140*	n.a.	0.011	-0.008	0.032	0.016
	5	0.000	0.018	-0.099	-0.145*	0.005	n.a.	-0.011	0.029	0.045	0.001
	6	-0.071	-0.079	-0.123	-0.102	-0.085	n.a.	-0.042	-0.098	-0.084	-0.092
	7	0.040	0.053	-0.003	-0.038	0.023	n.a.	0.037	0.064	0.061	0.039
	8	0.013	-0.017	0.075	0.007	0.048	n.a.	-0.065	0.003	-0.031	-0.018
	9	0.093	0.049	0.064	-0.046	0.025	n.a.	-0.020	0.077	0.050	0.054
	10	0.001	-0.016	0.001	-0.071	-0.002	n.a.	0.078	-0.013	0.001	0.002
	LBP (10)	6.695	5.616	15.012	17.744	9.553	n.a.	7.755	9.717	9.035	6.560
	p-value	(0.246)	(0.154)	(0.868)	(0.941)	(0.519)	n.a.	(0.347)	(0.534)	(0.471)	(0.234)

Table 2 - *continued*
Descriptive Statistics
Interest-Adjusted Currency Returns

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
UK	Mean Ret (%)	0.040	0.057	-0.085	-0.186	0.087	-0.231	n.a.	-0.001	0.035	-0.046
	Median Ret (%)	0.081	0.291	-0.218	-0.390	-0.490	-0.514	n.a.	-0.024	-0.116	-0.105
	Std Dev (%)	3.785	3.245	2.632	2.708	3.671	2.932	n.a.	3.268	2.674	2.382
	t-stat	0.164	0.277	-0.506	-1.078	0.370	-1.234	n.a.	-0.003	0.208	-0.300
	Skewness	-0.172	0.195	0.341	0.348	1.253	0.692	n.a.	0.173	0.382	0.574
	Kurtosis	0.926	1.907	1.560	1.235	3.749	1.778	n.a.	1.938	3.186	2.687
	Autocorrelations										
	1	0.113	0.056	0.097	0.070	0.067	0.098	n.a.	0.106	0.113	0.124
	2	-0.023	0.019	0.001	0.015	0.057	0.043	n.a.	0.018	0.023	-0.019
	3	-0.084	0.023	0.081	0.104	-0.025	0.082	n.a.	0.024	0.004	0.018
	4	-0.063	0.105	-0.003	0.015	0.106	0.010	n.a.	0.044	0.103	0.057
	5	-0.012	0.021	-0.052	-0.050	-0.037	-0.014	n.a.	-0.006	-0.005	-0.039
	6	-0.102	-0.096	-0.122	-0.055	-0.093	-0.043	n.a.	-0.123	-0.109	-0.117
	7	0.034	0.025	0.125	0.119	-0.033	0.037	n.a.	0.036	0.028	0.035
	8	-0.014	-0.077	-0.014	-0.014	0.065	-0.070	n.a.	0.028	0.012	-0.040
	9	0.081	-0.036	-0.038	-0.071	0.124	-0.030	n.a.	0.008	0.027	-0.012
	10	-0.079	-0.129	0.089	0.097	0.002	0.075	n.a.	-0.069	-0.060	-0.041
	LBP (10)	11.916	12.101	14.357	12.349	12.288	8.032	n.a.	8.783	9.948	9.498
	p-value	(0.709)	(0.722)	(0.843)	(0.738)	(0.734)	(0.374)	n.a.	(0.447)	(0.555)	(0.514)
US	Mean Ret (%)	0.063	0.068	-0.012	-0.112	0.142	-0.153	0.107	n.a.	0.079	0.015
	Median Ret (%)	0.183	0.095	0.132	-0.115	-0.270	-0.347	0.024	n.a.	-0.124	-0.030
	Std Dev (%)	2.869	1.356	3.266	3.354	3.698	3.643	3.274	n.a.	2.706	2.307
	t-stat	0.346	0.787	-0.057	-0.526	0.604	-0.660	0.515	n.a.	0.461	0.101
	Skewness	-0.572	-0.228	-0.049	0.009	0.756	0.257	0.208	n.a.	0.254	0.114
	Kurtosis	2.571	0.828	0.250	0.151	1.457	0.079	2.054	n.a.	-0.065	0.217
	Autocorrelations										
	1	0.067	-0.031	0.063	0.062	0.066	0.117	0.096	n.a.	0.098	0.104
	2	0.037	0.020	0.102	0.089	0.061	0.078	0.017	n.a.	0.048	0.077
	3	0.015	-0.004	0.080	0.050	0.029	0.027	0.018	n.a.	0.053	0.066
	4	-0.147*	0.000	0.021	-0.014	0.030	-0.002	0.056	n.a.	-0.008	-0.016
	5	-0.057	-0.012	0.070	0.065	-0.033	0.027	-0.012	n.a.	0.012	0.023
	6	0.081	-0.057	-0.073	-0.055	-0.108	-0.096	-0.119	n.a.	-0.112	-0.072
	7	0.002	0.114	0.085	0.090	-0.014	0.068	0.039	n.a.	0.029	0.054
	8	0.138*	0.104	0.010	0.009	0.090	-0.006	0.028	n.a.	0.067	0.072
	9	0.094	0.142*	0.076	0.053	0.072	0.086	0.008	n.a.	0.068	0.082
	10	-0.032	0.105	0.028	0.025	-0.002	-0.014	-0.067	n.a.	-0.016	-0.016
	LBP (10)	16.224	14.692	10.984	8.127	8.796	10.387	8.310	n.a.	9.196	10.193
	p-value	(0.907)	(0.856)	(0.641)	(0.384)	(0.448)	(0.593)	(0.401)	n.a.	(0.486)	(0.576)

Table 3
Performance of Long-Short Strategies
January 1980 – June 2000

Each month from January, 1980 through June, 2000 each currency is ranked from one to seven based upon the difference between the short-run and long-run moving average of prior returns using 354 different short-run - long-run moving average (MA) combinations ranging from [1-2] to [12-36]. Each of the MA combinations are given equal weight each month, generating monthly returns for ranks one to seven. The base currency is denoted on the far left. The MSCI and Equal columns are reproduced from Table 1. The first t-stat is used to test the significance of the mean return relative to a null hypothesis of zero. The Ljung and Box Q-statistic is denoted as LBP(10) and tests whether the 10 autocorrelations are jointly significant. The p-value for the Q-statistic is given below the LBP(10) row. The [Prob >] rows give the percentage of the total months that the given strategy has exceeded zero, the MSCI benchmark, and the Equal benchmark. The paired t-test is used to test the significance of the excess returns of each of the ranks and the long-short strategies relative to the MSCI benchmark and the Equal benchmark. The Wilcoxon is a nonparametric test of the excess returns. The [Proportion >] rows give the percentage of the 354 MA combinations that exceed, zero, the MSCI benchmark average return, and the Equal benchmark average return. ** and * indicate significance at the 1 and 5 percent levels.

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7	MSCI	Equal
Australia	Mean Ret (%)	0.254	0.262	0.234	0.029	-0.120	-0.222	-0.347	0.601**	0.597**	0.392*	0.291
	Median Ret (%)	0.021	-0.126	-0.214	-0.301	-0.478	-0.427	-0.724	0.806	0.857	0.021	-0.088
	Std Dev (%)	3.593	3.426	3.456	3.643	3.683	3.522	3.673	2.934	2.634	3.086	3.290
	t-stat	1.110	1.200	1.062	0.125	-0.510	-0.989	-1.483	3.215	3.558	1.991	1.390
	Skewness	1.179	1.285	1.084	0.836	0.842	0.799	0.674	-0.540	-0.574	1.391	1.180
	Kurtosis	3.968	4.659	3.024	2.109	1.558	2.052	1.623	1.279	1.612	4.599	3.178
	Autocorrelations											
	1	0.045	0.045	0.112	-0.003	0.052	0.048	0.017	-0.138*	-0.118	0.031	0.067
	2	-0.058	-0.042	-0.028	0.039	0.071	0.041	0.037	0.014	0.009	0.036	0.019
	3	-0.069	-0.051	-0.070	-0.056	-0.067	-0.061	-0.039	-0.036	-0.023	-0.073	-0.052
	4	-0.135*	-0.123	-0.085	-0.059	-0.111	-0.158*	-0.076	-0.135*	-0.122	-0.119	-0.097
	5	-0.027	-0.012	0.000	0.014	-0.046	-0.029	0.033	0.099	0.165*	-0.046	-0.014
	6	0.005	0.022	0.004	-0.079	-0.050	-0.040	-0.083	-0.105	-0.074	-0.003	-0.024
	7	0.040	0.069	0.055	0.048	0.083	0.041	-0.007	0.108	0.078	0.053	0.054
	8	0.050	0.035	0.042	-0.034	0.014	0.020	0.000	-0.071	-0.092	0.030	0.037
	9	0.095	0.082	0.149*	0.076	0.082	0.021	-0.037	-0.069	-0.071	0.117	0.089
	10	0.005	-0.024	-0.026	-0.001	0.012	-0.011	-0.027	0.019	0.013	-0.022	0.002
	LBP (10)	10.240	8.612	12.918	5.798	10.537	9.159	4.655	19.738*	19.882*	10.193	7.307
	(p-value)	(0.580)	(0.431)	(0.772)	(0.168)	(0.605)	(0.483)	(0.087)	(0.968)	(0.970)	(0.576)	(0.304)
	Prob > 0 (%)	50.407	49.187	47.561	45.935	42.683	45.122	41.870	63.415	64.634		
	Prob > MSCI (%)	45.122	47.561	43.902	40.244	33.740	32.114	31.301	56.504	56.098		
	paired t-test	-1.227	-1.316	-1.704	-3.271**	-4.411**	-5.262**	-5.696**	0.783	0.803		
	Wilcoxon test	-1.059	0.036	-1.459	-1.766	-3.540**	-3.853**	-4.070**	2.014*	1.749		
	Prob > Equal (%)	50.813	49.593	50.000	36.179	32.520	31.707	33.740	55.285	56.504		
	paired t-test	-0.349	-0.321	-0.767	-3.455**	-4.825**	-5.572**	-5.585**	1.098	1.134		
	Wilcoxon test	0.501	-0.159	0.918	-3.353**	-3.606**	-4.112**	-3.057**	0.962	1.496		
	Proportion > 0 (%)	100.000	98.588	98.023	60.452	14.407	5.367	0.000	100.000	100.000		
	Proportion > Equal (%)	30.226	46.610	23.446	0.847	0.000	0.000	0.000	98.023	97.740		
	Proportion > MSCI (%)	0.000	5.085	1.695	0.000	0.000	0.000	0.000	92.655	91.808		
Canada	Mean Ret (%)	0.185	0.204	0.102	-0.088	-0.117	-0.301	-0.347	0.532*	0.511**	0.210	0.093
	Median Ret (%)	0.095	0.082	-0.185	-0.259	-0.404	-0.563	-0.412	0.512	0.526	0.096	-0.149
	Std Dev (%)	2.769	2.556	2.581	2.887	2.908	2.820	3.039	3.252	2.785	1.853	2.331
	t-stat	1.049	1.253	0.623	-0.476	-0.630	-1.673	-1.788	2.565	2.875	1.778	0.625
	Skewness	-0.013	0.186	0.166	0.313	0.303	0.247	0.160	-0.100	0.299	0.068	0.097
	Kurtosis	1.454	1.631	0.787	0.384	0.484	0.155	1.714	4.048	4.880	0.562	0.350
	Autocorrelations											
	1	-0.105	0.024	0.029	-0.011	0.055	-0.026	-0.005	-0.092	-0.057	-0.056	-0.002
	2	-0.005	0.032	0.086	0.117	0.118	0.026	-0.001	-0.015	-0.055	0.025	0.060
	3	0.084	0.050	0.106	-0.001	0.004	-0.054	-0.007	-0.007	0.024	-0.006	0.022
	4	-0.139*	-0.006	0.052	0.037	0.041	0.009	0.046	-0.088	-0.066	0.023	0.021
	5	0.030	0.054	0.023	0.064	0.056	0.038	0.034	0.104	0.116	0.016	0.022
	6	-0.028	0.003	0.031	-0.064	-0.033	-0.074	-0.055	-0.028	-0.017	-0.081	-0.062
	7	-0.027	0.082	0.079	0.033	0.026	-0.020	0.044	-0.001	-0.010	0.029	0.024
	8	0.076	-0.001	0.030	-0.030	-0.050	-0.021	-0.087	0.085	0.074	-0.044	-0.041
	9	-0.024	0.109	0.076	0.038	-0.012	-0.019	-0.043	-0.116	-0.039	0.063	0.019
	10	-0.129	-0.075	-0.063	-0.040	0.072	0.064	-0.012	-0.023	0.016	-0.018	-0.051
	LBP (10)	15.240	7.668	9.877	6.899	7.584	4.054	4.381	12.039	7.838	4.446	3.410
	(p-value)	(0.876)	(0.339)	(0.549)	(0.265)	(0.331)	(0.055)	(0.071)	(0.718)	(0.355)	(0.075)	(0.030)
	Prob > 0 (%)	52.033	51.626	45.935	43.496	42.276	40.244	40.650	60.163	61.789		
	Prob > MSCI (%)	47.967	51.220	45.528	44.309	42.276	36.585	35.366	59.756	58.537		
	paired t-test	-0.184	-0.059	-1.082	-2.532*	-2.768**	-4.339**	-3.906**	1.302	1.385		
	Wilcoxon test	-1.095	0.708	-1.065	-0.290	-1.106	-2.892**	-3.534**	3.156**	2.506*		
	Prob > Equal (%)	54.472	53.659	51.626	42.683	40.244	35.772	38.211	58.130	59.350		
	paired t-test	0.729	1.306	0.127	-2.332*	-2.477*	-4.504**	-3.513**	1.637	1.750		
	Wilcoxon test	1.098	0.386	0.608	-1.362	-1.825	-3.143**	-2.380*	2.043*	2.520*		
	Proportion > 0 (%)	100.000	96.045	84.463	18.927	13.277	0.000	0.000	100.000	100.000		
	Proportion > Equal (%)	93.220	85.593	55.367	5.367	0.282	0.000	0.000	100.000	100.000		
	Proportion > MSCI (%)	32.486	53.672	11.299	0.565	0.000	0.000	0.000	100.000	99.153		

