Overreaction and Trading Strategies in European iShares

David P. Simon*
Department of Finance
Bentley College
Waltham, MA 02452
dsimon@bentley.edu

Joel S. Sternberg
Graduate School of Management
Clark University
Worcester, MA 01610

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Abstract

This paper examines the forecasting power of German, UK and French iShares for the next day returns of the underlying Morgan Stanley country equity indexes and assesses whether European iShares overreact to developments after the close of European trading. The findings indicate that although deviations of European iShare prices from net asset values (NAVs) at the close of US trading have significant forecast power for next day NAV returns, they overpredict. Deviations of closing iShare prices from their NAVs also lead to next day iShare price reversals that average roughly 3/8 of the size of the deviations. Finally, the paper demonstrates the profitability of trading rules that exploit the tendency of European iShares to overreact to late day US trading activity.

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*Corresponding author: David P. Simon, Department of Finance, Bentley College, 175 Forest St., Waltham, MA 02452-4705. We thank the Hughey Center for Financial Services at Bentley College for the data and Kristopher Heck of Barclays Global Services for helpful comments.

Overreaction and Trading Strategies in European iShares

Considerable research in recent years has focused on whether the positive comovement of international stock market returns reflects economic fundamentals or contagion.[1] Connolly and Wang (2003) find that macroeconomic announcements in the US, the UK and Japan do not explain the bulk of the intraday and overnight return comovements among these countries. Similarly, Karolyi and Stulz (1996) model the time varying correlation among Japanese ADRs and US stocks and find that these correlations do not increase on days when significant economic news is released, but rather increase on days when stock price changes are large.

A related issue is whether domestic markets overreact to foreign market developments. Along these lines, Craig, Dravid and Richardson (1995) examine the explanatory power of the Chicago Mercantile Exchange's Nikkei futures contract, which trades during the US trading day, for contemporaneous overnight Nikkei index returns. These authors find evidence consistent with market efficiency rather than contagion because the S&P 500 index does not have incremental predictive power beyond that of the Nikkei futures contract.[2]

The present paper examines whether German, UK and French iShares overreact to US market developments after European markets close and explores the trading implications of such overreactions.[3] The introduction of Exchange Traded Funds (ETFs) for international stocks in May 1996 has enhanced the ability to observe how US market developments are expected to affect other world markets that are closed and, more

[1] Recent studies documenting the positive and time varying correlation of international equity returns include Forbes and Rogobin (2002), Longin and Solnik (2001) and Bekaert, Harvey and Ng (2003). Contagion generally refers to financial markets trading based on developments in other markets rather than on the basis of their own fundamentals, particularly when fundamentals diverge.

[2] Loderer and Mittermayer (2004) find that in the Swiss market trading activity declines in anticipation of the US market open, and then Swiss stock prices tend to overreact to the US open before correcting.

specifically, to assess whether US trading of foreign equity indexes "gets it right". These international equity ETFs, trademarked as "iShares" by Barclays Global Investors, are traded on the American Stock Exchange and are based on Morgan Stanley Capital International (MSCI) Indexes.[4] Although iShares allow convertibility between the underlying basket of stocks and iShares, Engle and Sarkar (2002) demonstrate that European iShare prices at the close of US trading frequently deviate from their net asset values (NAVs).[5] These deviations occur because the trading hours of European iShares extend about four hours beyond European trading hours. This causes reported NAVs, which are based on the dollar value of MSCI indexes at the close of European trading, to be stale.[6]

This paper addresses two major issues. The first is whether deviations of iShare prices from their NAVs predict the next day returns of the underlying NAVs. If European iShare prices efficiently incorporate relevant new fundamental or technical information after European trading hours, deviations of European iShare prices from their closing NAVs should be unbiased predictors of the next day returns of the relevant European markets.[7]

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[3] See Mussavian and Hirsch (2002) for an overview of European Exchange Traded Funds.

[4] The American Stock Exchange currently offers country specific funds in Austria, Belgium, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland, UK, Australia, Hong Kong, Japan (two funds), Malaysia, Singapore, South Korea, Taiwan, South Africa, Brazil, Canada and Mexico. All but one of these iShares is based on the Morgan Stanley Capital International ("MSCI") index for the country, the exception being a second Japan iShare based on the TOPIX 150.

[5] Institutions who are "Affiliated Partners" can swap with Barclays Global Investors a minimum size basket of index shares for new iShares, or redeem iShares for a basket of index shares. The minimum size of the in-kind transfer is currently about $7 million. For more details on the exchange process see the iShare.com web site.

[6] Another possibility is that because the underlying NAVs are not announced until well after the close of US trading, market participants do not know the true value of the underlying portfolio. However, this paper shows that NAVs can be predicted fairly accurately based on changes of the benchmark stock indexes of the various countries.

[7] Ideally, we would examine whether premiums and discounts forecast NAV changes to the open the next day but can not because opening NAVs are not reported.

Alternatively, iShare prices may overreact to late day news or trading activity in US markets.[8] For example, if late day US equity rallies are associated with European iShare rallies that are systematically greater than the next day NAV rises, these overreactions should lead to predictable European iShare price declines the next day. The second major issue addressed in this paper is whether iShares systematically overreact to late day US market developments and whether such overreactions can be exploited by trading rules.

