Predictable patterns in ETFs' return and tracking error

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Abstract

Purpose – The purpose of this paper is to assess whether exchange-traded funds (ETFs) can beat the market, as it is expressed by the Standard and Poor (S&P) 500 Index, examine the outperformance persistence, calculate tracking error, assess the tracking error persistence, investigate the factors that induce tracking error and assess whether there are predictable patterns in ETFs' performance.

Design/methodology/approach – The author uses a sample of 50 iShares during the period 2002-2007 and calculates the simple raw return, the Sharpe ratio and the Sortino ratio, regresses the performance differences between ETFs and market index, calculates tracking error as the standard deviation in return differences between ETFs and benchmarks, assesses tracking error's persistence in the same fashion used to assess the ETFs' outperformance persistence, examines the impact of expenses, risk and age on tracking error and applies dummy regression analysis to study whether the performance of ETFs is predictable.

Findings – The results reveal that the majority of the selected iShares beat the S&P 500 Index, both at the annual and the aggregate levels while the return superiority of ETFs strongly persists at the short-term level. The tracking error of ETFs also persists at the short-term level. The regression analysis on tracking error reveals that the expenses charged by ETFs along with the age and risk of ETFs are some of the factors that can explain the persistence in tracking error. Finally, the dummy regression analysis indicates that the performance of ETFs can be somehow predictable.

Originality/value – The findings of this paper may be of help to investors seeking investment choices that will help them to gain above market returns. In addition, tracking error-concerned investors will be helped by the findings of the paper. Finally, the findings on return predictability can also be helpful to investors.

Keywords Investment funds, Stock exchanges, Return on investment

Paper type Research paper

1. Introduction

Exchange-traded funds (ETFs) are hybrids of ordinary corporate stocks and open-ended mutual funds which invest in baskets of shares aiming at closely replicate the performance and risk levels of specific broad, sector and international equity, fixed income and commodity indexes. The majority of ETFs currently available worldwide is passively managed with the exception of the actively managed ETFs listed on Deutshe Boerse and the recently launched active ETFs in the US market[1].

The reason why active ETFs are not widely available yet relates to the arbitrage opportunities offered by passive ETFs but not offered by active ETFs. Arbitrage chances arise when a declination between the trading prices of ETFs and the value of underlying securities exists. The efficient arbitrage execution contributes to the narrowness of these divergences. Arbitrage bases on the in kind creation/redemption process of passive ETFs and it is attainable because the holdings of the tracking market indexes are publicly known throughout the trading day. In contrast, the stocks held by the actively managed ETFs are not publishable information until the end of the trading

Studies in Economics and Finance
Vol. 28 No. 1, 2011
pp. 14-35

1086-7376
DOI 10.1108/10867371111110534

day because these stocks are picked by active ETFs so that they can beat the benchmark index. Therefore, if the holdings of active ETFs are disclosed frequently enough so that arbitrage could take place, their ability of beating the market weakens. In such a case, investors would simply let the fund managers do all of the research waiting for the disclosure of their choices and they would then buy the selected securities avoiding paying the management fees. Thus, the arbitrage and the in kind creation/redemption are non-events for active ETFs.

The passive management for the majority of ETFs entails that they just invest in all the components of the underlying index at the same weights without needing to execute any complex and costly investing strategies and without expecting, however, to produce any excess return with respect to the performance of the tracking benchmark. In contrast to this universal assertion regarding the passively managed ETFs, there are now some reports that suggest that an actively managed portfolio of ETFs can generate a positive alpha, in other words, to outperform its individual funds.

For instance, Carty and Carty (2008) argue that an actively managed portfolio of ETFs can achieve a positive alpha by choosing from a wide variety of assets concerning both large- and small-cap stocks, growth and value stocks, domestic and international stocks and developed and emerging market stocks Carty and Carty (2008). In contrast to the efficient market hypothesis, according to which the changes in stock prices follow a random walk while all the available information on a particular stock is embedded in its price, the observers of business cycles recognize that cycles persist for a period of time, that different market segments benefit to different degrees over the course of the cycle and that the sectors benefiting the most become highly valued enabling investors investing in the specific entities to make significant profit with respect to broad market indexes.

In the same spirit, a report conducted by Yannick Daniel from Societe Generale suggests that besides being used for acquiring a quick and cheap beta exposure, ETFs can also be used to create a so-called "portable" alpha component provided that the portfolio managers know which beta exposure provides the best hedge against systematic risk, that is, over which index the portfolio exhibits the lowest tracking error and the highest correlation[2]. Portable alpha strategies allow for the separation of market returns from strategies that add value (alpha) to a portfolio and they are called portable because they can be transposed to any existing strategy irrespective of the underlying systematic risk exposure.

One key element to active portfolio management concerns the performance persistence, which implies the ability of managers to systematically beat their benchmarks over short or longer periods of time. The literature has revealed that some mutual-fund managers (one-third of them according to Yannick Daniel from Societe Generale) possess some kind of stock picking or market timing skills at achieving above market returns in a persistent way. Among other researchers, Grinblatt and Titman (1992) shown that the performance of mutual funds persists at a long-run level while Bollen and Busse (2004) found evidence on more short-term persistence in mutual-funds performance. The findings of other empirical studies such as those of Brown and Goetzmann (1995) and Elton *et al.* (1996) also support the hypothesis of mutual-fund performance persistence. When it comes to ETFs, Kuo and Mateus (2007) investigate the performance persistence of 20 iShares MSCI country-specific ETFs in comparison with the Standard and Poor (S&P) 500 Index finding first that ETFs can beat the market and second that there is evidence on performance persistence based on annual returns.

One key element to passive portfolio management relates to the tracking error, which implies the difference between the performance of ETFs (or index funds) and the tracking indexes. Tracking error has attracted great interest in the literature. Larsen and Resnick (1998) demonstrate that the high-capitalization portfolios present inferior tracking error and volatility than the low-capitalization counterparts. Frino and Gallagher (2001) analyze the major factors that affect the size of tracking error, which are the expenses, the dividend payments arising from the stocks of an index as well as the size and the timing of index's rebalancing. They also discover a seasonal pattern in tracking error, namely tracking error is higher in January and May and lowest in June. Kostovetsky (2003) also analyzes the factors that impact the tracking error of ETFs and index funds. The tracking error of index funds is significantly affected by the bid-ask spreads of portfolio's stocks, the obligation of index funds to maintain a significant amount of money in cash to meet redemptions, the dividend policies and the transaction costs arising from index changes or corporate activity. The cash drag effect is applicable to ETFs too, even though it is much smaller. ETFs performance is affected by the dividend policies, which usually obligate the ETF managers to keep the received dividends on the index's stocks in non-bearing accounts. The non-reinvestment of the dividends has also been pointed out by Elton *et al.* (2002) as being one of the major determinative factors of SPDRs' tracking error. Finally, Blume and Edelen (2004) study the impact of S&P 500 composition's change on the abnormal returns of index funds tracking it and find that funds can achieve abnormal returns if the managers choose to adjust their portfolio immediately at the opening price on the consequent day of the change's announcement, rather than waiting until the closure on the day of change. This strategy induces the observed tracking error.