Table 3 - *continued*
Performance of Long-Short Strategies
January 1980 – June 2000

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7	MSCI	Equal
France	Mean Ret (%)	0.315	0.384**	0.218	0.156	-0.050	-0.222	-0.231	0.545**	0.537**	0.346*	0.224
	Median Ret (%)	0.091	0.266	0.204	0.017	-0.036	-0.290	-0.147	0.619	0.740	0.256	0.095
	Std Dev (%)	2.785	2.341	2.407	2.402	2.140	2.150	2.647	3.238	2.831	2.411	1.882
	t-stat	1.772	2.576	1.421	1.019	-0.364	-1.621	-1.368	2.642	2.972	2.25	1.87
	Skewness	-0.225	0.151	0.191	0.491	0.349	0.495	-0.275	-0.177	0.000	0.407	0.404
	Kurtosis	2.440	0.954	1.747	1.520	1.691	2.110	2.434	3.287	3.570	0.914	0.562
	Autocorrelations											
	1	-0.097	-0.039	-0.013	-0.003	0.041	0.037	0.010	-0.125	-0.095	0.026	0.035
	2	0.108	0.078	0.079	0.041	0.004	0.027	-0.012	-0.008	-0.043	0.125	0.102
	3	0.009	0.022	0.085	0.044	0.022	0.043	0.035	-0.018	-0.006	0.091	0.092
	4	-0.015	-0.032	0.093	-0.043	0.034	-0.041	-0.077	-0.138*	-0.104	0.059	0.061
	5	0.074	0.071	0.037	0.056	0.033	0.007	0.089	0.103	0.103	0.089	0.071
	6	-0.022	-0.165*	-0.047	-0.063	-0.062	-0.061	0.034	-0.011	-0.014	-0.055	-0.058
	7	0.075	0.061	0.075	0.049	0.035	0.058	0.018	-0.018	0.005	0.108	0.112
	8	0.058	-0.045	-0.010	-0.012	-0.052	-0.004	0.074	0.077	0.042	0.009	0.026
	9	-0.093	0.022	-0.008	-0.024	0.025	0.076	0.085	-0.117	-0.048	0.048	0.055
	10	0.063	0.111	0.123	0.072	0.014	-0.009	0.054	-0.008	0.042	0.072	0.116
	LBP (10)	11.912	14.724	11.407	5.080	3.185	4.581	7.901	15.963	9.265	14.131	15.115
	(p-value)	(0.709)	(0.858)	(0.673)	(0.114)	(0.023)	(0.083)	(0.361)	(0.899)	(0.493)	(0.833)	(0.872)
	Prob > 0 (%)	52.033	56.504	51.220	50.407	48.374	39.024	44.715	60.163	62.195		
	Prob > MSCI (%)	50.407	54.065	47.154	42.683	39.431	34.553	35.772	54.065	53.659		
	paired t-test	-0.233	0.393	-1.294	-2.178*	-3.760**	-4.667**	-4.058**	0.808	0.843		
	Wilcoxon test	0.206	1.816	-0.760	-1.615	-1.507	-3.457**	-3.285**	0.936	0.860		
	Prob > Equal (%)	50.407	57.724	49.187	42.276	38.211	34.146	36.179	56.504	58.943		
	paired t-test	0.740	1.817	-0.076	-0.876	-3.198**	-4.527**	-3.665**	1.389	1.485		
	Wilcoxon test	-0.866	1.962*	-1.049	-2.421*	-2.571*	-3.388**	-3.343**	1.584	2.688**		
	Proportion > 0 (%)	100.000	100.000	98.870	94.350	29.379	1.977	0.565	100.000	100.000		
	Proportion > Equal (%)	96.893	96.893	44.350	25.424	0.282	0.000	0.000	99.718	99.435		
	Proportion > MSCI (%)	31.638	70.621	14.689	0.000	0.000	0.000	0.000	94.068	96.045		
Germany	Mean Ret (%)	0.417*	0.474**	0.370*	0.245	0.131	-0.092	-0.132	0.549**	0.552**	0.196	0.056
	Median Ret (%)	0.435	0.420	0.300	0.292	0.138	-0.023	-0.057	0.574	0.615	0.143	0.097
	Std Dev (%)	2.818	2.371	2.432	2.506	2.263	2.258	2.764	3.224	2.789	2.500	1.979
	t-stat	2.321	3.136	2.385	1.531	0.906	-0.637	-0.748	2.670	3.104	1.231	0.445
	Skewness	-0.336	0.026	0.239	0.274	0.227	0.282	-0.344	-0.092	-0.044	0.215	0.161
	Kurtosis	2.912	0.747	2.239	1.398	1.403	1.981	3.306	3.521	3.447	0.689	0.183
	Autocorrelations											
	1	-0.103	-0.011	-0.006	0.034	0.021	-0.016	-0.012	-0.124	-0.091	0.011	0.019
	2	0.105	0.077	0.067	0.024	0.039	0.050	-0.058	-0.013	-0.035	0.087	0.075
	3	-0.023	-0.003	0.055	0.035	0.013	0.016	0.025	-0.010	0.001	0.050	0.043
	4	-0.042	-0.069	0.027	-0.048	0.035	-0.045	-0.126	-0.140*	-0.096	0.014	-0.006
	5	0.054	0.025	0.062	0.052	0.023	0.057	0.069	0.100	0.105	0.080	0.051
	6	-0.017	-0.120	-0.019	-0.021	-0.003	-0.034	0.061	-0.011	-0.011	-0.032	-0.022
	7	0.084	0.066	0.107	0.025	0.043	0.040	0.009	-0.014	0.013	0.103	0.097
	8	0.058	-0.020	-0.016	-0.036	-0.026	-0.006	0.054	0.079	0.052	-0.001	0.012
	9	-0.131	-0.036	-0.049	-0.030	-0.029	0.048	0.085	-0.119	-0.050	0.020	0.001
	10	0.092	0.110	0.105	0.062	0.030	-0.080	0.009	-0.014	0.022	0.052	0.085
	LBP (10)	15.344	10.790	9.203	3.665	2.010	4.836	9.417	16.116	8.662	7.685	6.787
	(p-value)	(0.880)	(0.626)	(0.487)	(0.039)	(0.004)	(0.098)	(0.507)	(0.904)	(0.436)	(0.340)	(0.255)
	Prob > 0 (%)	56.504	59.756	56.504	56.504	53.252	48.374	47.561	61.382	63.415		
	Prob > MSCI (%)	56.098	58.943	58.537	55.285	47.967	40.650	41.463	56.098	53.252		
	paired t-test	1.633	2.897**	1.808	0.535	-0.635	-2.421*	-2.321*	1.386	1.532		
	Wilcoxon test	1.249	1.771	1.851	1.689	-0.115	-2.219*	-2.060*	1.500	-0.196		
	Prob > Equal (%)	55.691	66.667	63.821	57.317	53.252	42.276	45.528	58.130	62.602		
	paired t-test	2.961**	4.897**	3.833**	2.411*	0.898	-1.541	-1.519	2.073*	2.299*		
	Wilcoxon test	-0.289	3.984**	2.577**	1.391	0.895	-1.952	-0.730	1.698	3.607**		
	Proportion > 0 (%)	100.000	100.000	99.718	98.870	90.678	22.316	4.802	100.000	100.000		
	Proportion > Equal (%)	100.000	100.000	99.718	95.480	76.836	7.345	0.565	100.000	99.718		
	Proportion > MSCI (%)	100.000	98.870	96.610	68.079	20.621	0.847	0.000	100.000	99.435		

Table 3 - *continued*
Performance of Long-Short Strategies
January 1980 – June 2000

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7	MSCI	Equal
Japan	Mean Ret (%)	0.125	0.301	0.109	-0.014	-0.220	-0.356	-0.342	0.466*	0.520**	-0.286	-0.382*
	Median Ret (%)	0.615	0.555	0.380	0.275	-0.026	0.134	-0.008	0.563	0.594	0.101	-0.019
	Std Dev (%)	3.509	3.131	3.014	3.180	3.188	3.420	3.444	3.207	2.820	3.155	2.886
	t-stat	0.557	1.508	0.567	-0.067	-1.082	-1.630	-1.556	2.280	2.891	-1.422	-2.077
	Skewness	-0.754	-0.720	-0.805	-0.848	-0.426	-0.536	-0.626	0.055	0.136	-0.747	-0.769
	Kurtosis	1.173	1.500	1.841	2.359	1.503	1.235	1.573	3.254	2.133	1.715	1.822
	Autocorrelations											
	1	-0.042	-0.013	0.015	-0.046	0.008	-0.033	-0.005	-0.059	-0.016	0.035	-0.012
	2	0.065	0.097	0.070	0.038	0.078	0.110	0.129*	-0.005	0.006	0.054	0.092
	3	-0.010	-0.059	-0.030	-0.041	0.019	0.002	-0.029	0.007	0.001	0.002	-0.030
	4	0.035	0.048	0.095	0.127	0.091	0.080	0.033	-0.164*	-0.142*	0.059	0.110
	5	0.021	-0.041	-0.004	-0.020	0.008	0.001	0.004	0.104	0.072	-0.035	-0.025
	6	-0.124	-0.084	-0.079	-0.070	-0.075	-0.069	-0.025	0.009	-0.003	-0.111	-0.101
	7	0.019	0.006	-0.033	-0.016	0.000	-0.001	-0.011	-0.051	-0.037	-0.027	-0.010
	8	0.013	0.020	0.064	0.117	0.122	0.096	0.099	0.125	0.114	0.098	0.083
	9	0.053	0.118	0.133	0.085	0.056	0.035	0.009	-0.079	0.013	0.074	0.086
	10	-0.014	-0.004	0.011	0.003	0.004	0.003	0.059	-0.003	0.054	-0.010	0.007
	LBP (10)	6.515	9.374	10.873	11.648	9.414	8.436	7.974	16.071	10.541	9.094	11.395
	(p-value)	(0.230)	(0.503)	(0.633)	(0.691)	(0.507)	(0.414)	(0.369)	(0.902)	(0.606)	(0.477)	(0.672)
	Prob > 0 (%)	57.317	61.382	55.285	56.911	49.187	52.033	50.000	57.724	63.008		
	Prob > MSCI (%)	61.382	67.480	64.228	58.130	51.626	50.000	47.561	52.846	54.472		
	paired t-test	3.128**	5.556**	3.957**	2.421*	0.553	-0.581	-0.392	2.701**	3.016**		
	Wilcoxon test	2.456*	3.364**	3.253**	1.365	0.342	0.560	-0.835	-0.589	0.081		
	Prob > Equal (%)	63.008	72.764	71.138	70.325	56.504	48.374	48.780	58.943	57.317		
	paired t-test	4.259**	7.658**	6.392**	4.769**	1.909	0.289	0.345	3.117**	3.470**		
	Wilcoxon test	2.193*	4.949**	4.955**	5.196**	1.486	-0.766	-1.034	2.181*	0.980		
	Proportion > 0 (%)	100.000	100.000	90.960	42.373	0.282	0.000	0.282	100.000	99.718		
	Proportion > Equal (%)	100.000	100.000	100.000	100.000	99.435	54.520	61.299	100.000	100.000		
	Proportion > MSCI (%)	100.000	100.000	99.718	100.000	79.096	26.271	31.356	100.000	100.000		
Swiss	Mean Ret (%)	0.474*	0.504**	0.460**	0.261	0.177	-0.032	0.018	0.456*	0.461**	0.138	-0.007
	Median Ret (%)	0.506	0.476	0.469	0.414	0.339	0.050	0.092	0.587	0.641	0.147	0.077
	Std Dev (%)	3.084	2.583	2.705	2.698	2.528	2.567	3.088	3.180	2.730	2.666	2.275
	t-stat	2.411	3.062	2.666	1.518	1.098	-0.193	0.090	2.250	2.651	0.811	-0.050
	Skewness	-0.368	-0.092	-0.022	-0.032	-0.268	-0.125	-0.469	-0.168	-0.049	-0.111	-0.228
	Kurtosis	2.036	0.633	1.547	1.195	0.860	1.721	2.951	2.775	2.452	0.444	0.243
	Autocorrelations											
	1	-0.040	0.082	0.069	0.135*	0.096	0.037	0.036	-0.107	-0.065	0.079	0.089
	2	0.089	0.052	0.061	0.029	0.008	0.038	-0.052	-0.021	-0.036	0.061	0.030
	3	0.021	-0.006	0.013	0.024	0.030	-0.004	0.042	-0.014	-0.005	0.034	0.033
	4	-0.014	0.009	0.018	-0.008	0.032	-0.051	-0.086	-0.135*	-0.097	0.016	0.010
	5	-0.001	-0.014	-0.018	0.031	-0.013	-0.013	0.101	0.071	0.089	0.032	-0.003
	6	-0.046	-0.135*	-0.065	-0.096	-0.084	-0.100	0.035	0.034	0.038	-0.098	-0.096
	7	0.046	-0.010	0.011	-0.006	0.067	0.030	0.033	-0.017	0.002	0.053	0.039
	8	0.022	-0.021	-0.012	-0.025	-0.032	-0.020	-0.008	0.077	0.045	-0.041	-0.021
	9	-0.103	0.001	0.013	-0.001	0.069	0.120	0.109	-0.128	-0.050	0.040	0.049
	10	0.002	0.072	0.090	-0.018	-0.032	-0.066	-0.024	-0.039	0.020	-0.007	-0.001
	LBP (10)	6.215	8.189	5.400	7.439	7.209	8.801	9.324	14.799	7.092	6.813	5.706
	(p-value)	(0.203)	(0.390)	(0.137)	(0.317)	(0.294)	(0.449)	(0.498)	(0.860)	(0.283)	(0.257)	(0.161)
	Prob > 0 (%)	57.724	59.350	59.756	56.911	55.285	51.626	52.439	58.130	60.569		
	Prob > MSCI (%)	58.537	63.415	67.480	58.130	54.065	47.154	46.748	53.252	53.659		
	paired t-test	2.553*	3.756**	3.436**	1.446	0.385	-1.394	-0.875	1.215	1.330		
	Wilcoxon test	1.442	3.022**	5.000**	2.269*	1.689	-0.022	-0.694	0.432	0.651		
	Prob > Equal (%)	60.569	67.480	69.106	61.789	57.724	49.593	47.154	56.911	56.911		
	paired t-test	3.996**	5.904**	5.669**	3.516**	2.230*	-0.244	0.205	1.864	2.038*		
	Wilcoxon test	1.295	3.538**	3.855**	2.564*	1.964*	0.427	-1.708	1.602	1.330		
	Proportion > 0 (%)	100.000	100.000	100.000	99.718	97.175	32.768	60.734	100.000	100.000		
	Proportion > Equal (%)	100.000	100.000	100.000	99.718	97.458	36.441	64.689	100.000	100.000		
	Proportion > MSCI (%)	100.000	100.000	100.000	84.463	64.124	2.260	8.192	98.305	98.870		