The results of this paper indicate that European iShare price deviations from estimated NAVs have significant predictive power for next day NAV returns. However, the findings also indicate that iShares substantially overreact to after-hours developments--iShare prices overpredict next day NAV returns, and iShare prices on average rise or fall the next day by roughly 3/8 of the previous day closing discount or premium, respectively. Finally, trading rule simulations suggest the profitability of shorting or buying iShares at the close of US trading, either outright or against offsetting positions in US equities, when iShares close at sufficiently large premiums or discounts to their NAVs, respectively.

The paper proceeds as follows: The first section provides background information on European iShares, discusses the methodology for estimating iShare premiums and discounts to their not yet reported NAVs at the close of US trading and presents preliminary information concerning the data. The second section describes the methodology used for examining the predictive power of iShare premiums and discounts for next day changes in the underlying basket of stocks and presents the results. The third section discusses the methodology used to determine whether European iShares overreact

[8] We assume that traders are able to estimate accurately European NAVs from underlying market movements and currency fluctuations through roughly noon EST, at which time European markets close. As a result, premiums and discounts should be negligible at the close of European trading.

to after-hours trading activity and provides estimation results. The fourth section shows the results of trading rule simulations based on the tendency of European iShares to overreact to after-hours trading activity and the fifth section summarizes and discusses the implications of the paper's results.

I. Background on European iShares and the Data

This section supplies background information on European iShares, discusses data construction issues and provides a preliminary data analysis. To date, little research has been conducted on international ETFs. Engle and Sarkar (2002) examine the deviations of international iShare prices from their net asset values and find substantial and longer lasting deviations for international iShares compared to domestic iShares, which they attribute to stale net asset values. Jares and Lavin (2004) find that the daily returns of Japan and Hong Kong iShares are highly correlated with daily S&P 500 returns and that iShare price changes have significant predictive power for next day movements in home market stock prices. These authors also demonstrate that Japan and Hong Kong iShares overpredict next day NAV returns and that profitable trading strategies could have been devised to exploit the overreaction of iShares for traders who do not face large transactions costs.

A major difference between Asian and European iShares is that US trading hours partly overlap with European trading hours. The Frankfurt Stock Exchange is open until 11:45 New York time, while the London Stock Exchange and the Paris Bourse are open until 11:30 New York time. Thus, the closing NAV for European iShares reflects information from the US market through mid-day. In addition, while market participants know the closing NAVs of Asian iShares at the end of US trading, market participants do not have official information about the NAVs of European iShares.[9]

To determine whether European iShares at the close of US trading both predict next day returns in their respective markets and overreact to late day US trading activity, we first need to determine whether European iShares at the close of US trading are trading at discounts or premiums to their NAVs. This task is complicated by the fact mentioned above that current day closing NAVs of European iShares are not reported by the close of US trading, and MSCI often does not report the closing index values by the close of US trading. Barclays reports the NAVs of European iShares for the close of European trading at 10 pm EST, while Morgan Stanley reports the underlying European country stock indexes during a window between 3:30 and 4:30 EST. Because precise information about European iShare discounts or premiums is not available, market participants trading European iShares in the late afternoon based on premiums or discounts must forecast European iShare NAVs on the basis of trading in the foreign equity and foreign exchange markets.

In this paper, we forecast European iShare NAVs at the close of US trading by adjusting the NAVs reported the previous evening for the close of the previous European trading day both by the current day's percentage change in the broad stock index of the particular country and by the percentage change in the value of the relevant foreign currency against the dollar. The formula for calculating estimated NAVs is

$$E(NAV_t) = NAV_{t-1} * (1 + INDEXRET_t) * (1 + FXRET_t) \quad , \qquad (1)$$

[9] Net asset values for Asian iShares are reported by Barclays Global Investors at around 1 PM New York time. Therefore, investors are able to trade during the US market day based on updated NAVs.

where INDEXRET for Germany, the UK and France is the daily close-to-close percentage return of the DAX, the FTSE and the CAC, respectively. FXRET is the daily percentage return against the dollar of the DM, Pound and French Franc up to January 1999 and the Euro for Germany and France beginning January 1999. Because iShare prices are expressed in dollars, a strengthening of the foreign currency and a weakening of the dollar increases the NAV of foreign iShares. The foreign exchange rate data are from the Federal Reserve and are dealer quotes reported around noon EST, which is close to the 4 pm London quotes used by Barclays to calculate NAVs.

Our assumption that unobserved closing NAVs move in line with the corresponding benchmark stock indexes and foreign exchange rates is tested by regressing the log difference of the actual NAV from day t-1 to day t on a constant and on the log difference of the estimated NAV at day t from the actual NAV at day t-1. The results in Table 1 indicate that over the sample period from July 1998 through May 2004 the estimated percentage change in NAVs for German, UK and French iShares enters with statistically significant coefficients of around .94, and the regressions explain roughly 95 percent of the percentage NAV changes. As a result, we proceed under the assumption that the estimated NAVs are reasonable guides for the not-yet-reported NAVs.[10]

Table 2 shows the means, standard deviations and top and bottom deciles and the first four daily autocorrelations for the variables used in the paper.[11] These variables include the German, UK and French iShare deviations from their estimated NAVs--

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[10] There is evidence of significant positive autocorrelation, which indicates that these forecasts could be improved. Also, the slope coefficients are significantly less than one and the intercept coefficient estimates are significantly greater than zero, revealing bias in the forecasts. However, we proceed with these estimates because they are reasonable "rules of thumb". If we adjusted for the bias, we would have to assume that agents knew of this bias during the whole sample period, which given the short sample, does not seem likely. More importantly, neither adjusting the estimated NAVs for the bias nor using the not yet reported NAVs qualitatively changes the results reported in this paper.