The objective of this paper is to examine the chances investors stand to gain above market returns using ETFs. To do so, we employ a sample of 50 Barclay's iShares and evaluate their performance versus the performance of the S&P 500 Index during the period 2002-2007 on annual and on an overall basis. Three alternative performance measures are used, namely the simple raw return, and two types of risk-adjusted performance of ETFs expressed via the Sharpe ratio and the Sortino ratio. The results reveal that the majority of the selected iShares beat the S&P 500 Index, both at the annual and the aggregate level. Going further, we assess whether the outperformance of ETFs over the broad market index persists though time. The results indicate that the return superiority of ETFs strongly persists at the short term. In the next step, we evaluate the tracking ability of ETFs. We do so estimating the tracking error of ETFs over their own benchmark (and not the S&P 500 Index) because the core purpose of each individual ETF is to replicate the performance of the assigned benchmark. Regression analysis on tracking error demonstrates that it is strongly persistent at the short-term level. Trying to explain the persistence in tracking error, we find that the expenses charged by ETFs, the age and risk of ETFs positively affect the tracking error. In the last step, we search for predictability patterns in ETFs' return. The results indicate that the performance in a specific year significantly accounts for the future return of ETFs.

The remainder of the paper is organized as follows. In Section 2, we develop the methodology used in our analysis of ETFs' performance versus the market return, the performance persistence, the tracking error of ETFs and tracking error persistence along with the prediction of performance. Section 3 describes the data used in this study and provides the statistics of the sample. The empirical findings are presented in Section 4 and the summary and conclusions are discussed in Section 5.

2. Methodology

2.1 Performance measurement and persistence

In the first step, we calculate the daily return of ETFs and indexes by subtracting the price of the ETF or index i on day $t-1$ from its price on day t and dividing the difference by the price on day $t-1$. The corresponding return of the S&P 500 Index is also estimated. In the calculation of returns, we assume that the dividends received by ETFs (if any) are reinvested on the exdividend day. Returns are expressed in percentage terms. Risk is estimated as the standard deviation of returns and it will be used in a subsequent section of this study when we will examine the factors that affect the tracking error of ETFs.

After computing the raw return of ETFs and indices, we estimate two alternative types of risk-adjusted performance. The first type concerns the Sharpe ratio, which is expressed via the next equation (1):

$$S_{p,i} = \frac{\bar{R}_{p,i} - \bar{R}_f}{\sigma_{p,i}} \tag{1}$$

where, $\bar{R}_{p,i}$ denotes the average daily return of the ETF i or the S&P 500 Index and $\bar{R}_f$ is the average daily Kenneth and French risk-free rate. $\sigma_{\mathrm{p.i}}$ is the standard deviation of ETF's i or S&P 500 Index's return. The Sharpe ratio assesses how well the ETF or the S&P 500 Index compensate their investors for the per unit risk they run. The higher the Sharpe ratio is, the better is the performance of the ETF or the index.

The second type of risk-adjusted performance we use is the Sortino ratio expressed via equation (2):

$$Sor_{p,i} = \frac{\bar{R}_{p,i} - \bar{R}_f}{\sigma_{i,d}} \tag{2}$$

where, $\bar{R}_{p,i}$ and $\bar{R}_f$ are defined as above while $\sigma_{\mathrm{i,d}}$ is the standard deviation of ETF's i or S&P 500 Index's negative returns. The Sortino ratio differentiates between good and bad volatility in the Sharpe ratio. This differentiation of upward and downward volatility allows the calculation of risk-adjusted return to provide a performance measure of ETF i or the market index without penalizing them for upward price changes. Similarly to Sharpe ratio, the higher the Sortino ratio is, the better is the performance of the ETFs or the benchmark.

Having computed the three alternative performance measures of ETFs and indexes, we evaluate performance persistence applying the regression analysis used, among others, by Grinblatt and Titman (1992) and Bollen and Busse (2004) in assessing the persistence in mutual-fund performance. This analysis concerns the cross-sectional regression of ETFs' performance in a specific year on their performance in the previous year. We note that in our analysis we do not regress the absolute performance records of ETFs but we regress the performance differences between ETFs and the S&P 500 Index. This approach enables us to assess whether the outperformance of ETFs in comparison with the market index persists through time. The cross-sectional model we apply is expressed by the following equation (3):

$$\mathrm{Per_t} = \alpha + \beta\, \mathrm{Per_{t-1}} + \mathrm{u} \tag{3}$$

where, Per successively expresses each one of the three different return measurements. The beta coefficient of the model is the indicator of persistence. Positive and significant betas imply persistence of outperformance and persistence's evidence strengthens when beta reaches the unity. Negative and significant betas reflect inversions to ETFs' performance as compared to market return while insignificant betas imply unsystematic variation of performance.

While performance persistence in actively managed mutual funds may indicate that the managers are talented enough to predict the stocks that will perform well or to select the right time to enter or exit the market, performance persistence in passively managed ETFs does not reflect any significant stock picking or market timing talent because ETF managers are not supposed to display any kind of these skills and they are simply required to follow the synthesis of the selected benchmarks. The outperformance of ETFs with respect to the S&P 500 Index probably relates to the momentum literature, which has revealed that returns from stocks or industries are persistent in the short run. However, as described in the introduction of this paper, an actively managed portfolio of ETFs, which just try to replicate the performance of their benchmarks, can help investors to end up with having gained a positive alpha. Therefore, a comparison between ETFs and the S&P 500 Index and analysis of outperformance persistence surely help investors to differentiate among the amazingly growing bulk of ETFs those that are likely to perform better with respect to the broad market return.

2.2 Tracking error measurement and persistence

The next researching issue concerns the estimation of ETFs' tracking error. To compute tracking error, we follow the approach suggested by Frino and Gallagher (2001), according which tracking error is estimated as the standard deviation in return differences between ETFs and benchmarks. Tracking error is expressed via the next equation (4):

$$\mathrm{TE} = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}\left(e_{pt} - \bar{e}_p\right)^2} \tag{4}$$

where, e_{pt} is the difference of returns on day t and $\bar{e}_p$ is the average return's difference over n days.

After estimating tracking error, we now turn our attention to the persistence in tracking error. We assess persistence following the methodology we use to examine the persistence in ETFs' performance. More specifically, we apply a single-factor cross-sectional model regressing the estimated tracking error in year t on the tracking error in year $t-1$. The applied cross-sectional regression model is expressed by the following equation (5):

$$\mathrm{TE_t} = \alpha + \beta\,\mathrm{TE_{t-1}} + \mathrm{u} \tag{5}$$

where, $\mathrm{TE_t}$ is the tracking error coefficients in year t calculated by equation (4). The beta coefficient of the model is the indicator of persistence. Positive and significant betas indicate that tracking error persists between two successive years. Negative or insignificant beta estimates imply that tracking error is not persistent.