Table 3 - *continued*
Performance of Long-Short Strategies
January 1980 – June 2000

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7	MSCI	Equal
UK	Mean Ret (%)	0.175	0.207	0.219	0.014	-0.246	-0.383*	-0.305	0.480*	0.505**	0.304	0.163
	Median Ret (%)	-0.053	0.079	0.031	-0.204	-0.246	-0.378	-0.330	0.600	0.745	0.180	0.100
	Std Dev (%)	2.977	2.799	2.570	2.829	2.785	2.679	3.193	3.387	2.985	2.643	2.354
	t-stat	0.923	1.159	1.335	0.079	-1.388	-2.24	-1.497	2.223	2.654	1.805	1.083
	Skewness	-0.011	0.383	0.543	0.941	0.632	0.310	0.722	-0.230	0.040	0.432	0.607
	Kurtosis	2.632	2.089	1.823	3.495	2.438	1.376	3.999	3.827	3.842	3.426	2.789
	Autocorrelations											
	1	0.023	0.075	0.103	0.062	0.064	0.054	0.121	-0.099	-0.050	0.092	0.106
	2	0.062	0.067	0.052	0.004	-0.116	-0.077	-0.056	-0.032	-0.045	0.003	-0.035
	3	0.012	-0.020	-0.030	0.008	0.011	0.015	0.002	-0.041	-0.033	-0.012	0.005
	4	-0.077	-0.086	-0.004	0.074	0.080	0.050	0.029	-0.153*	-0.152*	0.091	0.047
	5	0.035	0.002	-0.010	0.026	-0.043	-0.061	-0.019	0.116	0.124	-0.016	-0.048
	6	-0.065	-0.115	-0.093	-0.072	-0.046	-0.105	-0.141*	-0.035	-0.022	-0.121	-0.127
	7	-0.016	0.020	0.045	-0.012	0.068	0.075	0.039	-0.031	0.018	0.020	0.029
	8	-0.080	-0.134	-0.107	-0.039	-0.030	0.016	0.116	0.048	0.007	0.010	-0.043
	9	-0.062	-0.030	-0.009	-0.046	-0.009	-0.017	0.066	-0.082	-0.020	0.025	-0.015
	10	0.022	-0.041	-0.087	-0.033	0.006	-0.007	-0.044	0.006	0.018	-0.064	-0.042
	LBP (10)	6.541	12.622	10.804	4.891	8.157	7.857	14.613	14.690	11.055	8.958	9.182
	(p-value)	(0.232)	(0.754)	(0.627)	(0.102)	(0.386)	(0.357)	(0.853)	(0.856)	(0.647)	(0.464)	(0.485)
	Prob > 0 (%)	49.593	52.033	50.813	47.154	45.122	41.870	41.870	60.569	64.634		
	Prob > MSCI (%)	44.715	50.000	46.748	39.024	37.398	31.707	35.772	56.504	58.130		
	paired t-test	-0.975	-0.921	-0.906	-2.792**	-4.673**	-5.751**	-4.137**	0.636	0.786		
	Wilcoxon test	-2.013*	0.634	-0.780	-2.875**	-1.577	-4.174**	-3.024**	1.999*	2.835**		
	Prob > Equal (%)	51.220	51.626	53.659	41.057	32.114	31.707	34.146	57.317	59.350		
	paired t-test	0.104	0.472	0.752	-1.775	-4.727**	-5.898**	-3.645**	1.177	1.377		
	Wilcoxon test	0.040	0.015	1.159	-2.225*	-4.174**	-3.857**	-4.301**	1.807	2.712**		
	Proportion > 0 (%)	98.870	99.153	99.153	56.215	0.000	0.000	0.000	100.000	100.000		
	Proportion > Equal (%)	59.040	62.429	68.644	4.520	0.000	0.000	0.000	99.153	99.435		
	Proportion > MSCI (%)	3.107	19.209	22.599	0.000	0.000	0.000	0.000	91.808	96.610		
US	Mean Ret (%)	0.255	0.203	0.198	-0.016	-0.095	-0.192	-0.250	0.505*	0.468*	0.152	-0.018
	Median Ret (%)	0.335	0.057	0.133	-0.165	-0.142	-0.224	-0.333	0.525	0.625	0.001	-0.141
	Std Dev (%)	2.720	2.548	2.594	2.900	2.909	2.731	2.990	3.294	2.887	2.678	2.272
	t-stat	1.469	1.249	1.200	-0.087	-0.510	-1.105	-1.310	2.402	2.545	0.888	-0.124
	Skewness	-0.012	0.229	-0.011	0.176	0.316	0.119	0.121	0.008	0.375	0.262	0.105
	Kurtosis	1.579	1.375	0.933	0.581	1.203	0.271	1.637	4.593	5.197	0.021	0.352
	Autocorrelations											
	1	-0.003	0.035	0.095	0.043	0.062	0.080	0.067	-0.079	-0.051	0.074	0.072
	2	-0.001	0.059	0.080	0.099	0.071	0.057	0.038	-0.009	-0.034	0.024	0.047
	3	0.057	0.062	0.063	-0.003	0.055	0.018	0.017	-0.024	-0.003	0.032	0.041
	4	-0.127*	0.035	0.003	-0.005	-0.011	-0.091	-0.065	-0.155*	-0.115	-0.029	-0.043
	5	-0.028	0.047	0.058	0.057	0.041	0.077	0.010	0.104	0.114	-0.005	0.003
	6	0.040	0.026	0.026	-0.094	-0.075	-0.096	-0.124	-0.003	-0.001	-	-0.094
	7	-0.049	0.144*	0.108	0.059	0.015	-0.015	0.036	-0.022	-0.012	0.017	0.038
	8	0.114	0.055	0.109	0.064	0.031	0.020	0.007	0.072	0.050	0.057	0.057
	9	-0.013	0.096	0.107	0.083	0.042	0.028	0.035	-0.107	-0.035	0.060	0.068
	10	-0.126	-0.115	-0.099	-0.009	0.030	0.157*	0.070	0.005	0.034	-0.028	-0.033
	LBP (10)	13.065	14.505	16.727	9.300	5.619	14.553	8.179	14.335	8.518	7.973	7.355
	(p-value)	(0.780)	(0.849)	(0.919)	(0.496)	(0.154)	(0.851)	(0.389)	(0.842)	(0.422)	(0.369)	(0.308)
	Prob > 0 (%)	53.252	51.220	53.252	47.967	47.154	45.528	42.683	59.350	61.382		
	Prob > MSCI (%)	55.285	56.911	52.846	44.715	43.089	42.276	40.244	55.691	54.878		
	paired t-test	0.714	0.455	0.489	-1.723	-2.252*	-2.927**	-2.777**	1.251	1.244		
	Wilcoxon test	1.184	2.487*	0.614	-1.162	-1.133	-1.403	-2.284*	1.097	0.712		
	Prob > Equal (%)	57.317	60.976	60.976	50.000	45.122	44.309	41.463	59.350	61.382		
	paired t-test	2.183*	2.479*	2.772**	0.023	-0.880	-1.863	-1.795	1.970*	2.046*		
	Wilcoxon test	1.111	3.182**	2.788**	-0.031	-0.956	-1.024	-2.533*	2.589**	3.584**		
	Proportion > 0 (%)	100.000	99.153	99.153	34.463	16.384	4.237	0.282	100.000	100.000		
	Proportion > Equal (%)	100.000	99.435	99.718	42.373	23.164	5.085	0.565	100.000	100.000		
	Proportion > MSCI (%)	90.678	72.881	65.819	4.802	0.282	0.000	0.000	100.000	99.153		

Table 4
Performance of Long-Short Strategies
Subperiod Analysis

Each month each currency is ranked from one to seven based upon the difference between the short-run and long-run moving average of prior returns using 354 different short-run - long-run moving average combinations ranging from [1-2] to [12-36]. Each of the MA combinations are given equal weight each month, generating monthly returns. The base currency is denoted on the far left. The mean return is denoted with an asterisk if it is significantly different from zero during the subperiod. The [Prob >] rows give the percentage of the total months in the subperiod that the given strategy has exceeded zero, the MSCI benchmark, and the Equal benchmark. The paired t-test is used to test the significance of the excess returns of the long-short MA combinations relative to the MSCI benchmark and the Equal benchmark. The Wilcoxon is a nonparametric test of the excess returns. The [Proportion >] rows give the percentage of the 354 MA combinations that exceed zero, the MSCI benchmark average return, and the Equal benchmark average return. ** and * indicate significance at the 1 and 5 percent levels.