[11] All returns as well as premiums and discounts are adjusted for the impact of dividend distributions.

DEV_{GER}, DEV_{UK} and DEV_{FR}, the daily close to close iShare returns--RET_{GER}, RET_{UK}, RET_{FR}--and the relative daily close to close returns of European iShares versus S&P 500 depository Trust or Spiders (ticker symbol SPY)--$RET_{GER/SPY}$, $RET_{UK/SPY}$ and $RET_{FR/SPY}$ and the daily returns of Spiders, and the DAX, FTSE and CAC indexes--RET_{SPY}, RET_{DAX}, RET_{FTSE} and RET_{CAC}.

The iShare data is obtained from Tick Data, while the NAV data comes from Barclays' iShare.com website. The sample period runs from July 1998, when the iShare data is first available from Tick Data, through May 2004.[12] The other data comes from Yahoo.com. Because the trading volume of European iShares is sometimes light and because the analysis in this paper depends on the discount or premium at which iShares are trading at the close of US markets, we omit from the sample those days on which the closing transaction does not occur during the last hour of trading.[13]

The table shows that deviations of iShare prices from their NAVs are often substantial. The standard deviation of daily iShare premiums and discounts are between 79 and 92 basis points. The top and bottom decile cutoffs of German iShare deviations are 120 and -92 basis points, while the top and bottom decile cutoffs for UK iShares are 168 and -47 basis points. The top and bottom decile cutoffs for French iShares are 96 and -78 basis points.[14] Daily iShare returns have standard deviations ranging between 153 basis points at the low end for UK iShares and 187 basis points at the high end for German iShares. These return volatilities are 20 to 40 basis points higher than those of Spiders but are roughly in line with those of the corresponding benchmark stock indexes.

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[12] This data consists of one-minute open, high, low and close as well as volume data. European iShares began trading in May 1996.

[13] The average daily trading volume for the observations used in this paper for German, UK and French iShares is 83,862, 127,864 and 32,074, respectively. Omitting days when either close to close iShare returns or iShare deviations from NAVs would be calculated using closing iShare transactions that did not occur during the last hour of trading allows us to use 1,145, 959 and 717 observations for Germany, the UK and France, respectively, out of a total of 1442 observations.

The latter is somewhat surprising given that iShare returns are denominated in dollars and thus also include an exchange rate component which should increase their volatility.[15] Finally, the daily return differentials between iShares and Spiders are substantially less volatile than those of iShares alone. This owes to the lower volatility of Spider returns compared to iShare returns and to the relatively high positive correlation between European iShare and Spider returns. We examine the returns of iShare positions hedged by offsetting Spider positions later in the paper.

II. The Forecast Power of iShare Premiums and Discounts for NAV Returns

In this section we examine whether estimated iShare premiums and discounts have predictive power for next day NAV returns. If European iShares efficiently incorporate after-hours information, deviations at the US close of iShare prices from their NAVs should be unbiased predictors of next day NAV returns. For example, selloffs in US stocks that cause European iShares to trade at discounts relative to their estimated NAVs should correctly forecast lower European stock prices the next day. We examine whether premiums and discounts of iShares from estimated NAVs forecast subsequent changes in the corresponding European equity markets by regressing next day close to close NAV returns on the percentage deviation of iShare prices from estimated NAVs, as shown below.

$$\ln(NAV_{t+1}/NAV_t) = \alpha + \beta \ln(iShare_t/E(NAV_t)) + \varepsilon_t . \qquad (2)$$

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[14] These decile cutoffs for constructed discounts and premiums of iShare prices are close to the actual discounts and premiums reported after the close of trading.

[15] On the other hand, the MSCI indexes are much broader indexes than the DAX, FTSE and CAC.

Note that positive (negative) independent variables indicate that iShares closed at premiums (discounts) relative to estimated NAVs. A positive β coefficient estimate in equation 2 indicates that premiums (discounts) lead to next day NAV rallies (selloffs). An intercept coefficient estimate not significantly different from zero and a slope coefficient estimate not significantly different from one indicate that discounts and premiums are unbiased forecasts.[16]

The results in table 3 indicate that estimated discounts and premiums have statistically significant predictive power for next day NAV returns. The slope coefficients range between .32 and .43 and are statistically significantly positive but less than one. The intercept terms are significantly different from zero only for UK iShares. Together, these coefficient estimates indicate that one percent closing premiums (discounts) of iShare prices relative to estimated NAVs are associated with next day German and French NAV rallies (declines) of only about 40 basis points, while one percent UK iShare premiums and discounts are associated with next day NAV rallies of only 11 basis points and NAV declines of only 53 basis points, respectively. In addition, unreported results indicate that the slope coefficient estimates are not significantly different for discounts than premiums and including the next day Spider return as an additional independent variable does not change the extent of iShare overreaction.[17]