2.3 Explaining tracking error persistence

One key question concerns the sources of tracking error persistence, which might relate to the expense side of ETFs or their operation side. When it comes to expenses, other things being equal, if one ETF charges higher fees than another ETF, the first ETF is expected to have greater tracking error than the second one (i.e. the performance of the first ETF should be lower than the performance of the second one). However, expenses must not be the only element that induces tracking error and there might be other factors (operational ones) that affect tracking error. For instance, the risk to which an ETF is exposed is assumed to impact tracking error in a positive manner.

In this paper, apart from expenses we consider the impact on tracking error imposed by two more variables, which are the risk and the age of ETFs. Risk has been shown to positively affect tracking error (Rompotis, 2008). With respect to age, the majority of aged ETFs belong to the MSCI country-specific iShares which invest in stocks of international stock markets. International ETFs are assumed to display greater tracking error than the domestically invested ETFs.

We examine the impact of operational and non-operational factors on ETFs' tracking error applying cross-sectional regression analysis. More specifically, we regress the annual estimates of tracking error on the expense ratio of ETFs and the corresponding annual records of ETFs' risk and natural logarithm of age. The model we apply is represented by the following equation (6):

$$\mathrm{TE_t} = \alpha + \beta_1 \mathrm{ExRatio} + \beta_2 \mathrm{Risk_t} + \beta_3 \mathrm{LnAge_t} + \mathrm{u} \tag{6}$$

where $\mathrm{TE_t}$ is the tracking error estimates in year *t*. ExRatio is the published expense ratio of ETFs. We assume that the expense ratio has remained constant during the whole study period[3]. Risk is estimated as the standard deviation of ETFs' returns on an annual basis while LnAge is the natural logarithm of ETFs' age.

At this point, we should highlight that in order to avoid reporting spurious results due to multicollinearity bias resulted from the possibly high correlation among the explanatory variables of the model, we also perform a single-factor regression analysis of tracking error regressing tracking error on each individual variable. In any case, we expect the impact of expenses, risk and age on tracking error to be positive.

2.4 Predicting performance

One important issue in finance literature concerns the prediction of performance. We examine predictability following the regression analysis suggested by Blake and Morey (2000). More specifically, we first compute the performance of ETFs in 2002 and rank them in a descending order. Then, we calculate return for the period 2003-2007. We repeat the calculations for each year from 2003 to 2006. We then classify ETFs in five classes each of one consists of ten ETFs. Class-5 ETFs receive five stars, class-4 ETFs are assigned four stars, etc. (similarly to the Morningstar star rating system). The regression analysis we apply is represented by equation (7):

$$\mathrm{R_i} = \delta_0 + \delta_4 \mathrm{D4_i} + \delta_3 \mathrm{D3_i} + \delta_2 \mathrm{D2_i} + \delta_1 \mathrm{D1_i} + \mathrm{u} \tag{7}$$

where *R* is the out of sample return of ETFs successively estimated as the raw return, the Sharpe ratio and the Sortino ratio. The model is applied to each single performance measurement. The control factors of the model are four dummy variables which are symbolized as D4, D3, D2 and D1. D4 stands for ETFs that receive four stars, D3 represents ETFs that are assigned three stars, D2 relates to the ETFs that receive two stars and D1 represents ETFs that receive one star. Dummy variables take value 1 if the ETF i belongs to the relevant class and zero otherwise. The class-5 ETFs are expressed by the constant of the model. This class is the reference group for the regression model.

Hence, deltas count for the difference between the class-5 ETFs and the fourth, third, second and first classes, respectively. The predictive ability of the model will be confirmed, if, first, the δ_4 to δ_1 estimates are negative and statistically significant and, second, if deltas become more negative as we move from δ_4 to δ_1.

3. Data and statistics

Our data consists of the closing prices, which are the 4:00 p.m. bid/asked midpoint and the net asset values (NAVs) of a sample of 50 ETFs belonging to the family of Barclay's iShares while the study covers the period 2002-2007. The reason for choosing these ETFs relates to the data availability. More specifically, there are several other ETFs, such as the well-known SPDRs and QQQQ which track the S&P 500 Index and Nasdaq 100 Index, respectively, whose trading history exceeds the interval of the study period but the historical NAVs of which are not publicly available. Therefore, we could not include these ETFs in our sample as we wish to use both the trading and NAVs in our empirical analysis. Furthermore, we saw to it that we use all the available ETFs which cover the maximum possible period and whose both the daily closing prices and NAVs are publicly available. These requirements resulted in the 50 iShares selected since the trading history of the other ETFs belonging to Barclays or other families is shorter than the desired study period.

The 27 ETFs of the sample track domestic broad-market or sector indexes (20 and seven ETFs, respectively) while the rest 23 ETFs track the country indexes of Morgan Stanley or other international indexes (21 and two ETFs, respectively). The closing prices of iShares were gathered from www.Nasdaq.com while the closing NAVs were obtained by the web database of iShares (www.us.iShares.com). We also gathered the daily data of the tracking indexes from this site. With respect to the risk-free rate, we found its historical data on the web site of Kenneth French (mba.tuck.dartmouth.edu).

Table I presents the profiles of the sample's ETFs. Profiles are the symbol of ETFs, the name (which includes the name of the tracking index), the investing category of ETFs (broad, sector and international markets ETFs), the inception date (found on www.us.iShares.com), the age as of December 31, 2007 and the published expense ratio (found on www.us.iShares.com as well). According to the data in Table I, the average age of sample's ETFs is about nine years, which reflects a relevantly short trading history, while the average expense ratio of the sample is equal to 40 basis points (b.p.). Scanning though Table I, we see that the international ETFs present the higher expense ratios of the sample whereas the ETFs that invest in domestic broad market indexes display the lowest expense ratios.

4. Empirical results

4.1 Performance measurement and persistence

The performance estimates are presented in Table II. Table II does not report the absolute return estimates of ETFs and market index (S&P 500 Index), but it presents the average performance differences between ETFs and index (ETF performance − S&P 500 Index performance). In addition, return differences are presented on an annual and an aggregate basis while the three alternative performance measures are assessed. Moreover, performance is estimated considering both the trading prices (Panel A) and the NAVs (NAV-Panel B) of ETFs. We estimate performance both in trading and the NAV terms because investors usually are aware of the trading prices of ETFs (these are the prices