		Rank 1 – Rank 7				Rank (1, 2, 3) – Rank 7			
		1980 – 1984	1985 – 1989	1990 - 1994	1995 - 2000	1980 - 1984	1985 - 1989	1990 - 1994	1995 – 2000
Australia	Mean Ret (%)	0.587	0.941*	0.446	0.447	0.452	0.916*	0.437	0.586*
	Median Ret (%)	1.080	1.349	0.296	0.324	0.812	1.290	0.497	0.866
	Std Dev (%)	3.126	3.398	2.643	2.491	2.895	2.935	2.495	2.147
	Prob > 0 (%)	70.000	70.000	58.333	56.061	70.000	70.000	58.333	60.606
	Prob > MSCI (%)	56.667	63.333	53.333	53.030	58.333	61.667	51.667	53.030
	paired t-test	0.609	0.438	0.383	0.193	0.325	0.426	0.360	0.525
	Wilcoxon test	0.434	2.444*	0.766	0.425	1.156	1.914	0.221	0.246
	Prob > Equal (%)	60.000	55.000	48.333	57.576	61.667	56.667	50.000	57.576
	paired t-test	1.386	0.134	0.540	0.387	1.175	0.107	0.521	0.712
	Wilcoxon test	0.685	0.567	-0.493	1.466	1.207	0.861	-0.339	1.255
	Proportion > 0 (%)	98.305	99.153	89.548	96.893	98.023	99.435	94.633	100.000
	Proportion > Equal (%)	99.718	68.362	72.599	85.593	98.870	71.751	76.554	89.266
	Proportion > MSCI (%)	89.266	75.141	61.017	71.751	85.311	75.989	69.774	88.136
	MSCI Return (%)	0.313	0.605	0.295	0.358	0.313	0.605	0.295	0.358
	MSCI Std Dev (%)	1.869	4.526	2.620	2.722	1.869	4.526	2.620	2.722
	Equal Return (%)	-0.142	0.838	0.211	0.261	-0.142	0.838	0.211	0.261
	Equal Std Dev (%)	2.029	4.632	3.039	2.873	2.029	4.632	3.039	2.873
Canada	Mean Ret (%)	0.507	0.843	0.266	0.513	0.287	0.887*	0.309	0.555
	Median Ret (%)	0.832	1.028	0.222	0.331	0.677	0.894	0.296	1.067
	Std Dev (%)	2.897	4.286	2.864	2.732	2.662	3.383	2.633	2.354
	Prob > 0 (%)	63.333	65.000	55.000	57.576	60.000	66.667	56.667	63.636
	Prob > MSCI (%)	63.333	63.333	51.667	60.606	56.667	65.000	50.000	62.121
	paired t-test	1.063	0.948	-0.687	1.208	0.617	1.323	-0.608	1.439
	Wilcoxon test	1.575	2.142*	0.869	1.575	0.236	2.415*	0.736	1.594
	Prob > Equal (%)	66.667	53.333	50.000	62.121	68.333	55.000	51.667	62.121
	paired t-test	1.754	0.614	-0.541	1.402	1.417	0.892	-0.461	1.617
	Wilcoxon test	1.664	0.125	0.471	1.792	2.238*	0.309	1.060	1.409
	Proportion > 0 (%)	97.740	97.740	71.751	100.000	92.373	99.718	76.554	100.000
	Proportion > Equal (%)	100.000	70.339	36.723	100.000	100.000	92.938	34.746	100.000
	Proportion > MSCI (%)	96.893	88.418	30.226	100.000	90.678	98.870	25.706	100.000
	MSCI Return (%)	0.023	0.241	0.576	0.019	0.023	0.241	0.576	0.019
	MSCI Std Dev (%)	1.209	2.210	1.959	1.830	1.209	2.210	1.959	1.830
	Equal Return (%)	-0.460	0.443	0.522	-0.113	-0.460	0.443	0.522	-0.113
	Equal Std Dev (%)	1.857	2.672	2.396	2.193	1.857	2.672	2.396	2.193
France	Mean Ret (%)	0.695	0.786	0.246	0.463	0.629	0.812	0.152	0.552
	Median Ret (%)	0.780	1.101	0.339	0.338	0.903	1.062	0.326	0.816
	Std Dev (%)	2.993	4.204	2.792	2.761	2.854	3.379	2.592	2.403
	Prob > 0 (%)	65.000	65.000	55.000	56.061	61.667	68.333	55.000	63.636
	Prob > MSCI (%)	41.667	66.667	58.333	50.000	43.333	66.667	56.667	48.485
	paired t-test	-1.797	1.892	0.233	0.314	-2.123*	2.175*	0.056	0.604
	Wilcoxon test	-0.729	2.024*	1.443	-0.412	0.007	1.914	1.332	-1.000
	Prob > Equal (%)	50.000	66.667	60.000	50.000	56.667	65.000	58.333	56.061
	paired t-test	-0.818	1.833	0.517	0.626	-1.064	2.143*	0.338	0.967
	Wilcoxon test	0.236	2.032*	1.855	-0.795	1.980*	1.436	1.516	0.489
	Proportion > 0 (%)	99.718	89.548	69.209	99.718	99.718	97.740	68.079	100.000
	Proportion > Equal (%)	15.819	99.718	69.209	89.266	8.757	99.718	68.079	98.588
	Proportion > MSCI (%)	0.000	100.000	53.672	80.226	0.000	100.000	53.107	94.068
	MSCI Return (%)	1.337	-0.414	0.124	0.337	1.337	-0.414	0.124	0.337
	MSCI Std Dev (%)	2.650	2.244	2.377	2.026	2.650	2.244	2.377	2.026
	Equal Return (%)	0.980	-0.302	0.000	0.220	0.980	-0.302	0.000	0.220
	Equal Std Dev (%)	1.988	1.754	1.848	1.700	1.988	1.754	1.848	1.700

Table 4 - *continued*
Performance of Long-Short Strategies
Subperiod Analysis

		Rank 1 – Rank 7				Rank (1, 2, 3) – Rank 7			
		1980 – 1984	1985 – 1989	1990 - 1994	1995 - 2000	1980 - 1984	1985 - 1989	1990 - 1994	1995 – 2000
Germany	Mean Ret (%)	0.576	0.856	0.299	0.472	0.547	0.899*	0.226	0.538
	Median Ret (%)	0.842	1.077	0.366	0.297	0.579	1.127	0.351	0.863
	Std Dev (%)	2.865	4.207	2.807	2.806	2.771	3.316	2.613	2.368
	Prob > 0 (%)	65.000	68.333	56.667	56.061	65.000	71.667	53.333	63.636
	Prob > MSCI (%)	46.667	68.333	60.000	50.000	45.000	66.667	53.333	48.485
	paired t-test	-0.816	2.228*	0.364	0.216	-0.992	2.556*	0.234	0.435
	Wilcoxon test	-0.066	2.245*	1.671	-0.208	-0.817	1.612	0.169	-0.866
	Prob > Equal (%)	58.333	70.000	53.333	51.515	65.000	70.000	58.333	57.576
	paired t-test	0.328	2.218*	0.655	0.510	0.273	2.569*	0.525	0.784
	Wilcoxon test	1.200	2.702**	-0.059	-0.125	2.635**	2.312*	1.340	1.070
	Proportion > 0 (%)	99.435	94.633	76.271	100.000	98.870	99.435	76.271	100.000
	Proportion > Equal (%)	68.079	100.000	77.401	85.593	73.164	100.000	76.271	95.763
	Proportion > MSCI (%)	13.277	100.000	63.277	71.186	5.367	100.000	66.102	81.638
	MSCI Return (%)	0.885	-0.609	0.107	0.383	0.885	-0.609	0.107	0.383
	MSCI Std Dev (%)	2.691	2.590	2.451	2.020	2.691	2.590	2.451	2.020
	Equal Return (%)	0.457	-0.505	-0.017	0.269	0.457	-0.505	-0.017	0.269
	Equal Std Dev (%)	2.025	2.133	1.936	1.686	2.025	2.133	1.936	1.686
Japan	Mean Ret (%)	0.821*	0.726	-0.040	0.368	0.777*	0.780	0.067	0.461
	Median Ret (%)	0.996	1.355	-0.231	0.247	0.784	0.967	0.205	0.591
	Std Dev (%)	2.622	4.332	2.839	2.698	2.483	3.436	2.636	2.584
	Prob > 0 (%)	65.000	66.667	46.667	53.030	66.667	68.333	58.333	59.091
	Prob > MSCI (%)	55.000	60.000	51.667	45.455	56.667	58.333	51.667	51.515
	paired t-test	2.088*	1.995	1.008	0.471	2.004*	2.275*	1.247	0.646
	Wilcoxon test	-0.184	0.714	-0.206	-1.223	0.508	0.044	-0.434	0.125
	Prob > Equal (%)	65.000	60.000	55.000	56.061	63.333	55.000	53.333	57.576
	paired t-test	2.984**	1.701	1.041	0.782	2.895**	2.027*	1.280	0.961
	Wilcoxon test	1.119	1.126	0.699	1.242	0.729	-0.383	0.044	1.351
	Proportion > 0 (%)	100.000	96.328	43.785	99.718	100.000	98.305	59.887	99.718
	Proportion > Equal (%)	100.000	100.000	79.661	99.718	100.000	99.718	84.746	99.718
	Proportion > MSCI (%)	100.000	100.000	80.508	98.870	100.000	100.000	85.876	98.588
	MSCI Return (%)	-0.099	-0.648	-0.542	0.106	-0.099	-0.648	-0.542	0.106
	MSCI Std Dev (%)	3.047	3.097	2.382	3.796	3.047	3.097	2.382	3.796
	Equal Return (%)	-0.590	-0.371	-0.538	-0.062	-0.590	-0.371	-0.538	-0.062
	Equal Std Dev (%)	2.662	2.629	2.429	3.578	2.662	2.629	2.429	3.578
Swiss	Mean Ret (%)	0.370	0.760	0.294	0.406	0.398	0.839*	0.107	0.498
	Median Ret (%)	0.756	1.033	0.116	0.192	0.727	1.053	0.145	0.698
	Std Dev (%)	2.965	4.139	2.781	2.640	2.820	3.200	2.556	2.248
	Prob > 0 (%)	60.000	65.000	55.000	53.030	58.333	65.000	51.667	66.667
	Prob > MSCI (%)	40.000	61.667	61.667	50.000	46.667	61.667	56.667	50.000
	paired t-test	-0.748	1.738	0.570	0.281	-0.709	2.041*	0.243	0.550
	Wilcoxon test	-1.730	1.134	2.061*	-0.157	-0.147	1.060	1.038	-0.450
	Prob > Equal (%)	56.667	60.000	60.000	51.515	56.667	61.667	58.333	51.515
	paired t-test	0.309	1.664	0.885	0.581	0.393	1.971	0.558	0.882
	Wilcoxon test	1.193	0.883	1.458	-0.010	0.861	1.141	0.957	-0.342
	Proportion > 0 (%)	91.525	82.486	75.706	98.870	99.153	98.305	65.537	100.000
	Proportion > Equal (%)	68.644	94.915	90.395	88.983	85.311	99.718	71.186	96.328
	Proportion > MSCI (%)	11.017	99.435	76.836	78.814	0.282	100.000	67.232	90.113
	MSCI Return (%)	0.680	-0.417	-0.018	0.291	0.680	-0.417	-0.018	0.291
	MSCI Std Dev (%)	2.846	2.769	2.596	2.330	2.846	2.769	2.596	2.330
	Equal Return (%)	0.244	-0.308	-0.157	0.174	0.244	-0.308	-0.157	0.174
	Equal Std Dev (%)	2.302	2.468	2.169	2.110	2.302	2.468	2.169	2.110

Table 4 - *continued*
Performance of Long-Short Strategies
Subperiod Analysis

		Rank 1 – Rank 7				Rank (1, 2, 3) – Rank 7			
		1980 – 1984	1985 – 1989	1990 - 1994	1995 - 2000	1980 - 1984	1985 - 1989	1990 - 1994	1995 – 2000
UK	Mean Ret (%)	0.402	0.989	0.162	0.378	0.404	0.936*	0.148	0.530
	Median Ret (%)	0.655	1.136	0.348	0.406	0.714	0.868	0.416	1.006
	Std Dev (%)	3.070	4.427	3.081	2.721	2.805	3.668	2.823	2.509
	Prob > 0 (%)	61.667	63.333	61.667	56.061	65.000	68.333	60.000	65.152
	Prob > MSCI (%)	50.000	63.333	51.667	60.606	45.000	68.333	53.333	65.152
	paired t-test	-1.163	1.740	-0.301	0.986	-1.280	1.865	-0.341	1.402
	Wilcoxon test	0.677	1.436	0.147	1.817	-0.405	2.937**	0.699	2.667**
	Prob > Equal (%)	56.667	60.000	51.667	60.606	58.333	63.333	51.667	63.636
	paired t-test	-0.278	1.566	-0.093	1.280	-0.295	1.699	-0.126	1.680
	Wilcoxon test	1.516	0.942	-0.140	1.536	1.840	1.804	-0.015	2.022*
	Proportion > 0 (%)	97.175	98.023	71.751	98.870	97.458	99.153	74.859	100.000
	Proportion > Equal (%)	25.141	97.175	46.045	100.000	15.537	98.305	46.328	100.000
	Proportion > MSCI (%)	0.000	99.718	35.876	98.870	0.000	99.435	22.599	100.000
	MSCI Return (%)	1.017	-0.097	0.350	-0.020	1.017	-0.097	0.350	-0.020
	MSCI Std Dev (%)	2.610	2.704	3.185	1.808	2.610	2.704	3.185	1.808
	Equal Return (%)	0.563	0.062	0.214	-0.157	0.563	0.062	0.214	-0.157
	Equal Std Dev (%)	2.504	2.362	2.621	1.838	2.504	2.362	2.621	1.838
US	Mean Ret (%)	0.526	0.697	0.328	0.470	0.301	0.780	0.206	0.576
	Median Ret (%)	0.697	1.019	0.168	0.395	0.421	0.794	0.232	1.153
	Std Dev (%)	2.832	4.420	2.909	2.764	2.637	3.622	2.681	2.471
	Prob > 0 (%)	65.000	61.667	51.667	59.091	60.000	63.333	56.667	65.152
	Prob > MSCI (%)	68.333	51.667	48.333	54.545	66.667	48.333	48.333	56.061
	paired t-test	1.690	-0.226	-0.113	1.389	1.340	-0.141	-0.397	1.687
	Wilcoxon test	2.076*	0.640	-0.022	-0.406	1.885	-0.383	0.074	-0.118
	Prob > Equal (%)	75.000	50.000	50.000	62.121	73.333	51.667	55.000	65.152
	paired t-test	2.174*	-0.001	0.413	1.627	1.823	0.151	0.135	2.007*
	Wilcoxon test	3.578**	0.177	-0.088	1.760	3.379**	0.508	1.303	2.201*
	Proportion > 0 (%)	97.740	98.023	84.746	100.000	92.373	99.153	68.079	100.000
	Proportion > Equal (%)	100.000	54.520	67.514	100.000	100.000	72.599	59.887	100.000
	Proportion > MSCI (%)	100.000	43.220	46.610	100.000	100.000	44.633	38.418	100.000
	MSCI Return (%)	-0.441	0.863	0.379	-0.163	-0.441	0.863	0.379	-0.163
	MSCI Std Dev (%)	2.398	3.373	2.366	2.268	2.398	3.373	2.366	2.268
	Equal Return (%)	-0.687	0.698	0.151	-0.214	-0.687	0.698	0.151	-0.214
	Equal Std Dev (%)	2.205	2.780	2.055	1.737	2.205	2.780	2.055	1.737