III. Tests of European iShare Reversals

Given that iShare premiums and discounts substantially overpredict subsequent NAV returns, the question arises as to whether discounts and premiums lead to

[16] We also estimated these models with next day DAX, FTSE and CAC returns rather than NAV returns and got similar results.

statistically and economically significant iShare price reversals the next day. For example, suppose that an afternoon rally in US equities leads to European iShares closing at premiums relative to their estimated NAVs. The evidence presented in the previous section that next day NAV rallies tend to be substantially less than the size of the premium suggests that the next day either iShare prices fall or the premium remains or some combination of the two.[18] Therefore, premiums (discounts) from estimated NAVs may result in iShares trading systematically lower (higher) the next day.

We test whether iShares systematically overreact to developments after the close of European trading by testing for iShare reversals.[19] We regress one day ahead daily log returns of European iShares on the log percentage deviation of iShare closing prices from their estimated NAVs on the previous day, as shown below.

$$\ln(\text{iShare}_{t+1}/\text{iShare}_t) = \alpha + \beta \ln(\text{iShare}_t/E(\text{NAV}_t)) + \varepsilon_t \quad (3)$$

A significantly negative β coefficient would be consistent with the presence of iShare reversals.

The results shown in table 4 indicate that discounts and premiums at the close have significant predictive power for all three next day iShare returns and the intercept coefficient is statistically significant only for UK iShares. The coefficient estimates imply that one percent German and French iShare premiums (discounts) are associated with next day iShare declines (rallies) of roughly 29 basis points, while one percent UK iShare premiums and discounts are associated with next day declines of 19 basis points and

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[17] The results from adding next day Spider returns as an independent variable are merely suggestive as Spiders continue to trade roughly four hours later than European equities.
[18] Table 2 shows that premiums and discounts are somewhat persistence as the autocorrelations for the first four lags are large and positive.

rallies of 57 basis points, respectively. Given that premiums and discounts frequently are substantial (as shown in table 2), these reversals often are large. Unreported results also demonstrate that the results do not owe to outliers--the slope coefficient estimates remain statistically significant when observations with estimated premiums or discounts greater than 2 percent are eliminated from the sample,

It is important to note that next day iShare returns are affected by the next day performance of US equities.[20] Suppose that a late day US equity market rally causes European iShares to close at premiums relative to estimated NAVs. Although our results indicate that iShares tend to sell off the next day, the probability and magnitude of such a selloff will be greater if US equities also decline the next day. To make potential iShare positions more of a pure bet on iShare overreaction, traders could enter iShare positions along with offsetting US stock positions. For example, traders could short European iShares against offsetting long US stock positions if iShares are trading at premiums, and traders could go long European iShares against offsetting short US stock positions if iShares are trading at discounts. The profitability of these "hedged" positions would be less dependent on what happens to US equity prices the next day than outright iShare positions. Also, to the extent that the variability of hedged positions is less than that of outright iShare positions, traders could prudently have larger hedged positions than outright positions and benefit from higher Sharpe ratios. The lower volatility of "hedged" positions compared to outright iShare positions is borne out by the preliminary data presented in table 2 and owes to the fact that European iShares and offsetting Spider positions are sufficiently negatively correlated, so that the additional variance from

[19] We use the term reversal to denote premiums that are followed by iShare declines and discounts that are followed by iShare rallies, rather than to denote premiums or discounts that become smaller.

[20] When we add the next day S&P 500 return as an independent variable in equation 3, it enters with a highly statistically significant coefficient of around .8 and its inclusion does not change the coefficient on the estimated discount or premium.

Spiders is more than offset by the negative covariance between the two offsetting (long and short) positions.

We assume that offsetting positions are dollar equivalent Spider positions. Spiders are among the most actively traded ETFs and are traded on the American Stock Exchange under the ticker symbol SPY. Whether the next day returns of hedged iShare positions are significantly predictable is tested by regressing the difference of the next day return of European iShares versus Spiders on the deviation at the close between iShares and their estimated NAVs, as shown below.

$$\ln(iShare_{t+1}/iShare_t) - \ln(SPY_{t+1}/SPY_t) = \alpha + \beta \ln(iShare_t/E(NAV_t)) + \varepsilon_t. \quad (4)$$

If the β coefficient in equation 4 is significantly negative, premiums (discounts) lead to underperformance (outperformance) of European iShares relative to Spiders.[21] Such results would be consistent with short (long) iShare positions, hedged by equal-value Spider positions being statistically significantly profitable when European iShares close at premiums (discounts).[22]

The results for the hedged positions are shown in table 5 and indicate that iShare discounts and premiums lead to statistically significant next day European iShare outperformances or underperformances relative to Spiders. The coefficient estimates are not much different for hedged and outright positions. One percent premiums (discounts) lead to 30 and 23 basis point German and French iShare next day underperformances (outperformances) relative to Spiders, while one percent UK iShare premiums and discounts are associated with next day UK iShare underperformances and

[21] Strictly speaking, this would be the case if the intercept term is not statistically different from zero.

outperformances of 15 and 47 basis points, respectively. The finding that the impacts of discounts and premiums for outright and for hedged iShare returns are similar is consistent with unreported evidence that next day Spider returns are not systematically affected by previous day iShare discounts or premiums. Thus, equal dollar value offsetting Spider positions add approximately mean zero returns to next day iShare returns. Although the coefficient estimates are not much different for outright and hedged iShare positions, the standard errors on the coefficient estimates are smaller, suggesting that the performance of hedged iShare positions has tighter confidence intervals than that of outright iShare positions. These results suggest that traders attempting to exploit the systematic overreaction of iShares to late day US developments likely are better off with hedged iShare positions than with outright iShare positions.