Table I.
Profiles of ETFs

Symbol	Name	Category	Inception date	Age (years)	Expense ratio (%)
EWA	iShares MSCI Australia Index Fund	International	March 12, 1996	11.81	0.52
EWC	iShares MSCI Canada Index Fund	International	March 12, 1996	11.81	0.52
EWD	iShares MSCI Sweden Index Fund	International	March 12, 1996	11.81	0.51
EWG	iShares MSCI Germany Index Fund	International	March 12, 1996	11.81	0.52
EWH	iShares MSCI Hong Kong Index Fund	International	March 12, 1996	11.81	0.52
EWI	iShares MSCI Italy Index Fund	International	March 12, 1996	11.81	0.52
EWJ	iShares MSCI Japan Index Fund	International	March 12, 1996	11.81	0.52
EWK	iShares MSCI Belgium Index Fund	International	March 12, 1996	11.81	0.52
EWL	iShares MSCI Switzerland Index Fund	International	March 12, 1996	11.81	0.52
EWM	iShares MSCI Malaysia Index Fund	International	March 12, 1996	11.81	0.52
EWN	iShares MSCI Netherlands Index Fund	International	March 12, 1996	11.81	0.52
EWO	iShares MSCI Austria Index Fund	International	March 12, 1996	11.81	0.52
EWP	iShares MSCI Spain Index Fund	International	March 12, 1996	11.81	0.52
EWQ	iShares MSCI France Index Fund	International	March 12, 1996	11.81	0.52
EWS	iShares MSCI Singapore Index Fund	International	March 12, 1996	11.81	0.52
EWT	iShares MSCI Taiwan Index Fund	International	June 20, 2000	7.53	0.73
EWU	iShares MSCI United Kingdom Index Fund	International	March 12, 1996	11.81	0.52
EWW	iShares MSCI Mexico Index Fund	International	March 12, 1996	11.81	0.52
EWY	iShares MSCI South Korea Index Fund	International	May 09, 2000	7.65	0.63
EWZ	iShares MSCI Brazil Index Fund	International	July 10, 2000	7.48	0.63
EZU	iShares MSCI EMU Index Fund	international	July 25, 2000	7.44	0.52
IDU	iShares Dow Jones US Utilities Index Fund	Sector	June 12, 2000	7.56	0.48
IEV	iShares S&P Europe 350 Index Fund	International	July 25, 2000	7.44	0.60
IJH	iShares S&P MidCap 400 Index Fund	Broad	May 22, 2000	7.61	0.20
IJJ	iShares S&P MidCap 400/Barra Value IF	Broad	July 24, 2000	7.44	0.25
IJK	iShares S&P MidCap 400/BARRA Growth IF	Broad	July 24, 2000	7.44	0.25

(*continued*)

Table I.

Symbol	Name	Category	Inception date	Age (years)	Expense ratio (%)
IJR	iShares S&P SmallCap 600 Index Fund	Broad	May 22, 2000	7.61	0.20
IJS	iShares Small Cap 600/BARRA Value IF	Broad	July 24, 2000	7.44	0.25
IJT	iShares Small Cap 600/BARRA Growth IF	Broad	July 24, 2000	7.44	0.25
IOO	iShares S&P Global 100 Index Fund	Broad	December 05, 2000	7.07	0.40
IVE	iShares S&P 500/BARRA Value Index Fund	Broad	May 22, 2000	7.61	0.18
IVV	iShares S&P 500 Index Fund	Broad	May 15, 2000	7.63	0.09
IVW	iShares S&P 500/BARRA Growth Index Fund	Broad	May 22, 2000	7.61	0.18
IWB	iShares Russell 1000 Index Fund	Broad	May 15, 2000	7.63	0.15
IWD	iShares Russell 1000 Value Index Fund	Broad	May 22, 2000	7.61	0.20
IWF	iShares Russell 1000 Growth Index Fund	Broad	May 22, 2000	7.61	0.20
IWM	iShares Russell 2000 Index Fund	Broad	May 22, 2000	7.61	0.20
IWN	iShares Russell 2000 Value Index Fund	Broad	July 24, 2000	7.44	0.25
IWO	iShares Russell 2000 Growth Index Fund	Broad	July 24, 2000	7.44	0.25
IWV	iShares Russell 3000 Index Fund	Broad	May 22, 2000	7.61	0.20
IWW	iShares Russell 3000 Value Index Fund	Broad	July 24, 2000	7.44	0.25
IWZ	iShares Russell 3000 Growth Index Fund	Broad	July 24, 2000	7.44	0.25
IYC	iShares Dow Jones US Consumer Index Fund	Sector	June 12, 2000	7.56	0.48
IYF	iShares Dow Jones US Financials Index Fund	Sector	May 22, 2000	7.61	0.48
IYG	iShares Dow Jones US Financial Services IF	Sector	June 12, 2000	7.56	0.48
IYH	iShares Dow Jones US Health Care Index Fund	Sector	June 12, 2000	7.56	0.48
IYJ	iShares Dow Jones US Industrials Index Fund	Sector	June 12, 2000	7.56	0.48
IYK	iShares Dow Jones US Consumer Goods IF	Sector	June 12, 2000	7.56	0.48
IYY	iShares Dow Jones US Total Market Index Fund	Broad	June 12, 2000	7.56	0.20
OEF	iShares S&P 100 Index Fund	Broad	October 23, 2000	7.19	0.20
Average				8.98	0.40

Note: This table presents the profiles of ETFs which are the symbol, name, investing category, inception date, age as of December 31, 2007, and expense ratio

Table II. Performance of ETFs

Year	Raw return All ETFs	S&P 500	Over/equal	Under	Sharpe ratio All ETFs	S&P 500	Over/equal	Under	Sortino ratio All ETFs	S&P 500	Over/equal	Under
Panel A: price returns												
2002	−0.064	−0.092	0.045	−0.016	−0.038	−0.060	0.026	−0.005	−0.064	−0.105	0.047	−0.014
n	50		36	14	50		43	7	50		45	5
2003	0.130	0.099	0.038	−0.016	0.100	0.088	0.022	−0.013	0.162	0.145	0.045	−0.022
n	50		44	6	50		36	14	50		29	21
2004	0.068	0.037	0.038	−0.013	0.061	0.046	0.028	−0.013	0.092	0.071	0.040	−0.022
n	50		43	7	50		36	15	50		35	15
2005	0.035	0.014	0.029	−0.010	0.022	0.003	0.027	−0.013	0.035	0.006	0.044	−0.019
n	50		40	10	50		40	10	50		38	12
2006	0.079	0.053	0.040	−0.014	0.062	0.054	0.030	−0.017	0.095	0.085	0.044	−0.031
n	50		37	13	50		28	22	50		27	23
2007	0.036	0.019	0.045	−0.033	0.010	0.001	0.029	−0.026	0.013	0.001	0.040	−0.036
n	50		32	18	50		32	18	50		32	18
Per.	0.047	0.021	0.032	−0.005	0.027	0.011	0.020	−0.006	0.039	0.015	0.031	−0.008
n	50		42	8	50		42	8	50		42	8
Panel B: NAV returns												
2002	−0.067	−0.092	0.041	−0.019	−0.043	−0.060	0.022	−0.010	−0.072	−0.105	0.042	−0.018
n	50		37	13	50		43	7	50		42	8

(*continued*)

Table II.