Table 5
Performance of Long-Short Strategies
Strategies Three and Four

Each month from January, 1980 through June, 2000 each currency is ranked from one to seven based upon the difference between the short-run and long-run moving average (MA) of prior returns using 93 different short-run - long-run moving average combinations ranging from [4-5] to [6-36]. Each of the MA combinations are given equal weight each month, generating monthly returns. The base currency is denoted at the top of each column. The mean return is denoted with an asterisk if it is significantly different from zero during the period. The [Prob >] rows give the percentage of the total months in the subperiod that the given strategy has exceeded zero, the MSCI benchmark, and the Equal benchmark. The paired t-test is used to test the significance of the excess returns of the long-short strategies relative to the MSCI benchmark and the Equal benchmark. The Wilcoxon is a nonparametric test of the excess returns. The [Proportion >] rows give the percentage of the 93 MA combinations that exceed zero, the MSCI benchmark average return, and the Equal benchmark average return. ** and * indicate significance at the 1 and 5 percent levels.

	Strategy Three: Rank 1 – Rank 7							
	Australia	Canada	France	Germany	Japan	Swiss	UK	US
Mean Ret (%)	0.685**	0.597**	0.631**	0.601**	0.505*	0.527*	0.536*	0.593*
Median Ret (%)	0.907	0.532	0.679	0.623	0.581	0.388	0.645	0.498
Std Dev (%)	3.303	3.606	3.603	3.593	3.534	3.554	3.774	3.628
Prob > 0 (%)	61.789	60.976	60.976	60.569	58.943	59.350	59.350	59.756
Prob > MSCI (%)	57.317	55.691	55.285	54.878	54.065	56.504	56.098	56.911
paired t-test	1.026	1.456	1.070	1.486	2.684**	1.395	0.789	1.492
Wilcoxon test	2.282*	0.939	1.594	0.932	-0.075	2.003*	1.680	1.451
Prob > Equal (%)	55.285	59.756	56.098	57.724	56.098	58.130	58.130	58.130
paired t-test	1.312	1.760	1.613	2.114*	3.066**	2.002*	1.295	2.173*
Wilcoxon test	0.833	2.771**	1.365	1.626	0.624	2.133*	2.144*	1.659
Proportion > 0 (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Proportion > Equal (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Proportion > MSCI (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

	Strategy Four: Rank (1, 2, 3) – Rank 7							
	Australia	Canada	France	Germany	Japan	Swiss	UK	US
Mean Ret (%)	0.693**	0.589**	0.608**	0.601**	0.602**	0.516**	0.536*	0.557**
Median Ret (%)	0.858	0.590	0.750	0.653	0.640	0.547	0.700	0.606
Std Dev (%)	2.952	3.103	3.136	3.076	3.096	3.054	3.326	3.155
Prob > 0 (%)	65.041	61.382	60.976	62.195	63.415	60.569	60.569	61.382
Prob > MSCI (%)	57.317	58.943	52.439	53.659	54.878	51.626	56.098	56.911
paired t-test	1.101	1.612	1.095	1.659	3.178**	1.489	0.863	1.520
Wilcoxon test	2.144*	2.563*	0.149	0.068	0.004	-0.650	1.737	1.473
Prob > Equal (%)	57.317	61.382	58.537	60.976	59.350	54.878	59.350	60.163
paired t-test	1.397	1.933	1.703	2.377*	3.599**	2.160*	1.419	2.289*
Wilcoxon test	1.705	3.344**	2.575*	2.884**	1.887	0.179	2.750**	2.619**
Proportion > 0 (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Proportion > Equal (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Proportion > MSCI (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

Table 6
Performance of Long-Short Strategies
Exclude Japan From Analysis

Each month from January, 1980 through June, 2000 each currency is ranked from one to six based upon the difference between the short-run and long-run moving average (MA) of prior returns using 354 different short-run - long-run moving average combinations ranging from [1-2] to [12-36]. Each of the MA combinations are given equal weight each month, generating monthly returns. The base currency is denoted at the top of each column. The mean return is denoted with an asterisk if it is significantly different from zero during the period. The [Prob >] rows give the percentage of the total months in the subperiod that the given strategy has exceeded zero, the MSCI benchmark, and the Equal benchmark. The paired t-test is used to test the significance of the excess returns of the long-short strategies relative to the MSCI benchmark and the Equal benchmark. The Wilcoxon is a nonparametric test of the excess returns. The [Proportion >] rows give the percentage of the 354 MA combinations that exceed zero, the MSCI benchmark average return, and the Equal benchmark average return. ** and * indicate significance at the 1 and 5 percent levels.

	Rank 1 – Rank 6						
	Australia	Canada	France	Germany	Japan	Swiss	UK
Mean Ret (%)	0.527**	0.503*	0.520*	0.509*	0.457*	0.476*	0.445*
Median Ret (%)	0.600	0.430	0.577	0.536	0.518	0.593	0.636
Std Dev (%)	2.953	3.263	3.271	3.252	3.056	3.374	3.293
Prob > 0 (%)	60.163	58.130	58.537	58.130	59.756	59.350	60.163
Prob > MSCI (%)	56.504	57.317	55.691	55.691	56.504	54.065	53.659
paired t-test	0.901	1.757	1.068	1.570	1.575	0.961	1.879
Wilcoxon test	2.137*	1.629	1.761	1.293	1.893	0.869	-0.094
Prob > Equal (%)	51.626	56.504	58.130	56.504	59.756	54.878	56.098
paired t-test	0.591	1.413	1.076	1.791	1.847	1.000	1.684
Wilcoxon test	-0.373	1.531	2.738**	1.141	3.173**	1.029	1.411
Proportion > 0 (%)	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Proportion > Equal (%)	92.655	100.000	99.435	100.000	100.000	100.000	100.000
Proportion > MSCI (%)	96.893	100.000	99.435	100.000	100.000	99.435	100.000

	Rank (1, 2, 3) – Rank 6						
	Australia	Canada	France	Germany	Japan	Swiss	UK
Mean Ret (%)	0.548**	0.517**	0.505**	0.514**	0.434*	0.515**	0.444*
Median Ret (%)	0.592	0.383	0.589	0.525	0.602	0.622	0.480
Std Dev (%)	2.552	2.729	2.787	2.738	2.649	2.986	2.813
Prob > 0 (%)	63.821	59.756	61.789	61.382	60.569	64.634	61.382
Prob > MSCI (%)	56.504	58.130	54.065	56.504	52.439	51.220	60.163
paired t-test	1.062	2.161*	1.119	1.783	1.578	1.172	2.165*
Wilcoxon test	1.965*	1.873	0.863	1.542	-0.137	-0.827	3.129**
Prob > Equal (%)	52.846	59.350	58.943	58.943	54.878	57.317	58.537
paired t-test	0.707	1.703	1.133	2.042*	1.864	1.218	1.919
Wilcoxon test	0.136	2.679**	2.946**	2.052*	0.648	2.240*	2.508*
Proportion > 0 (%)	100.000	100.000	99.718	99.435	99.435	99.718	99.718
Proportion > Equal (%)	95.198	99.718	97.740	99.435	99.718	99.153	99.718
Proportion > MSCI (%)	97.175	99.718	98.305	99.153	99.435	99.153	99.718

Table 7
Correlations Across Countries for Individual Long-Short Strategies

The correlations between individual the long-short strategies in individual countries are given below. The "Strategy One" and “Strategy Two” portfolio incorporates an equal allocation to long-short moving average rules ranging from [1-2] to [12-36]. The "Strategy Three” and “Strategy Four” portfolio incorporates an equal allocation to long-short moving average rules ranging from [4-5] to [6-36]. For each base currency, the seven other currencies are ranked according to each of the moving average rules. The portfolio strategy for each currency is then to give each of the moving average rules equal weight to determine a weighted long-short strategy each month. [Rank 1 - Rank 7] is a long-short strategy which is long rank one and short rank seven. [Rank (1, 2, 3) - Rank 7] gives an equal long allocation to ranks one, two, and three and is short rank seven.

Strategy One		Australia	Canada	France	Germany	Japan	Swiss	UK	US
Rank 1 − Rank 7	Australia		0.785	0.817	0.811	0.665	0.787	0.767	0.780
	Canada			0.979	0.978	0.860	0.954	0.927	0.967
	France				0.991	0.870	0.964	0.945	0.975
	Germany					0.868	0.963	0.945	0.977
	Japan						0.826	0.813	0.848
	Swiss							0.906	0.958
	UK								0.929
	US								
Strategy Two		**Australia**	**Canada**	**France**	**Germany**	**Japan**	**Swiss**	**UK**	**US**
Rank (1, 2, 3) − Rank 7	Australia		0.809	0.837	0.833	0.723	0.804	0.810	0.805
	Canada			0.966	0.964	0.861	0.935	0.923	0.973
	France				0.990	0.881	0.962	0.940	0.966
	Germany					0.875	0.960	0.938	0.966
	Japan						0.843	0.854	0.856
	Swiss							0.905	0.943
	UK								0.934
	US								
Strategy Three		**Australia**	**Canada**	**France**	**Germany**	**Japan**	**Swiss**	**UK**	**US**
Rank 1 − Rank 7	Australia		0.781	0.808	0.801	0.642	0.787	0.741	0.784
	Canada			0.975	0.977	0.843	0.956	0.911	0.968
	France				0.985	0.845	0.960	0.928	0.972
	Germany					0.850	0.962	0.928	0.978
	Japan						0.817	0.793	0.839
	Swiss							0.892	0.955
	UK								0.912
	US								
Strategy Four		**Australia**	**Canada**	**France**	**Germany**	**Japan**	**Swiss**	**UK**	**US**
Rank (1, 2, 3) − Rank 7	Australia		0.778	0.810	0.809	0.695	0.790	0.768	0.788
	Canada			0.960	0.958	0.858	0.935	0.905	0.973
	France				0.987	0.870	0.961	0.923	0.964
	Germany					0.865	0.965	0.922	0.964
	Japan						0.839	0.839	0.858
	Swiss							0.897	0.945
	UK								0.922
	US								

Table 8
Autocorrelations
Squared Interest-Adjusted Returns

The dataset consists of the squared interest-adjusted monthly returns for individual currencies from January, 1980 through June, 2000. The period consists of 246 months. The base currency is denoted on the far left and the columns to the right give the return statistics of seven other currencies with respect to the base currency. MSCI and Equal returns are calculated relative to the base currency. The MSCI column is calculated using the MSCI weights excluding the base currency. The Equal column calculates the currency return assuming an equal proportion allocated to the seven currencies. The Ljung and Box Q-statistic is denoted as LBP(10) and tests whether the 10 autocorrelations are jointly significant. The p-value for the Q-statistic is given in the last row for each base currency. ** and * indicate significance at the 1 and 5 percent levels.