Overall, these results indicate that the overreaction of iShares to after-hours information is reflected both in a smaller than predicted next day positive or negative NAV return and in a statistically significant tendency for iShare premiums or discounts to lead to next day iShare selloffs or rallies, respectively. Because the underlying NAVs typically do not rally (decline) as much as indicated by the premiums (discounts), the evidence suggests that iShare prices adjust by declining (rallying) both by themselves and relative to Spiders following premiums (discounts). In the next section we more closely examine the economic significance of these findings by assessing whether systematic trading rules based on iShare overreaction are profitable for both outright and hedged iShare positions.

IV. Trading iShare Reversals

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[22] The assumption is that the hedge ratio of European ETFs relative to Spiders is 1-1. Statistical estimates of optimal hedge ratios are not much different and the results are little changed when optimal hedge ratios are used.

The previous section demonstrates that iShare premiums and discounts lead to statistically significant next day iShare price reversals. This section examines the economic significance of these reversals in the context of trading strategies. The trading strategies stipulate first that when estimated discounts at the close are greater than 50 basis points, either outright long iShare positions or long iShare positions hedged by equal dollar value short Spider positions are entered at the close. Similarly, when estimated iShare premiums at the close are greater than 50 basis points, the trading rules assume that either outright short iShare positions or short iShare positions hedged by equal dollar value long Spider positions are entered at the close. These positions are exited at the close on the following day.

The second round of trading strategies adds to the above rule the condition that long (outright or hedged) iShare positions that attempt to exploit discounts are entered only on days when Spider returns are positive, and short (outright or hedged) iShare positions that attempt to exploit premiums are entered only on days when Spider returns are negative. This extra condition avoids buying or selling European iShares at the close of days when US markets have weakened or strengthened, respectively. This strategy is consistent with avoiding selling on strength and buying on weakness. As in the previous section, only days on which iShares trade in the last hour of trading on both entry and exit days are included in the simulations. The simulations are performed assuming that transactions take place at the closing price, without explicit provisions for transaction costs, which are discussed later. Thus, the simulations likely represent upper bounds of potential profits.

Table 6 shows the results for trading rules that buy or sell iShares either outright or on a hedged basis when discounts or premiums at the US close are greater than 50 basis points, respectively. The table shows the mean return, which is more precisely the percentage change of the value of the underlying position, the standard error of returns and the maximum and minimum return.[23] These strategies are significantly profitable for all three European iShares. For outright trades, German iShare profits average 28 and 24 basis points for discounts and premiums, respectively, while UK iShare profits average 53 and 29 basis points and French iShare profits average 41 and 26 basis points. When hedged positions are entered, average profits remain statistically significant and are about the same as outright positions, although the standard errors tend to be quite a bit lower. For example, the standard errors for hedged German iShare trades are about 25 percent lower than for outright trades. These results suggest that hedged trades provide better risk-return tradeoffs than outright trades.

To shed light on the market conditions that lead to substantial discounts or premiums, the table also shows for days that trades are entered iShare returns, the corresponding benchmark index returns as well as Spider returns, in addition to the closing estimated discounts or premiums. The table shows that large discounts and premiums occur when iShare returns are more in line with Spider returns than with those of the corresponding benchmark indexes. These episodes likely reflect large moves after European markets have closed. For example, on days that German iShares close at discounts of at least 50 basis points, the DAX rises an average of 47 basis points, whereas German iShares and Spiders both are down an average of 56 basis points. Similarly, on days that German iShares close at premiums greater than 50 basis points, the DAX declines an average of 30 basis points, while German iShares and Spiders rise an average of 40 basis points. The patterns are similar for UK and French iShares. Overall, these

[23] Positive profits are indicated when mean returns are positive for long outright or long iShare/short Spider positions, while positive profits are indicated when mean returns are negative for short outright or short iShare/long Spider positions.

results suggest that after European trading ends, late day changes in US equity prices are associated with corresponding European iShare moves, which are partly reversed the next day. Unreported simulations indicate that these results do not owe to outliers--when discounts or premiums greater than 2 percent are omitted from the simulations, returns on both outright and hedged strategies remain statistically significant and are little changed.[24]

The trading rule simulations are refined by adding to the 50 basis point discount or premium trigger the conditions that long outright or hedged iShare trades are entered only when Spider returns are positive on the day and short outright or hedged iShare trades are entered only when Spider returns are negative on the entry day. Such trades are consistent with not trading against the very short term trend in US markets.

The results shown in table 7 indicate that this additional condition also leads to highly statistically significant profits that are about double the profits associated with the previous trading rules. For example, outright and hedged German iShare average returns are statistically significant 55 and 52 basis points for discounts, and 48 and 49 basis points for premiums, respectively. The increased profitability is comparable for UK and French iShares. Thus, buying (shorting) iShares at discounts (premiums) to estimated NAVs is substantially more profitable on average when Spiders have closed up (down) on the day trades are entered.