Year	Raw return				Sharpe ratio				Sortino ratio			
	All ETFs	S&P 500	Over/ equal	Under	All ETFs	S&P 500	Over/ equal	Under	All ETFs	S&P 500	Over/ equal	Under
2003	0.127	0.099	0.035	−0.016	0.107	0.088	0.027	−0.013	0.172	0.145	0.045	−0.022
n	50		43	7	50		41	9	50		37	13
2004	0.067	0.037	0.037	−0.013	0.066	0.046	0.030	−0.014	0.097	0.071	0.042	−0.023
n	50		43	7	50		38	12	50		38	12
2005	0.035	0.014	0.029	−0.011	0.024	0.003	0.029	−0.016	0.038	0.006	0.044	−0.026
n	50		41	9	50		41	9	50		41	9
2006	0.036	0.053	0.058	−0.041	0.013	0.054	0.026	−0.052	0.017	0.085	0.036	−0.079
n	50		12	38	50		7	43	50		5	45
2007	0.036	0.019	0.045	−0.033	0.010	0.001	0.029	−0.026	0.013	0.001	0.040	−0.036
n	50		32	18	50		32	18	50		32	18
Per.	0.046	0.021	0.031	−0.005	0.030	0.011	0.023	−0.006	0.043	0.015	0.034	−0.008
n	50		42	8	50		42	8	50		42	8

Notes: This table presents the performance of ETFs and the S&P's 500 Index (market return); performance is successively expressed as the raw return of ETFs, the Sharpe ratio and the Sortino ratio; in addition, the average performance and the number (n) of ETFs which outperform or perfectly replicate (over/equal) and underperform the market (under), respectively, along with the total number of ETFs included in the sample; Panel A presents estimates in price terms and Panel B presents estimates in NAV terms found in newspapers or on the exchange's data libraries) but investors are interested in being informed on the actual value of their investments. Finally, the table presents the average return estimate of all ETFs and the average market return, the average performance and the number of ETFs that perform at least equivalently to the market index and the average return and the number of ETFs that underperform the market.

Considering raw return in Panel A, the results show that, on average, the ETFs outperform the S&P 500 Index in each single year of the study period. This is also the case when the aggregate returns are considered. In particular, the average period's daily return of ETFs equals the 4.7 b.p. while the corresponding performance of the market is 2.1 b.p. Going further, Panel A reveals that the majority of ETFs outperform (or, at least, perform equally to the market) either when the annual or the aggregate performance records are considered. For instance, 42 and eight ETFs outperform and underperform the market on an aggregate basis. The risk-adjusted performance (Sharpe and Sortino ratios, respectively) behaves similarly to the raw return. The results in Panel A show that ETFs, either when the annual or the aggregate estimates are taken into account, outperform the market. In particular, the average Sharpe (Sortino) ratio is equal to 0.027 (0.039) while the respective ratio of the market index is 0.011 (0.015). Furthermore, 42 ETFs outperform the market when only eight ETFs present poorer performance as compared to the market performance (both when the Sharpe ratio and the Sortino ratio are considered).

The results of NAV performance measures do not decline from the results when the returns are estimated in price terms. Regarding raw return, ETFs, on average, outperform the market (both on an annual and overall basis). The majority of ETFs (42 out of 50 ETFs) perform equally or better than the market. The same pattern applies to Sharpe and Sortino ratios.

Overall, the results in Table II demonstrate that even though investors follow a passive-investing strategy by investing in passively managed ETFs, they still stand chances of achieving greater returns than the market returns, which are represented by the S&P 500 Index. The duration of our study period and the constant outperformance of the majority of the sample's ETFs in comparison with the market performance indicate that investors should take into account the previous returns of these products (along with other market or economic factors) when they are to decide whether they will invest passively or they will choose active investing products so as to beat the market. In other words, passively managed investing products can provide investors with great opportunities of gaining above broad market returns provided that investors are capable of detecting these opportunities and applying profitable strategies based on momentum or sector market trends.

The regression results on outperformance persistence with respect to the market return (S&P 500 Index) are presented in Table III. Presented are the constant (alpha) and slope (beta) estimates of the model, the *t*-tests, which count for the statistical significance of estimates, and the values of R^2. In addition, Panel A presents the regression results when the raw returns are used. Panel B concerns the Sharpe ratio and Panel C regards the Sortino ratio. Moreover, each panel reports results both for price returns and NAV returns.

Regression results provide sound evidence on outperformance persistence for all the alternative performance measures. Particularly, considering raw returns, about all the beta estimates are positive and statistically significant at the 10 percent level or better. The only non-significant coefficient concerns the regression between 2002 and 2003.

Table III.
Performance persistence

Period	Price returns α	t-test	β	t-test	R^2	NAV returns α	t-test	β	t-test	R^2
Panel A – performance measure: raw return										
03 on 02	0.034***	2.683	−0.206	−0.755	0.181	0.032*	2.758	−0.247	−0.905	0.168
04 on 03	0.014**	2.498	0.536*	4.802	0.325	0.015*	2.749	0.538*	4.748	0.320
05 on 04	0.006	1.260	0.509*	2.929	0.235	0.006	1.296	0.530*	2.927	0.242
06 on 05	0.210*	3.523	0.238***	1.822	0.065	−0.031*	−2.978	0.596**	2.070	0.299
07 on 06	0.002	0.161	0.587*	2.859	0.146	0.034*	87.49	1.025*	155.01	0.998
Panel B – performance measure: Sharpe ratio										
03 on 02	0.007	1.437	0.238	1.448	0.042	0.013**	2.409	0.376**	2.022	0.078
04 on 03	0.009**	2.057	0.495*	3.189	0.175	0.01***	1.721	0.546**	2.392	0.248
05 on 04	0.015*	3.079	0.283**	2.014	0.078	0.015*	2.772	0.280***	2.001	0.078
06 on 05	0.016	1.453	−0.510*	−3.329	0.240	−0.049*	−8.087	0.373**	2.484	0.114
07 on 06	0.007	1.460	0.175	1.098	0.024	0.046*	33.73	0.901*	36.17	0.986
Panel C – performance measure: Sortino ratio										
03 on 02	0.012	1.266	0.118	0.684	0.010	0.02***	1.857	0.273	1.416	0.040
04 on 03	0.016*	2.471	0.340**	2.566	0.121	0.016**	2.112	0.377***	1.862	0.180
05 on 04	0.023*	3.058	0.270***	1.747	0.060	0.025*	2.909	0.267***	1.709	0.057
06 on 05	0.160	0.701	−0.523*	−4.027	0.299	−0.078*	−9.328	0.315**	2.345	0.103
07 on 06	0.011	1.564	0.154	1.019	0.021	0.074*	29.27	0.912*	31.73	0.982

Notes: Statistical significance at: *1, **5 and ***10 percent levels; this table presents the results of a cross-sectional regression model which searches for persistence patterns in ETFs' performance against the performance of the S&P's 500 Index (market return); the difference in performance between ETFs and market in year t is regressed on the respective lagged return difference in year $t-1$; three alternative performance estimates are used, that is the raw return, the Sharpe ratio and the Sortino ratio; the model is applied both to price returns and NAV returns

In this case, the beta estimate is negative and insignificant implying an unsystematic fluctuation in ETFs' outperformance between these years. The findings about raw return apply both to the price and NAV returns.