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Australia	Autocorrelations										
	1	n.a.	0.057	0.196**	0.184**	0.146*	0.238**	0.262**	0.017	0.134*	0.213**
	2	n.a.	0.057	-0.065	-0.043	-0.011	-0.040	-0.032	0.106	0.029	-0.018
	3	n.a.	0.037	-0.028	-0.019	-0.015	0.008	-0.063	0.089	0.018	-0.006
	4	n.a.	-0.005	0.003	0.013	0.019	0.015	-0.046	-0.006	-0.026	-0.009
	5	n.a.	0.075	0.025	0.005	0.053	0.006	0.052	0.116	0.039	0.032
	6	n.a.	0.111	-0.014	-0.012	-0.073	-0.017	0.016	0.044	0.009	0.009
	7	n.a.	0.007	-0.021	0.010	-0.015	-0.022	-0.027	0.003	-0.006	0.000
	8	n.a.	-0.002	0.044	0.038	-0.008	0.021	0.048	0.022	0.018	0.031
	9	n.a.	0.040	0.041	0.014	-0.007	-0.017	0.068	0.007	0.003	0.012
	10	n.a.	-0.049	-0.040	-0.035	0.014	-0.006	0.011	-0.050	-0.039	-0.031
	LBP (10)	n.a.	7.288	11.931	9.416	7.412	14.344	20.806*	9.179	5.562	11.706
	p-value	n.a.	(0.302)	(0.71)	(0.507)	(0.314)	(0.842)	(0.978)	(0.485)	(0.149)	(0.695)
Canada	Autocorrelations										
	1	0.051	n.a.	-0.017	0.016	0.008	0.051	-0.038	0.085	0.025	-0.073
	2	0.045	n.a.	-0.052	-0.006	0.097	0.002	-0.012	0.101	-0.023	-0.006
	3	0.051	n.a.	-0.029	-0.008	-0.070	-0.021	-0.055	0.033	-0.001	-0.063
	4	0.001	n.a.	0.070	0.026	-0.011	0.024	0.211**	-0.072	0.052	0.067
	5	0.102	n.a.	0.046	0.023	0.041	-0.005	0.076	-0.054	0.237**	0.099
	6	0.161*	n.a.	0.027	0.020	-0.048	0.007	0.019	-0.068	-0.008	0.017
	7	0.006	n.a.	-0.119	-0.079	-0.001	-0.135*	-0.025	-0.038	0.043	-0.065
	8	-0.004	n.a.	0.035	0.050	-0.057	0.063	0.006	0.058	-0.023	-0.053
	9	0.067	n.a.	0.113	0.104	0.089	0.102	0.041	0.007	0.182*	0.077
	10	-0.047	n.a.	0.038	0.065	-0.002	0.032	0.077	-0.033	0.037	0.066
	LBP (10)	12.289	n.a.	10.106	6.308	7.202	9.148	15.400	8.955	23.732**	10.078
	p-value	(0.734)	n.a.	(0.569)	(0.211)	(0.294)	(0.482)	(0.882)	(0.464)	(0.992)	(0.566)
France	Autocorrelations										
	1	0.175**	-0.022	n.a.	-0.016	-0.023	0.078	0.089	-0.033	0.004	-0.005
	2	-0.074	-0.050	n.a.	-0.034	0.066	0.004	0.037	-0.064	-0.053	-0.070
	3	-0.018	-0.022	n.a.	0.021	0.012	0.026	0.044	-0.038	-0.015	-0.011
	4	0.003	0.060	n.a.	-0.028	-0.023	0.037	0.020	0.015	0.003	-0.048
	5	0.010	0.037	n.a.	0.002	0.004	0.014	0.154*	0.023	-0.005	-0.039
	6	-0.017	0.008	n.a.	-0.037	-0.030	0.149*	-0.006	-0.002	-0.033	-0.030
	7	-0.014	-0.123	n.a.	-0.027	0.016	0.018	0.040	-0.035	-0.020	-0.056
	8	0.053	0.027	n.a.	0.339**	-0.038	0.185**	0.035	0.006	0.049	0.074
	9	0.065	0.100	n.a.	0.308**	0.013	0.015	0.091	0.112	0.185**	0.216**
	10	-0.041	0.024	n.a.	-0.016	0.016	0.030	0.059	0.070	0.079	0.031
	LBP (10)	11.023	8.563	n.a.	53.051**	2.069	16.185	12.126	6.392	11.700	16.262
	p-value	(0.644)	(0.426)	n.a.	(1.000)	(0.004)	(0.906)	(0.723)	(0.219)	(0.694)	(0.908)
Germany	Autocorrelations										
	1	0.171**	0.003	-0.016	n.a.	0.019	0.125	0.150*	0.045	0.142*	0.119
	2	-0.042	-0.009	-0.036	n.a.	0.069	-0.062	0.057	-0.025	-0.005	0.028
	3	-0.015	-0.003	0.023	n.a.	0.002	-0.016	0.073	-0.011	0.012	0.033
	4	0.021	0.023	-0.028	n.a.	-0.040	0.034	0.097	-0.004	0.000	0.022
	5	-0.010	0.016	0.005	n.a.	-0.005	0.089	0.044	0.004	-0.018	-0.091
	6	-0.011	0.007	-0.040	n.a.	-0.022	0.110	-0.018	0.005	-0.020	-0.036
	7	0.033	-0.083	-0.028	n.a.	0.027	0.029	0.040	0.003	0.049	0.024
	8	0.063	0.044	0.337**	n.a.	-0.036	-0.064	0.002	0.026	0.046	-0.011
	9	0.035	0.082	0.302**	n.a.	0.032	0.054	-0.001	0.102	0.135*	0.083
	10	-0.023	0.055	-0.016	n.a.	0.028	0.244**	0.035	0.151*	0.212**	0.134
	LBP (10)	9.345	4.808	51.825**	n.a.	2.689	26.614**	10.954	9.060	21.796*	12.585
	p-value	(0.500)	(0.096)	(1.000)	(n.a.)	(0.012)	(0.997)	(0.639)	(0.474)	(0.984)	(0.752)

Table 8 - *continued*
Autocorrelations
Squared Interest-Adjusted Returns

		Australia	Canada	France	Germany	Japan	Swiss	UK	US	MSCI	Equal
Japan	Autocorrelations										
	1	0.164*	0.021	-0.020	0.038	n.a.	0.106	0.038	0.032	0.036	0.031
	2	-0.014	0.065	0.074	0.071	n.a.	0.041	-0.012	0.070	0.073	0.095
	3	-0.009	-0.079	0.028	0.011	n.a.	0.007	-0.096	-0.064	-0.051	-0.028
	4	0.032	-0.010	-0.028	-0.050	n.a.	-0.013	0.002	-0.016	-0.023	-0.029
	5	0.080	0.084	0.011	-0.003	n.a.	-0.007	0.050	0.101	0.062	0.003
	6	-0.073	-0.052	-0.036	-0.023	n.a.	-0.040	0.019	-0.039	-0.034	-0.045
	7	0.007	0.012	0.020	0.038	n.a.	0.066	0.036	0.030	0.044	0.057
	8	0.002	-0.064	-0.041	-0.039	n.a.	0.048	-0.072	-0.058	-0.048	-0.056
	9	0.002	0.076	0.004	0.023	n.a.	0.083	-0.058	0.021	0.010	-0.002
	10	-0.005	0.000	-0.001	0.012	n.a.	0.046	0.032	0.048	0.053	0.036
	LBP (10)	9.650	7.471	2.643	3.227	n.a.	7.422	5.952	7.027	5.327	5.188
	p-value	(0.528)	(0.320)	(0.011)	(0.024)	n.a.	(0.315)	(0.181)	(0.277)	(0.132)	(0.122)
Swiss	Autocorrelations										
	1	0.221**	0.038	0.085	0.110	0.051	n.a.	0.113	0.113	0.209**	0.223**
	2	-0.025	0.007	0.010	-0.061	0.057	n.a.	-0.002	0.012	-0.001	0.028
	3	0.019	-0.009	0.026	-0.026	0.005	n.a.	0.113	-0.014	0.030	0.065
	4	0.027	0.012	0.024	0.017	-0.001	n.a.	0.044	0.009	0.018	-0.008
	5	-0.006	0.000	0.013	0.084	-0.004	n.a.	0.026	-0.006	-0.071	-0.127
	6	-0.017	-0.002	0.169*	0.104	-0.041	n.a.	-0.038	0.004	-0.029	-0.052
	7	-0.004	-0.138*	0.016	0.029	0.056	n.a.	-0.009	-0.077	-0.065	-0.098
	8	0.065	0.071	0.169*	-0.062	0.038	n.a.	0.089	0.073	0.191**	0.125
	9	-0.006	0.086	0.023	0.059	0.077	n.a.	0.048	0.106	0.216**	0.102
	10	0.015	0.023	0.052	0.260**	0.055	n.a.	-0.011	0.093	0.112	0.031
	LBP (10)	13.310	8.332	17.027	27.244**	5.195	n.a.	9.708	10.912	36.836**	26.699**
	p-value	(0.793)	(0.404)	(0.926)	(0.998)	(0.122)	n.a.	(0.534)	(0.636)	(1.000)	(0.997)
UK	Autocorrelations										
	1	0.257**	-0.017	0.087	0.136*	0.039	0.083	n.a.	0.147*	0.207**	0.191**
	2	-0.032	-0.006	0.025	0.039	0.000	-0.013	n.a.	-0.002	-0.006	-0.029
	3	-0.063	-0.048	0.023	0.040	-0.076	0.092	n.a.	-0.001	-0.019	-0.045
	4	-0.027	0.179**	0.018	0.091	-0.005	0.031	n.a.	0.163*	0.170*	0.074
	5	0.074	0.096	0.137*	0.036	0.047	0.012	n.a.	0.069	0.093	0.147*
	6	0.017	0.013	-0.003	-0.012	-0.001	-0.037	n.a.	0.012	0.038	0.030
	7	-0.018	-0.033	0.045	0.063	0.027	-0.004	n.a.	-0.007	-0.038	-0.015
	8	0.057	-0.006	0.023	-0.004	-0.059	0.060	n.a.	0.005	-0.029	-0.076
	9	0.094	0.037	0.073	-0.002	-0.048	0.021	n.a.	0.077	0.029	-0.010
	10	0.015	0.079	0.020	0.009	0.025	-0.022	n.a.	0.037	-0.009	-0.044
	LBP (10)	21.717*	12.847	8.796	8.560	4.056	5.430	n.a.	14.643	20.641*	18.134
	p-value	0.983	0.768	0.448	0.426	0.055	0.139	n.a.	0.854	0.976	0.947
US	Autocorrelations										
	1	0.026	0.080	-0.024	0.065	0.027	0.124	0.081	n.a.	0.007	0.063
	2	0.100	0.097	-0.055	-0.002	0.080	0.025	-0.006	n.a.	0.075	0.016
	3	0.122	0.038	-0.050	-0.019	-0.058	-0.028	-0.007	n.a.	-0.056	-0.084
	4	-0.001	-0.074	0.044	0.014	-0.025	0.048	0.218**	n.a.	0.062	0.082
	5	0.163*	-0.051	0.032	0.011	0.062	-0.008	0.048	n.a.	0.174**	0.090
	6	0.090	-0.072	0.013	0.015	-0.047	0.011	0.015	n.a.	0.002	0.001
	7	0.009	-0.032	-0.014	0.021	0.016	-0.062	0.004	n.a.	0.047	0.076
	8	0.033	0.070	0.007	0.022	-0.058	0.053	0.005	n.a.	-0.029	-0.026
	9	0.028	0.002	0.119	0.133*	0.027	0.128	0.072	n.a.	0.096	0.100
	10	-0.054	-0.032	0.061	0.120	0.038	0.066	0.032	n.a.	0.117	0.157*
	LBP (10)	15.731	9.036	6.709	9.388	5.585	11.411	15.297	n.a.	16.782	16.450
	p-value	(0.892)	(0.471)	(0.247)	(0.504)	(0.151)	(0.674)	(0.878)	n.a.	(0.921)	(0.913)

Table 9
Autocorrelations
Squared Long – Short Strategies

Each month from January, 1980 through June, 2000 each currency is ranked from one to seven based upon the difference between the short-run and long-run moving average of prior returns using 354 different short-run - long-run moving average combinations ranging from [1-2] to [12-36]. Each of the strategies are given equal weight each month, generating monthly returns. The base currency is denoted on the far left. The Ljung and Box Q-statistic is denoted as LBP(10) and tests whether the 10 autocorrelations are jointly significant. The p-value for the Q-statistic is given in the last row for each base currency. ** and * indicate significance at the 1 and 5 percent levels.