V. Conclusions

This paper demonstrates that European iShares frequently close at substantial premiums or discounts to their net asset values, which owes to the fact that European

[24] The simulation results also are very similar if the actual (not yet reported) discounts or premiums are

equity markets, from which NAV's are calculated by Barclays Global Investors, close around the mid-day of US trading. This paper focuses on the predictive power of iShare premiums and discounts for subsequent NAV changes and examines the implications of the findings for trading strategies. The results indicate that European iShare premiums and discounts have predictive power for subsequent NAV changes, but are biased forecasts. The next day NAV return tends to be only 1/3 of the premium or discount. This result implies that European iShares overreact to late day US market developments. Overreaction is also borne out by the finding that iShares tend to fall or rise by roughly 3/8 of the previous day's premium or discount, respectively. Trading rules that involve buying or shorting iShares either outright or hedged with offsetting Spider positions when discounts or premiums are greater than 50 basis points are statistically significant and range from about 1/4 to 1/2 percent per day. These profits about double and remain highly statistically significant when the constraint is added that long or short iShare trades are entered only when Spiders have closed up or down on the day, respectively. The simulations also demonstrate that iShare positions hedged by offsetting Spider positions are roughly as profitable as outright iShare positions, but typically have substantially lower volatility. These results suggest that hedged iShare positions lead to more favorable risk-return tradeoffs that outright iShare positions.

The question remains as to whether the potential profits from these trading strategies can be achieved when transactions costs are considered. While brokerage fees are not likely to be very important given that discount brokerage firms allow unlimited share transactions for $10 commissions, the potentially more important costs are bid-ask spreads. The simulations in this paper are based on closing transactions--as long as they occurred within the last hour of trading--and thus do not include the effect of bid-ask

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used rather than the estimated or projected discounts or premiums.

spreads. Bid-ask spreads in these iShares can be as low as one cent but are more substantial at times. Given that German, UK and French iShares traded at average prices between \$16 and \$21 over the sample period, daily percentage returns of 1/2 percent correspond to daily absolute returns of roughly 10 cents. Thus, a substantial part of profits could be eroded if traders merely transact at quoted bid and ask prices when they are wide. However, for traders who can finesse or work the bid-ask spreads, the substantial premiums and discounts at which European iShares frequently trade could lead to interesting trading opportunities.[25] Investors who plan to buy and hold European iShares for extended periods undoubtedly could get an edge by entering such positions when iShares trade at substantial discounts or at least not buying when European iShares trade at substantial premiums. In any case, the evidence strongly indicates that European iShares overreact to late day developments in US markets.

[25] In addition, traders can choose to enter trades only if they get good entry prices and can get out of positions the next day at anytime rather than just at the close, as assumed in the simulations.

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Table 1. The forecast power of estimated iShare net asset value (NAV) changes for same day actual iShare NAV changes, where the estimated NAV on day t is equal to the observed NAV on day t-1 times either the day t DAX, FTSE or CAC return and times the return against the dollar of either the DM, Pound or French Franc or Euro beginning in January 1999. Standard errors are shown in parentheses and one and two asterisks denote statistical significance at the five and one percent levels, respectively. (Daily Data from July 1998- May 2004)

$$\ln (NAV_t / NAV_{t-1}) \quad = \alpha + \beta \ln (E(NAV_t) / NAV_{t-1} + \varepsilon_t$$

	German	UK	French
α	.00023*	.00019**	.00026*
	(.00011)	(.00007)	(.00011)
β	.94061**	.94341**	.94433**
	(.00622)	(.00524)	(.00692)
R^2	.9444	.9635	.9487
D.W.	2.762	2.728	2.760

Table 2. Daily iShare Data in Basis Points from July 1998-May 2004

	Mean	Standard Deviation	Top Decile	Bottom Decile	ρ_1	ρ_2	ρ_3	ρ_4
DEV_{GER}	13.3	92.3	120.3	-89.5	.124	.143	.112	.108
DEV_{UK}	58.5	91.3	168.0	-46.9	.247	.193	.180	.169
DEV_{FR}	7.0	78.6	95.5	-77.9	.074	.094	.083	.106
RET_{GER}	-3.59	187.3	217.5	-219.0	-.037	-.009	.017	.029
RET_{UK}	-3.18	152.9	170.2	-183.4	-.104	-.096	-.007	.015
RET_{FR}	5.26	172.1	198.0	-211.4	-.039	-.047	-.025	.032
$RET_{GER/SPY}$	-3.67	142.3	171.2	-174.4	-.138	-.040	-.000	.002
$RET_{UK/SPY}$	-2.77	125.1	146.2	-152.5	-.187	-.118	-.062	.022
$RET_{FR/SPY}$	-3.88	139.2	166.9	-180.2	-.160	-.124	-.024	.027
RET_{SPY}	-0.4	132.5	156.5	-163.9	-.028	-.035	-.034	.002
RET_{DAX}	-4.6	190.2	216.4	-227.6	.003	-.018	-.016	.068
RET_{FTSE}	-4.2	136.4	153.1	-167.1	-.003	-.066	-.097	.059
RET_{CAC}	-6.6	171.0	178.8	-199.3	.027	-.034	-.071	.036

DEV are the deviations of closing German, UK and French iShare prices from their estimated closing net asset values. RET are the daily returns for German, UK and French ishares, for the respective daily iShare returns relative to the returns on S&P depository trusts (SPY) and for the DAX, FTSE, CAC and S&P depository trusts.