With respect to Sharpe ratio estimated in price return terms, two out of five beta estimates are positive and significant (years 2003-2004 and 2004-2005), one beta coefficient is negative and significant (years 2005-2006), while the rest estimates are insignificant. The negative beta indicates an inversion to performance. Considering the NAV returns, all the betas are positive and significant at least at the 10 percent level.

Finally, the results about Sortino ratio are qualitatively equal to those about Sortino ratio. Regarding price returns, two betas are positive and significant (similarly to Sharpe ratio), there is one significantly negative beta (years 2005-2006) and two insignificant beta estimates. When it comes to NAV returns, all but the first beta estimate (years 2002-2003) are positive and significant.

The main inference derived from the regression analysis applied to search for persistence patterns in ETFs' performance as compared to the market return is that the performance of ETFs is indeed strongly persistent and regardless of not reflecting managers' selection or market timing abilities (as the sample contains passively managed products which are not supposed to display such skills), it indicates that investors are highly likely to derive sufficient gains by choosing ETFs whose lagged return is superior to the lagged market return.

4.2 Tracking error measurement and persistence

The descriptive statistics of ETFs' tracking error are reported in Table IV. Presented are the average tracking error of the sample, the standard deviation of sample's estimated tracking error records, the median tracking error, the minimum and maximum tracking errors and the coefficients of skewness and kurtosis. The statistics are presented on an annual basis while the aggregate statistics of the period are also furnished in the table. Moreover, tracking errors are computed both in price return and NAV return terms.

According to the results in Table IV, the average tracking error of the sample is below the 1 percent, either if the price returns or the NAV returns are considered. The average (median) tracking error of the period is equal to 0.626 percent (0.354 percent) and 0.138 percent (0.121 percent) in price and NAV returns, respectively. Considering the fluctuation in annual average-tracking errors, the lowest estimate of the period in price returns terms concerns 2005 being equal to 0.424 percent whilst the maximum annual average-tracking error estimate is 0.908 percent and is observed in 2002. The corresponding estimates in NAV terms concern 2006 and 2002 being equal to 0.101 and 0.184 percent, respectively.

With respect to the volatility in tracking error records, the standard deviation estimates (both the annual ones and that of the whole period) are relevantly low indicating that the distribution of sample's tracking errors is not extremely variant. In particular, the period's standard deviation is 0.436 and 0.102 when the price and NAV returns are considered, respectively. However, the estimated minimum and maximum tracking errors indicate that there is a significant difference in extreme scores implying that the tracking error of ETFs varies from the one ETF to the other[4]. Finally, the estimate of skewness shows that the tracking error data are not skewed when the price returns are assessed. However, there seems to be a skewness issue when the NAV tracking errors are taken into account. The same pattern applies

Year	Average (%)	Median (%)	SD (%)	Min. (%)	Max. (%)	Skewness (%)	Kurtosis (%)
Panel A: price returns tracking error							
2002	0.908	0.671	0.597	0.234	2.420	0.753	−0.318
2003	0.627	0.362	0.424	0.172	1.705	0.721	−0.629
2004	0.494	0.276	0.350	0.139	1.392	0.685	−0.752
2005	0.424	0.230	0.292	0.128	1.019	0.516	−1.309
2006	0.460	0.248	0.382	0.110	1.380	0.829	−0.528
2007	0.657	0.317	0.579	0.129	2.050	1.021	−0.059
Period	0.626	0.354	0.436	0.180	1.664	0.681	−0.824
n	50	50	50	50	50	50	50
Panel B: NAV returns tracking error							
2002	0.184	0.123	0.173	0.016	0.751	1.344	1.394
2003	0.113	0.091	0.091	0.016	0.508	1.884	5.833
2004	0.093	0.064	0.076	0.011	0.404	1.925	4.910
2005	0.106	0.067	0.115	0.015	0.749	3.834	19.731
2006	0.101	0.068	0.112	0.012	0.744	4.181	22.603
2007	0.120	0.071	0.128	0.012	0.839	3.820	19.847
Period	0.138	0.121	0.102	0.017	0.584	1.870	6.239
n	50	50	50	50	50	50	50

Notes: This table presents the descriptive statistics of ETFs' tracking error; presented are the average tracking error of the sample, the standard deviation of the sample, the median tracking error of the sample, the minimum and maximum tracking errors of the sample, and the skewness and kurtosis coefficients of tracking error sample; tracking error is estimated as the standard deviation of daily return differences between ETFs and indices; Panel A presents estimates in price return terms and Panel B presents estimates in NAV return terms; *n* expresses the number of ETFs included in the sample

Table IV.
Tracking error of ETFs

to the kurtosis coefficients. More specifically, the price return tracking error estimates seem to follow the normal distribution while the NAV tracking errors are more leptokurtic than the normal distribution suggests.

When it comes to tracking error persistence, the results of the respective regression analysis are reported in Table V. Presented in the table are the alpha and beta estimates of the model, the *t*-tests evaluating the statistical significance of the estimates, and the R^2, which assess the explanatory power of the applied regression. The results in Table V reveal that the tracking error of ETFs is strongly persistent through time. All the beta coefficients are positive and statistically significant at the 10 percent or better. This finding applies both to price return tracking errors and NAV return tracking errors. The results suggest that the indexers should always bear in mind that the performance of the passively managed ETFs they choose to invest in is expected to slightly (or less slightly) deviate from the performance of the corresponding indexes in a persistent way and, therefore, they must be willing to receive less than the market performance.

4.3 Explaining tracking error persistence

The results of the cross-sectional regression analysis on the determinative variables of tracking error persistence are presented in Table VI. The table reports the estimates of expense ratio, age and risk of ETFs, the *t*-tests for the statistical significance of estimates and the R^2 for the sufficiency of the applied model at explaining tracking error. The results are presented on an annual basis while the model is estimated both with

Period	α	*t*-test	β	*t*-test	R^2
Panel A: price returns tracking error					
03 on 02	0.025	0.742	0.664*	13.765	0.875
04 on 03	−0.010	−0.776	0.803*	26.961	0.948
05 on 04	0.024	1.333	0.810*	27.276	0.939
06 on 05	−0.082*	−6.269	1.280*	25.606	0.957
07 on 06	0.001	0.054	1.425*	13.445	0.884
Panel B: NAV returns tracking error					
03 on 02	0.089*	4.785	0.131**	1.777	0.062
04 on 03	0.041*	2.833	0.463*	4.627	0.308
05 on 04	−0.019	−0.967	1.344*	4.929	0.790
06 on 05	0.003	0.587	0.925*	14.488	0.909
07 on 06	0.009	1.229	1.098*	22.255	0.912

Notes: Statistical significance at: *1 and **10 percent levels; the results of a cross-sectional regression model which searches for persistence patterns in ETFs' tracking error; the tracking error of ETFs in year t is regressed on the lagged tracking error in year $t-1$; the model is applied both to price returns and NAV returns

Table V. Tracking error persistence

the price return tracking errors (Panel A) and the NAV return tracking errors (Panel B). When we use the NAV return tracking errors, we remove the expense ratio from the model because NAVs are free from management expenses and therefore there must be no sensible relationship between tracking error and expense ratio. Finally, the model is applied both as a multi- and a single-factor model.