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7
Australia	Autocorrelations									
	1	0.108	0.149*	0.190**	0.231**	0.227**	0.248**	0.231**	0.034	-0.005
	2	0.026	0.030	-0.008	-0.049	-0.022	-0.045	-0.024	-0.009	0.042
	3	0.033	0.025	0.033	-0.009	-0.056	-0.022	-0.064	-0.069	-0.040
	4	0.097	0.091	0.018	-0.029	-0.022	-0.023	-0.049	0.075	-0.004
	5	0.043	0.075	0.076	0.039	0.015	-0.004	-0.012	-0.022	0.005
	6	-0.023	-0.008	-0.025	-0.023	0.047	0.037	0.054	-0.014	0.049
	7	-0.010	-0.013	-0.020	-0.021	0.077	-0.001	0.018	0.008	-0.033
	8	0.051	0.035	0.051	0.044	0.043	0.004	0.000	0.098	0.022
	9	-0.002	-0.016	-0.013	-0.004	0.060	0.018	0.034	-0.057	-0.032
	10	-0.011	0.009	0.000	-0.054	0.006	-0.043	-0.051	-0.052	-0.033
	LBP (10)	6.744	9.470	11.318	15.360	16.741	16.320	16.292	6.864	2.322
	p-value	(0.251)	(0.512)	(0.667)	(0.881)	(0.92)	(0.909)	(0.908)	(0.262)	(0.007)
Canada	Autocorrelations									
	1	0.107	0.083	0.044	-0.023	-0.010	-0.095	-0.049	0.017	-0.028
	2	0.085	0.129*	0.107	0.000	-0.039	-0.088	-0.042	0.007	0.046
	3	-0.037	-0.013	-0.037	0.025	-0.009	-0.022	-0.044	-0.043	-0.021
	4	0.110	0.078	0.086	0.158*	0.014	0.069	-0.058	-0.033	-0.040
	5	0.004	0.148*	0.181**	0.024	-0.047	0.001	-0.052	-0.039	-0.014
	6	0.014	0.019	-0.039	0.046	0.157*	0.110	-0.006	-0.042	-0.014
	7	-0.017	-0.018	0.025	-0.033	-0.083	-0.125	-0.089	0.053	-0.023
	8	0.064	0.073	0.024	-0.051	0.048	0.007	-0.089	0.054	0.017
	9	0.062	0.061	0.130	0.033	0.099	0.082	0.014	0.046	-0.028
	10	0.094	0.073	0.106	-0.046	-0.059	0.001	-0.063	-0.066	-0.047
	LBP (10)	12.029	16.238	20.944*	8.678	12.613	13.751	7.900	4.560	2.215
	p-value	(0.717)	(0.907)	(0.979)	(0.437)	(0.754)	(0.815)	(0.361)	(0.081)	(0.006)
France	Autocorrelations									
	1	0.173**	0.027	0.038	0.042	0.149*	0.106	0.049	0.036	-0.027
	2	-0.055	-0.062	-0.124	-0.059	0.028	0.180**	0.181**	0.006	0.058
	3	-0.014	0.047	0.030	0.057	0.049	0.086	-0.009	-0.058	-0.012
	4	-0.010	0.079	0.016	-0.053	0.085	0.038	0.116	0.027	-0.035
	5	-0.019	-0.011	0.058	-0.034	-0.006	0.010	0.031	-0.048	-0.005
	6	-0.009	0.006	-0.003	-0.012	-0.009	0.021	0.053	-0.041	-0.003
	7	0.131	0.021	-0.001	-0.067	-0.016	0.024	-0.027	0.057	-0.027
	8	0.136	0.039	-0.025	0.041	0.052	0.062	0.024	0.040	0.008
	9	0.173*	0.183**	0.093	0.117	0.021	-0.038	-0.068	0.053	-0.029
	10	-0.099	-0.105	0.074	0.049	-0.024	0.121	0.012	-0.081	-0.071
	LBP (10)	26.637**	14.698	8.816	8.523	8.832	17.843	14.098	5.813	2.988
	p-value	(0.997)	(0.857)	(0.45)	(0.422)	(0.452)	(0.942)	(0.831)	(0.169)	(0.018)
Germany	Autocorrelations									
	1	0.220**	0.111	0.060	0.064	0.287**	0.174**	0.051	0.040	-0.017
	2	-0.015	0.007	-0.074	-0.070	0.060	0.178**	0.175**	-0.002	0.040
	3	-0.024	0.089	0.067	0.051	0.059	0.062	0.063	-0.048	-0.008
	4	-0.005	0.084	-0.026	-0.021	0.116	0.039	0.132	0.021	-0.040
	5	-0.069	-0.023	-0.013	-0.020	-0.021	-0.013	0.014	-0.053	-0.014
	6	0.011	0.111	0.024	-0.034	-0.019	0.007	0.021	-0.040	-0.013
	7	0.261**	0.143*	0.061	-0.013	-0.053	-0.056	-0.010	0.054	-0.021
	8	0.165*	0.076	0.004	-0.029	0.034	0.069	0.018	0.058	0.017
	9	0.193*	0.150*	0.078	0.011	0.041	-0.036	-0.070	0.055	-0.021
	10	-0.074	-0.011	0.144*	0.145*	0.033	0.038	0.005	-0.076	-0.073
	LBP (10)	46.964**	21.736*	11.192	8.812	26.477**	18.774*	14.620	5.833	2.555
	p-value	(1.000)	(0.983)	(0.657)	(0.450)	(0.997)	(0.957)	(0.853)	(0.171)	(0.010)

Table 9 - *continued*
Autocorrelations
Squared Long – Short Strategies

		Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 1 – Rank 7	Rank (1, 2, 3) – Rank 7
Japan	Autocorrelations									
	1	0.046	-0.021	0.000	0.015	0.065	0.049	0.074	0.034	-0.001
	2	0.037	0.076	0.079	0.082	0.049	0.079	0.046	0.060	0.097
	3	-0.037	-0.008	-0.041	-0.039	-0.039	-0.057	-0.023	-0.002	0.023
	4	-0.058	-0.015	-0.030	-0.063	-0.027	-0.037	0.014	0.023	0.038
	5	-0.063	-0.037	-0.040	0.046	0.058	0.063	0.046	-0.035	-0.036
	6	0.027	0.005	-0.024	-0.040	0.009	-0.035	-0.045	0.011	0.035
	7	0.084	0.109	0.067	-0.029	0.007	-0.001	-0.043	0.079	0.010
	8	0.043	-0.013	-0.037	-0.027	-0.009	-0.039	0.015	0.073	0.032
	9	0.035	0.081	0.007	-0.007	0.021	0.042	0.006	0.061	-0.010
	10	0.011	0.017	0.044	-0.003	0.012	0.026	0.067	-0.066	-0.025
	LBP (10)	5.639	6.528	4.587	4.314	3.148	5.457	4.636	6.441	3.807
	p-value	(0.155)	(0.231)	(0.083)	(0.068)	(0.022)	(0.141)	(0.086)	(0.223)	(0.044)
Swiss	Autocorrelations									
	1	0.264**	0.143*	0.192**	0.107	0.174**	0.171**	0.057	0.057	-0.007
	2	0.031	0.108	-0.023	-0.044	-0.017	0.174*	0.112	-0.020	0.020
	3	-0.038	0.110	0.075	0.038	0.023	0.079	0.022	-0.043	-0.024
	4	-0.041	-0.016	-0.028	0.049	0.073	0.089	0.049	0.033	-0.036
	5	-0.070	-0.054	-0.032	-0.050	0.050	-0.005	-0.022	-0.047	-0.022
	6	0.021	0.113	0.021	-0.029	-0.041	0.005	-0.024	-0.049	-0.005
	7	0.198**	-0.006	0.013	-0.087	-0.046	-0.027	-0.018	0.082	-0.009
	8	0.176*	0.199**	0.083	0.075	0.109	-0.001	-0.029	0.061	0.026
	9	0.190*	0.275**	0.100	0.113	0.093	-0.049	-0.092	0.038	-0.064
	10	-0.030	-0.012	0.087	0.097	-0.010	0.060	-0.010	-0.070	-0.065
	LBP (10)	45.376**	43.014**	16.902	13.721	15.338	19.397*	7.152	6.866	2.931
	p-value	(1.000)	(1.000)	(0.923)	(0.814)	(0.880)	(0.965)	(0.289)	(0.262)	(0.017)
UK	Autocorrelations									
	1	0.008	0.010	0.058	0.147*	0.217**	0.152*	0.200**	0.005	-0.058
	2	-0.032	0.001	-0.033	-0.032	0.060	0.044	0.036	0.044	0.087
	3	-0.046	-0.035	-0.016	-0.063	0.002	-0.009	-0.049	-0.038	-0.014
	4	0.009	0.067	-0.002	0.012	0.066	0.094	-0.030	0.033	0.025
	5	0.022	0.092	0.171**	0.079	0.046	0.001	-0.013	-0.027	0.005
	6	0.020	0.021	0.054	0.062	-0.023	-0.004	-0.062	-0.054	-0.029
	7	0.013	-0.044	-0.027	0.024	-0.007	-0.001	-0.001	0.031	-0.044
	8	0.065	-0.063	-0.074	-0.088	0.023	0.010	-0.007	0.025	0.009
	9	0.017	-0.027	-0.051	-0.022	0.026	0.009	-0.037	0.051	-0.035
	10	-0.021	-0.028	-0.043	-0.010	0.020	0.008	-0.039	-0.035	-0.036
	LBP (10)	2.276	5.362	11.534	11.041	14.207	8.192	12.314	3.313	4.152
	p-value	(0.006)	(0.134)	(0.683)	(0.646)	(0.836)	(0.390)	(0.735)	(0.027)	(0.060)
US	Autocorrelations									
	1	0.011	0.067	0.080	0.114	0.019	0.013	-0.045	0.015	-0.027
	2	0.021	0.090	0.143*	0.066	-0.019	0.040	0.004	-0.013	0.024
	3	0.032	-0.037	0.032	0.008	-0.060	-0.035	-0.011	-0.025	-0.029
	4	0.032	0.134*	0.067	0.148*	0.013	0.037	-0.089	0.029	-0.003
	5	0.015	0.042	0.212**	0.019	-0.067	-0.052	-0.005	-0.048	-0.010
	6	0.000	0.028	-0.057	-0.032	0.163*	0.094	-0.025	-0.026	-0.012
	7	0.015	0.029	0.160*	0.074	0.002	-0.027	-0.036	0.042	-0.026
	8	0.038	0.079	0.040	-0.083	-0.008	-0.010	-0.034	0.056	0.027
	9	0.030	0.057	0.120	0.066	0.047	0.079	0.014	0.022	-0.045
	10	0.105	0.144*	0.113	-0.002	0.052	0.088	-0.032	-0.064	-0.038
	LBP (10)	4.050	16.015	32.91**	13.982	9.925	7.508	3.503	3.536	1.805
	p-value	0.055	0.901	1.000	0.826	0.553	0.323	0.033	0.034	0.002

Table 10
GARCH Estimation
Base Currency Returns

The dataset consists of monthly returns for individual currencies from January, 1980 through June, 2000. The period consists of 246 months. The base currency is denoted in the far left column. The following model is used for the GARCH estimation:

$$\tilde{r}_t = c + g\ s_{t-1} + \tilde{e}_t$$

where

$$\tilde{e}_t = \tilde{z}_t\ s_t$$

$$\tilde{z}_t = \mathrm{N}[0,1]$$

$$s_t^2 = v + a_1 e_{t-2}^2 + a_2 \mathrm{I}(e_{t-1}) + b\ s_{t-1}^2$$

$$\mathrm{I}(e_{t-1}) = e_{t-1} \text{ if } e_{t-1} > 0$$

$$= 0 \quad \text{if } e_{t-1} \le 0$$

Standard errors for the parameter estimates are computed using Quasi Maximum Likelihood. ** and * indicate significance at the 1 and 5 percent levels.

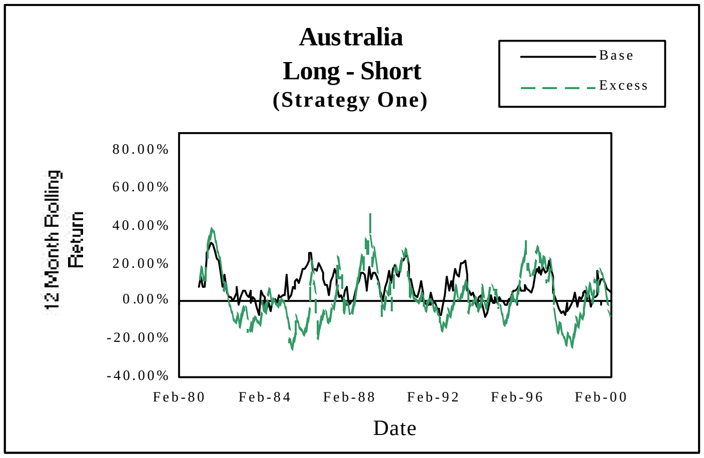
		Australia	Canada	France	Germany	Japan	Swiss	UK	US
Australia	c	n.a.	0.004	0.002	0.008	0.008	0.014	0.022	0.002
	g	n.a.	-0.082	-0.066	-0.155	-0.020	-0.275	-0.546	0.014
	v	n.a.	0.000	0.001	0.001	0.002	0.001	0.001	0.000
	a_1	n.a.	0.029	0.153	0.194	0.179	0.285	0.191	0.092
	a_2	n.a.	0.011	0.007	0.007	0.000	0.002	0.000	0.012
	b	n.a.	0.800	0.000	0.000	0.000	0.000	0.000	0.744
Canada	c	-0.001	n.a.	-0.002	0.000	0.001	-0.008	-0.007	-0.002
	g	0.018	n.a.	0.032	0.023	0.103	0.237	0.212	0.209
	v	0.000	n.a.	0.001	0.001	0.001	0.001	0.000	0.000
	a_1	0.149	n.a.	0.000	0.000	0.018	0.000	0.000	0.027
	a_2	0.000	n.a.	0.006	0.005	0.000	0.010	0.000	0.005
	b	0.788**	n.a.	0.198	0.300	0.311	0.061	0.700	0.200
France	c	-0.005	-0.004	n.a.	0.000	0.000	-0.001	-0.003	0.002
	g	0.173	0.175	n.a.	0.180	0.178	0.175	0.155	0.024
	v	0.001	0.001	n.a.	0.000	0.001	0.000	0.001	0.001
	a_1	0.148	0.000	n.a.	0.003	0.006	0.176	0.097	0.000
	a_2	0.000	0.000	n.a.	0.000	0.000	0.002	0.005	0.000
	b	0.000	0.296	n.a.	0.800	0.200	0.600*	0.000	0.260
Germany	c	-0.006	-0.005	-0.002	n.a.	0.000	-0.001	-0.003	0.001
	g	0.168	0.148	0.149	n.a.	0.152	0.148	0.134	0.027
	v	0.001	0.001	0.000	n.a.	0.001	0.000	0.000	0.001
	a_1	0.205	0.023	0.013	n.a.	0.059	0.036	0.210	0.056
	a_2	0.000	0.000	0.020	n.a.	0.000	0.002	0.000	0.000
	b	0.000	0.199	0.100	n.a.	0.292	0.055	0.304	0.193
Japan	c	-0.010	0.008	-0.012	-0.010	n.a.	-0.017	-0.013	-0.014
	g	0.123	-0.311	0.204	0.210	n.a.	0.420	0.248	0.317
	v	0.001*	0.001	0.000	0.001	n.a.	0.001	0.001	0.001
	a_1	0.157	0.019	0.000	0.034	n.a.	0.051	0.009	0.033
	a_2	0.001	0.000	0.013	0.013	n.a.	0.013	0.000	0.000
	b	0.000	0.272	0.395	0.262	n.a.	0.274	0.071	0.300
Swiss	c	-0.013	-0.004	-0.003	-0.003	0.001	n.a.	-0.002	0.008
	g	0.310	0.106	0.089	0.159	0.114	n.a.	0.065	-0.175
	v	0.001	0.001	0.000	0.000	0.001	n.a.	0.001	0.001*
	a_1	0.267*	0.121	0.175	0.074	0.096	n.a.	0.184	0.164
	a_2	0.000	0.000	0.000	0.000	0.000	n.a.	0.000	0.000
	b	0.000	0.007	0.017	0.093	0.227	n.a.	0.000	0.001
UK	c	-0.024	-0.012	-0.011	-0.010	-0.012	-0.004	n.a.	-0.013
	g	0.639	0.422	0.420	0.398	0.471	0.172	n.a.	0.485
	v	0.001	0.000	0.000	0.000	0.001	0.001	n.a.	0.000
	a_1	0.178*	0.063	0.063	0.137	0.026	0.115	n.a.	0.155
	a_2	0.000	0.001	0.002	0.003	0.000	0.009	n.a.	0.001
	b	0.000	0.800	0.600*	0.500	0.245	0.000	n.a.	0.593
US	c	-0.013	-0.007	-0.024	-0.015	-0.012	-0.011	-0.009	n.a.
	g	0.429	0.448	0.694	0.439	0.431	0.305	0.294	n.a.
	v	0.000	0.000	0.001	0.001	0.001	0.001*	0.000	n.a.
	a_1	0.164	0.189	0.000	0.059	0.000	0.147	0.128	n.a.
	a_2	0.000	0.000	0.002	0.001	0.006	0.005	0.000	n.a.
	b	0.707**	0.300	0.403	0.207	0.251	0.006	0.689**	n.a.