Table 3. The Predictive Power of iShare Discounts or Premiums for Next Day Net Asset Value Returns

$$\ln(NAV_{t+1}/NAV_t) = \alpha + \beta \ln(iShare_t/E(NAV_t)) + \varepsilon_t$$

	German	UK	French
α	-.00085	-.00213**	-.00085
	(.00048)	(.00045)	(.00050)
β	.39824**	.3219**	.4258**
	(.06256)	(.0463)	(.0754)
$RBAR^2$	.0427	.0513	.0446
DW	1.862	1.900	1.887

Standard errors are shown in parentheses and one and two asterisks denote statistical significance at the five and one percent levels, respectively.

Table 4. The Predictive Power of iShare Discounts or Premiums for Next Day iShare Returns

$$\ln(iShare_{t+1}/iShare_t) = \alpha + \beta \ln(iShare_t/E(NAV_t)) + \varepsilon_t$$

	German	UK	French
α	.00005	.00191**	-.00003
	(.00051)	(.00054)	(.00005)
β	-.29412**	-.3772**	-.2952**
	(.06537	(.0546)	(.0759)
$RBAR^2$	.0201	.0493	.0172
DW	1.914	2.027	1.958

Standard errors are shown in parentheses and one and two asterisks denote statistical significance at the five and one percent levels, respectively.

Table 5. The Predictive Power of iShare Discounts or Premiums for the Next Day Relative Performance of iShares versus S&P 500 Depository Receipts

$$\ln(iShare_{t+1}/iShare_t) - \ln(SPY_{t+1}/SPY_t) = \alpha + \beta \ln(iShare_t/E(NAV_t)) + \varepsilon_t$$

	German	UK	French
α	.00005 (.00039)	.00155** (.00046)	-.00023 (.00043)
β	-.30000** (.05036)	-.30871** (.04951)	-.22713** (.05965)
$RBAR^2$	.0370	.0494	.0158
DW	2.142	2.356	2.207

Standard errors are shown in parentheses and one and two asterisks denote statistical significance at the five and one percent levels, respectively.

Table 6. Percentage daily returns in basis points of trading rules that go long or short German, UK and French iShares (EWG) either outright or against offsetting SPY positions when iShares close at discounts or premiums relative to NAVs, respectively. $Long_{EWG}$/ Short $_{SPY}$ is the percentage change (in basis points) in the value of a long German iShare positions and short an equal dollar value Spider position. Positive returns indicate profitable trades for long trades (shown in top panel) and negative returns indicate profitable trades for short trades (shown in bottom panel). Trades are executed at the close and are reversed the next day at the close. The table also shows on days positions are initiated the discounts or premiums in absolute terms, and the returns of iShares, Spiders and the corresponding benchmark index.

Trigger Rule: Buy if Discount > 50 bps

		Mean	Std Error	Maximum	Minimum
German:	RET_{EWGt}	28.3*	13.2	839.0	-795.3
(235 trades)	$Long_{EWG}$/ $Short_{SPY}$	26.3**	9.7	486.3	-501.8
	$Discount_{t-1}$	106.2**	3.9	503.3	483.5
	RET_{EWGt-1}	-55.9**	13.9	738.2	-795.3
	RET_{SPYt-1}	-55.6**	10.9	525.3	-739.5
	RET_{DAXt-1}	47.3**	13.8	708.6	-591.5
UK:	RET_{EWUt}	52.6**	16.1	613.2	-452.7
(104 trades)	$Long_{EWU}$/$Short_{SPY}$	39.9**	15.2	499.5	-414.3
	$Discount_{t-1}$	97.2**	5.5	396.3	50.3
	RET_{EWUt-1}	-134.1**	16.2	320.6	-643.4
	RET_{SPYt-1}	-111.1**	15.4	345.4	-588.8
	$RET_{FTSEt-1}$	-24.4	16.2	398.4	-481.5
French:	RET_{EWQt}	41.0*	16.2	572.7	-487.9
(147 trades)	$Long_{EWQ}$/$Short_{SPY}$	41.9**	12.5	441.8	-370.6
	$Discount_{t-1}$	98.7**	5.7	636.6	50.0
	RET_{EWQt-1}	-93.7**	15.6	612.5	-683.2
	RET_{SPYt-1}	-81.3**	12.7	323.3	-739.5
	RET_{CACt-1}	-11.5	15.8	700.2	-538.8