Panel A shows that the majority of expense, age and risk estimates are positive and highly significant at the 5 percent or better. This finding applies both to the estimates derived from the multiple regression model and the one-factor models and it also applies to each single year of the study period. Based on these results, we draw the conclusion that the considered variables significantly affect the tracking error of ETFs. Moreover, we infer that the persistence in tracking error depends on both ETFs' operational and non-operational factors as expenses are not the only element that influences the tracking efficiency of ETFs.

The results in Panel B are in line with the results in Panel A. More specifically, the majority of age and risk coefficients are positive and significant. However, the significance of the estimates is inferior to that of the results concerning the price return tracking errors. Nevertheless, the essence of regression outcomes is that the age and risk affect tracking error in a direct manner, even though the magnitude of the impact seems to be less significant than that when price return tracking errors are considered.

4.4 Predicting performance

The last researching issue concerns the predictability of ETFs' performance. The results of the relevant regression analysis on performance prediction are presented in Table VII. The model is successively applied using the raw return (Panel A), the Sharpe ratio (Panel B) and the Sortino ratio (Panel C). Moreover, the model is applied both to the trading price returns and NAV returns. Presented in the table are the estimates of δ coefficients of model (7), the t-statistics, the R^2 and the F-statistics which assess the overall statistical significance of the results.

Table VI.
Explaining tracking error persistence

Year	α	t-test	β_1	t-test	β_2	t-test	β_3	t-test	R^2
Panel A: price returns									
2002 Multiple Reg.	−1.591*	−9.008	1.433*	5.225	0.400*	5.035	0.774*	7.661	0.874
2002 Single Reg. 1	−0.175	−1.017	2.714*	6.825	–	–	–	–	0.718
2002 Single Reg. 2	−0.008	−0.042	–	–	0.727*	4.973	–	–	0.340
2002 Single Reg. 3	−0.746**	−2.577	–	–	–	–	0.789*	9.135	0.852
2003 Multiple Reg.	−1.195*	−9.321	0.830*	4.738	0.347*	4.463	0.757*	7.483	0.897
2003 Single Reg. 1	−0.011	−0.074	1.578*	5.250	–	–	–	–	0.782
2003 Single Reg. 2	−0.487**	−2.258	–	–	0.729*	6.088	–	–	0.436
2003 Single Reg. 3	−0.348***	−1.935	–	–	–	–	0.645*	7.393	0.869
2004 Multiple Reg.	0.047	0.111	0.445**	2.180	−0.167	−0.848	0.391*	6.437	0.905
2004 Single Reg. 1	0.030	0.221	1.144*	3.433	–	–	–	–	0.786
2004 Single Reg. 2	−0.772*	−3.748	–	–	0.730*	6.248	–	–	0.449
2004 Single Reg. 3	−0.129	−0.595	–	–	–	–	0.510*	7.248	0.882
2005 Multiple Reg.	−0.947*	−4.627	0.769*	3.602	0.360*	3.227	0.437*	4.152	0.785
2005 Single Reg. 1	−0.043	−0.451	1.145*	5.524	–	–	–	–	0.752
2005 Single Reg. 2	−0.875*	−3.908	–	–	0.683*	5.859	–	–	0.417
2005 Single Reg. 3	−0.085	−0.450	–	–	–	–	0.517*	5.794	0.788
2006 Multiple Reg.	−1.213*	−4.200	0.865*	3.414	0.404**	2.437	0.518*	4.152	0.772
2006 Single Reg. 1	−0.151***	−1.711	1.450*	4.980	–	–	–	–	0.663
2006 Single Reg. 2	−1.522*	−4.130	–	–	0.969*	5.416	–	–	0.379

(*continued*)

Year	α	t-test	β_1	t-test	β_2	t-test	β_3	t-test	R^2
2006 Single Reg. 3	−0.117	−0.875	–	–	–	–	0.563*	3.900	0.756
2007 Multiple Reg.	−2.428*	−4.586	0.983*	2.743	0.778*	2.455	0.772*	4.276	0.767
2007 Single Reg. 1	−0.256**	−2.316	2.237*	5.219	–	–	–	–	0.552
2007 Single Reg. 2	−2.963*	−4.513	–	–	1.668*	5.541	–	–	0.390
2007 Single Reg. 3	−0.436**	−2.412	–	–	–	–	0.795*	4.725	0.742
Panel B: NAV returns									
2002 Multiple Reg.	0.152	0.936	–	–	−0.015	−0.272	0.030	0.376	0.006
2002 Single Reg. 1	0.207*	2.818	–	–	−0.019	−0.436	–	–	0.003
2002 Single Reg. 2	0.127	0.964	–	–	–	–	0.034	0.443	0.004
2003 Multiple Reg.	−0.111	−1.483	–	–	0.117*	3.883	0.039	0.735	0.256
2003 Single Reg. 1	−0.068	−1.457	–	–	0.118*	3.974	–	–	0.245
2003 Single Reg. 2	0.047	0.665	–	–	–	–	0.056	0.926	0.018
2004 Multiple Reg.	−0.107***	−1.771	–	–	0.066**	2.127	0.091**	2.487	0.209
2004 Single Reg. 1	−0.040	−0.706	–	–	0.077**	2.375	–	–	0.105
2004 Single Reg. 2	−0.003	−0.078	–	–	–	–	0.102*	2.716	0.133
2005 Multiple Reg.	−0.310*	−2.851	–	–	0.103**	2.063	0.269*	4.219	0.322
2005 Single Reg. 1	−0.096	−0.861	–	–	0.106***	1.826	–	–	0.065
2005 Single Reg. 2	−0.115**	−2.071	–	–	–	–	0.271*	4.111	0.260
2006 Multiple Reg.	−0.114	−1.015	–	–	0.005	0.095	0.220*	4.599	0.340
2006 Single Reg. 1	−0.095	−0.708	–	–	0.096	1.473	–	–	0.043
2006 Single Reg. 2	−0.104	−1.076	–	–	–	–	0.221***	1.946	0.340
2007 Multiple Reg.	−0.433*	−4.024	–	–	0.088	1.047	0.304**	2.198	0.499
2007 Single Reg. 1	−0.261	−1.465	–	–	0.175**	2.149	–	–	0.088
2007 Single Reg. 2	−0.260***	−1.991	–	–	–	–	0.320*	2.758	0.478

Notes: Statistical significance at: *1, **5 and ***10 percent levels; this table presents the results of various multiple- and single-factor cross-sectional regression models which seek to explain the short-term persistence in ETFs' tracking error; the tracking error of ETFs in year t is regressed on the corresponding expense ratio (β_1), natural logarithm of age (β_2) and risk (β_3) estimated as the standard deviation of ETFs' daily returns; the model is applied both to price returns and NAV returns; when the net assets values returns are considered we remove the expense ratio from the model as returns are free from expenses

Table VI.