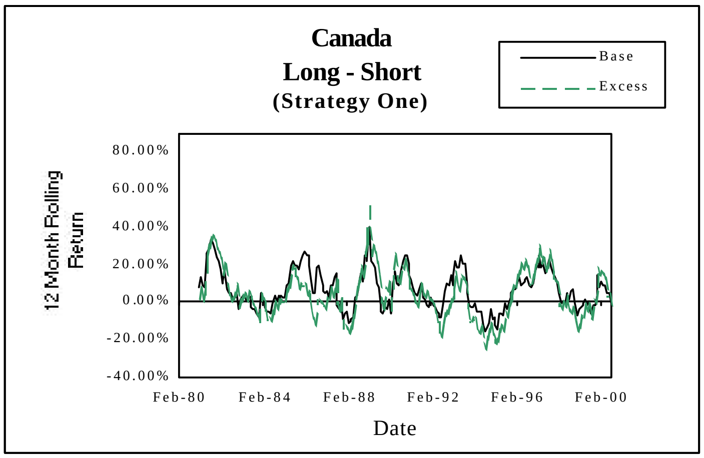
Table 11
Bootstrap Simulations
Long – Short Strategies

For each base currency, each simulation builds a dataset consisting of 246 months by randomly selecting interest-adjusted monthly returns with replacement for the other seven currencies. In the simulated dataset for each base currency, each currency is ranked from one to seven base upon the difference between the short-run and long-run moving average of prior returns using 354 different short-run - long-run moving average (MA) combinations ranging from [1-2] to [12-36]. Each of the MA combinations are given equal weight each month, generating a simulated series of monthly returns to the individual rankings. The simulations are repeated 1,000 times for each base currency. The (Sim Mean) gives the average of the simulated values for the relevant statistic and the (Sim Count <) gives the count of the number of simulations which are less than the actual value of the statistic from the original data. Each base currency is listed at the top of each of the columns.

		Rank 1 – Rank 7							
		Australia	Canada	France	Germany	Japan	Swiss	UK	US
Mean Ret	Sim Mean (%)	-0.003	-0.003	-0.004	-0.003	0.006	-0.008	-0.011	-0.002
	Sim Count <	1000	999	999	999	988	992	993	998
Median Ret	Sim Mean (%)	0.010	0.006	0.007	0.007	0.009	0.002	0.002	0.013
	Sim Count <	1000	995	999	999	997	999	999	997
Std Dev	Sim Mean (%)	2.802	3.020	3.005	2.988	2.914	2.845	3.075	3.027
	Sim Count <	777	859	866	872	939	946	938	885
Skewness	Sim Mean (%)	-0.031	-0.030	-0.026	-0.025	-0.004	-0.027	-0.029	-0.037
	Sim Count <	73	434	306	424	593	356	272	554
Kurtosis	Sim Mean (%)	1.622	2.041	1.814	1.789	1.482	2.190	1.801	1.999
	Sim Count <	510	916	876	907	941	747	915	955
Autocorrelations									
1	Sim Mean (%)	-0.001	-0.005	-0.004	-0.003	-0.003	-0.004	-0.005	-0.004
	Sim Count <	16	105	29	35	233	75	88	148
2	Sim Mean (%)	-0.003	-0.002	-0.001	-0.001	-0.002	0.000	-0.002	-0.001
	Sim Count <	581	435	456	422	480	354	314	452
3	Sim Mean (%)	-0.008	-0.004	-0.004	-0.003	-0.001	-0.004	-0.004	-0.004
	Sim Count <	312	490	419	471	553	458	279	380
4	Sim Mean (%)	-0.002	-0.001	-0.001	-0.001	0.000	-0.003	0.000	-0.002
	Sim Count <	19	91	9	11	2	13	5	5
5	Sim Mean (%)	-0.003	-0.002	-0.001	-0.001	0.000	0.000	-0.002	-0.002
	Sim Count <	954	959	959	943	949	872	969	950
6	Sim Mean (%)	-0.006	-0.006	-0.005	-0.005	-0.004	-0.006	-0.005	-0.006
	Sim Count <	64	361	453	452	580	739	320	511
7	Sim Mean (%)	-0.004	-0.003	-0.002	-0.003	-0.001	-0.001	-0.002	-0.003
	Sim Count <	963	515	400	425	219	406	330	373
8	Sim Mean (%)	-0.003	-0.003	-0.002	-0.003	-0.003	-0.005	-0.002	-0.003
	Sim Count <	141	920	906	913	983	898	806	882
9	Sim Mean (%)	-0.002	-0.003	-0.002	-0.002	-0.004	-0.002	-0.002	-0.002
	Sim Count <	151	37	35	40	130	18	115	59
10	Sim Mean (%)	-0.010	-0.007	-0.007	-0.007	-0.007	-0.004	-0.006	-0.007
	Sim Count <	682	396	494	459	519	297	578	569
Prob > 0 (%)	Sim Mean (%)	50.188	50.083	50.094	50.160	50.126	50.035	50.036	50.138
	Sim Count <	1000	998	999	1000	986	992	1000	999
Prob > MSCI (%)	Sim Mean (%)	49.282	49.607	47.292	48.671	49.299	48.508	48.983	50.436
	Sim Count <	983	998	985	990	850	918	994	932
Prob > Equal (%)	Sim Mean (%)	50.104	50.830	48.174	50.280	50.315	50.748	50.010	51.229
	Sim Count <	937	988	992	992	995	968	986	992
Proportion > 0 (%)	Sim Mean (%)	49.023	49.246	49.010	49.005	50.603	47.739	47.916	48.808
	Sim Count <	954	951	952	952	944	951	949	953
Proportion > MSCI (%)	Sim Mean (%)	9.091	21.032	9.611	22.863	83.519	30.558	13.670	30.305
	Sim Count <	984	990	988	984	510	942	971	961
Proportion > Equal (%)	Sim Mean (%)	16.143	37.276	18.369	40.689	91.272	50.328	26.857	52.632
	Sim Count <	967	957	993	947	379	900	962	889

Figure 1
Rolling 12 Month Long – Short Strategy Returns





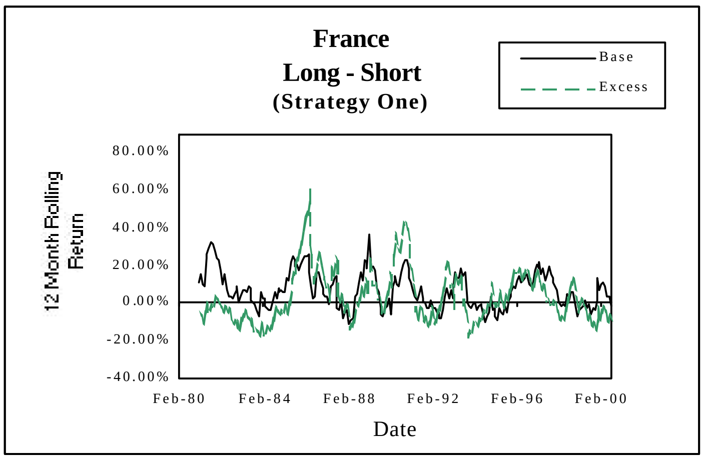
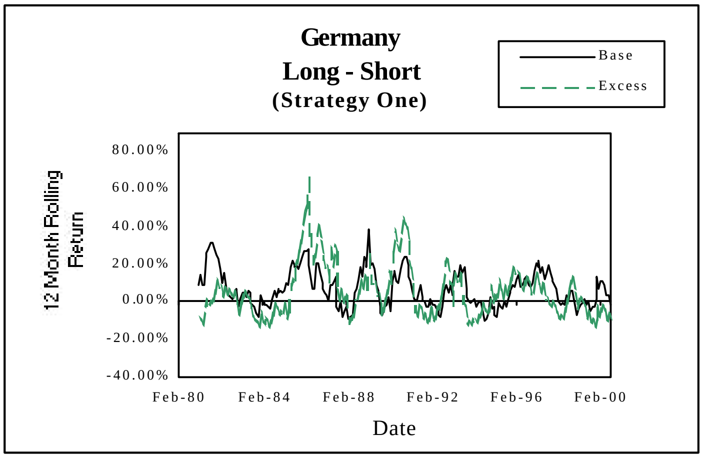
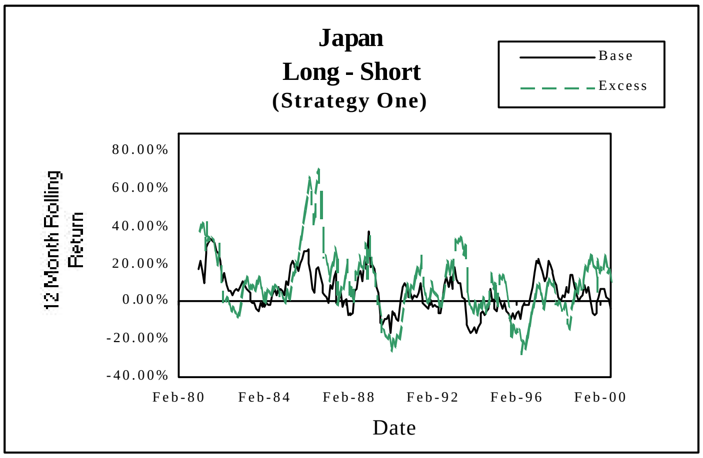


Figure 1 - *continued*
Rolling 12 Month Long – Short Strategy Returns





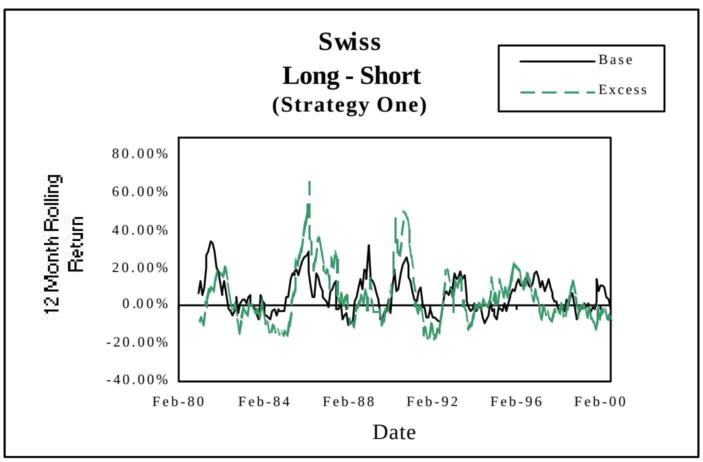


Figure 1 - *continued*
Rolling 12 Month Long – Short Strategy Returns