Trigger Rule: Sell if Premium > 50 bps

		Mean	Std Error	Maximum	Minimum
German:	RET_{EWGt}	-24.6*	10.0	769.6	-832.9
(372 trades)	$Short_{EWG}$/$Long_{SPY}$	-23.4**	7.9	760.7	-669.1
	$Premium_{t-1}$	113.7**	3.5	632.9	50.0
	RET_{EWGt-1}	39.4**	9.9	839.0	-434.9
	RET_{SPYt-1}	39.7**	6.9	580.2	-337.5
	RET_{DAXt-1}	-29.7**	9.9	697.9	-645.0
UK:	RET_{EWUt}	-29.3**	6.6	556.7	-643.4
(507 trades)	$Short_{EWU}$/$Long_{SPY}$	-18.4**	5.5	350.6	-655.5
	$Premium_{t-1}$	125.6**	2.7	493.4	50.0
	RET_{EWUt-1}	39.5**	6.7	652.7	-436.9
	RET_{SPYt-1}	33.9**	6.2	580.3	-481.7
	$RET_{FTSEt-1}$	-8.7	6.3	590.4	-555.9
French:	RET_{EWQt}	-26.3*	11.6	524.3	-625.3
(210 trades)	$Short_{EWQ}$/$Long_{SPY}$	-34.6**	9.9	374.2	-624.4
	$Premium_{t-1}$	97.3**	3.3	455.4	50.4
	RET_{EWQt-1}	61.6**	11.3	524.3	-561.8
	RET_{SPYt-1}	59.6**	9.3	580.2	-289.5
	RET_{CACt-1}	0.0	12.1	612.0	-604.4

Table 7. Percentage daily returns in basis points of trading rules that go long or short German, UK and French iShares (EWG) either outright or against offsetting SPY positions when 1) iShares close at discounts or premiums relative to NAVs and 2) Spider returns are positive or negative, respectively. $Long_{EWG}$/ $Short_{SPY}$ is the percentage change (in basis points) in the value of a long German iShare positions and short an equal dollar value Spider position. Positive returns indicate profitable trades for long trades (shown in top panel) and negative returns indicate profitable trades for short trades (shown in bottom panel). Trades are executed at the close and are reversed the next day at the close. The table also shows on days positions are initiated the discounts or premiums in absolute terms, and the returns of iShares, Spiders and the corresponding benchmark index.

Trigger Rule: Buy if Discount > 50 bps and SPY Return > 0

		Mean	Std Error	Maximum	Minimum
German:	RET_{EWGt}	55.0*	22.3	839.0	-322.8
(81 trades)	$Long_{EWG}/Short_{SPY}$	51.8**	15.1	387.0	-291.3
	$Discount_{t-1}$	98.8**	4.5	260.5	51.9
	RET_{EWGt-1}	79.0**	17.0	442.3	-223.1
	RET_{SPYt-1}	111.9**	10.9	525.3	2.6
	RET_{DAXt-1}	193.5**	19.7	708.6	-278.3
UK:	RET_{EWUt}	114.7**	33.3	480.7	-146.8
(24 trades)	$Long_{EWU}/Short_{SPY}$	83.7**	31.4	499.5	-251.1
	$Discount_{t-1}$	88.4**	14.5	396.3	51.1
	RET_{EWUt-1}	-29.3	32.8	320.6	-270.3
	$RET_{SPY\ t-1}$	83.9**	14.5	345.4	3.0
	$RET_{FTSEt-1}$	92.0	30.7	398.4	-190.0
French:	RET_{EWQt}	82.9**	30.4	572.7	-364.7
(45 trades)	$Long_{EWQ}/Short_{SPY}$	114.4**	25.9	441.8	-364.4
	$Discount_{t-1}$	83.3**	5.1	224.8	50.0
	RET_{EWQt-1}	20.1	20.4	339.5	-208.4
	$RET_{SPY\ t-1}$	85.5**	10.3	323.4	1.8
	RET_{CACt-1}	104.3**	26.3	700.2	-139.5

Trigger Rule: Sell if Premium > 50 bps and SPY Return < 0

		Mean	Std Error	Maximum	Minimum
German:	RET_{EWGt}	-47.5**	14.9	738.2	-487.9
(138 trades)	$Short_{EWG}/Long_{SPY}$	-49.2**	13.0	760.7	-428.2
	$Premium_{t-1}$	105.0**	4.6	295.4	50.2
	RET_{EWGt-1}	-59.9**	14.0	342.8	-434.9
	RET_{SPYt-1}	-85.0**	5.7	-2.2	-337.5
	RET_{DAXt-1}	-116.3**	15.8	520.0	-633.6
UK :	RET_{EWUt}	-46.4**	11.3	453.6	-643.4
(198 trades)	$Short_{EWU}/Long_{SPY}$	-30.2**	9.4	332.2	-655.3
	$Premium_{t-1}$	114.1**	3.5	308.4	50.2
	RET_{EWUt-1}	-41.4**	8.9	320.1	-436.9
	RET_{SPYt-1}	-93.2**	5.1	-1.1	-481.7
	$RET_{FTSEt-1}$	-70.0**	9.2	-507.5	487.8
French:	RET_{EWQt}	-55.4**	20.7	372.9	-625.3
(68 trades)	$Short_{EWQ}/Long_{SPY}$	-90.4**	18.0	316.8	-624.4
	$Premium_{t-1}$	95.6**	4.8	239.8	51.1
	RET_{EWQt-1}	-23.1	17.0	267.7	-561.8
	RET_{SPYt-1}	-73.0	6.5	-2.2	-289.5
	RET_{CACt-1}	-73.9	19.5	408.4	-604.5