Table VII.
Predicting performance

	Price returns							NAV returns						
Period	δ_0	δ_4 (four stars)	δ_3 (three stars)	δ_2 (two stars)	δ_1 (one star)	R^2	*F*-stat.	δ_0	δ_4 (four stars)	δ_3 (three stars)	δ_2 (two stars)	δ_1 (one star)	R^2	*F*-stat.
Panel A – performance measure: raw return														
2003-	0.085*	−0.022	−0.011	−0.036**	−0.006	0.155	2.070	0.078*	−0.012	−0.007	−0.029**	−0.001	0.111	1.405
2007	(8.571)	(−1.571)	(−0.791)	(−2.563)	(−0.413)			(7.979)	(−0.878)	(−0.490)	(−2.052)	(−0.053)		
2004-	0.088*	−0.027**	−0.040*	−0.051*	−0.052*	0.353	6.132*	0.082*	−0.024***	−0.026**	−0.050*	−0.040*	0.286	4.506*
2007	(10.183)	(−2.170)	(−3.226)	(−4.125)	(−4.249)			(9.159)	(−1.862)	(−2.017)	(−3.951)	(−3.179)		
2005-	0.066*	−0.019	−0.005	−0.025	−0.030***	0.103	1.304	0.081*	−0.021	−0.034**	−0.045*	−0.055*	0.305	4.938*
2007	(5.926)	(−1.182)	(−0.324)	(−1.614)	(−1.860)			(8.408)	(−1.569)	(−2.500)	(−3.305)	(−4.033)		
2006-	0.079*	−0.001	−0.035**	−0.046*	−0.026	0.205	2.906**	0.082*	−0.011	−0.033***	−0.046*	−0.030***	0.172	2.336***
2007	(6.618)	(−0.071)	(−2.074)	(−2.705)	(−1.504)			(6.804)	(−0.670)	(−1.971)	(−2.704)	(−1.795)		
2007	0.081*	−0.041***	−0.078*	−0.058**	−0.050**	0.199	2.786**	0.124*	−0.075*	−0.097*	−0.115*	−0.156*	0.793	43.226*
	(4.703)	(−1.693)	(−3.202)	(−2.362)	(−2.042)			(14.181)	(−6.076)	(−7.801)	(−9.263)	(−12.562)		
Panel B – performance measure: Sharpe ratio														
2003-	0.060*	−0.016**	−0.003	−0.015***	−0.105***	0.159	2.132***	0.055*	0.004	0.003	−0.007*	−0.006	0.050	0.597
2007	(11.560)	(−2.172)	(−0.374)	(−1.987)	(−1.995)			(8.422)	(0.430)	(0.338)	(−0.768)	(−0.618)		
2004-	0.040*	−0.019**	0.011	−0.005	−0.004	0.252	3.781*	0.051*	−0.003	−0.008	−0.036*	−0.016	0.322	5.335*
2007	(6.952)	(−2.420)	(1.402)	(−0.641)	(−0.558)			(6.268)	(−0.287)	(−0.742)	(−3.904)	(−1.504)		
2005-	0.041*	−0.020**	−0.003	−0.026*	−0.016***	0.204	2.890**	0.045*	−0.016	−0.002	−0.028**	−0.021***	0.190	2.643**
2007	(6.337)	(−2.181)	(−0.359)	(−2.828)	(−1.696)			(5.933)	(−1.526)	(−0.166)	(−2.651)	(−1.963)		
2006-	0.037*	0.006	−0.011	−0.021***	−0.005	0.133	1.731	0.043*	0.002	−0.014	−0.025***	−0.008	0.112	1.412
2007	(4.693)	(0.541)	(−0.960)	(−1.888)	(−0.451)			(4.696)	(0.134)	(−1.088)	(−1.915)	(−0.589)		
2007	0.017	−0.001	−0.016	−0.016	−0.001	0.047	0.551	0.058*	−0.032*	−0.049*	−0.065*	−0.097*	0.883	84.530*
	(1.489)	(−0.096)	(−0.997)	(−1.031)	(−0.080)			(10.716)	(−5.478)	(−8.688)	(−11.183)	(−11.889)		
Panel C – performance measure: Sortino ratio														
2003-	0.078*	−0.003	0.011	−0.015	−0.015	0.159	2.128***	0.084*	−0.002	0.000	−0.006	−0.017	0.054	0.637
2007	(10.452)	(−0.299)	(1.041)	(−1.384)	(−1.421)			(9.253)	(−0.173)	(0.004)	(−0.485)	(−1.344)		
2004-	0.068*	−0.016	−0.036*	−0.022***	−0.009	0.186	2.565***	0.056*	−0.001	−0.008	0.013	−0.005	0.053	0.630
2007	(8.030)	(−1.307)	(−3.004)	(−1.838)	(−0.769)			(5.429)	(−0.043)	(−0.554)	(0.906)	(−0.363)		
2005-	0.047*	−0.001	0.003	−0.025***	−0.011	0.102	1.283	0.055*	−0.012	0.010	−0.031**	−0.021	0.174	2.366***
2007	(4.723)	(−0.097)	(0.211)	(−1.761)	(−0.744)			(5.139)	(−0.804)	(0.691)	(−2.037)	(−1.414)		
2006-	0.054*	0.004	−0.018	−0.032**	−0.011	0.133	1.733	0.058*	0.014	−0.027	−0.034***	−0.010	0.181	2.492***
2007	(4.926)	(0.270)	(−1.185)	(−2.044)	(−0.714)			(4.803)	(0.788)	(−1.529)	(−1.962)	(−0.609)		
2007	0.033**	−0.015	−0.037***	−0.034	−0.012	0.084	1.033	0.082*	−0.046*	−0.070*	−0.091*	−0.136*	0.884	85.671*
	(2.165)	(−0.712)	(−1.702)	(−1.582)	(−0.562)			(10.871)	(−5.828)	(−8.955)	(−11.340)	(−11.837)		

Notes: Statistical significance at: *1, **5 and ***10 percent levels; this table presents the results of a cross-sectional dummy variable regression model which assesses the predictability of ETFs' performance; performance is successively expressed as the raw return of ETFs, the Sharpe ratio and the Sortino ratio; the model is applied both to price returns and the NAV returns; the values in parentheses denote the *t*-tests for the difference of estimates from zero

Considering the raw return in Panel A, the results provide sufficient evidence on performance predictability. In particular, when the price raw returns are considered the estimations of the constant are all positive and significant at the 1 percent level indicating that the top-performing ETFs in a year are highly likely to perform well in the subsequent years. Moreover, the δ_4 to δ_1 estimates are all negative while the majority of them (12 out of 20 estimates) are statistically significant at the 10 percent or better. The negative estimates of δ_4 to δ_1 coefficients indicate that the ETFs that achieve inferior return with respect to the top performing ETFs in a specific year are likely to remain subordinate in comparison to the high valued ETFs in the next years. The results on NAV returns confirm the fact that the performance of ETFs is somehow predictable. All the constant estimates are positive and significant at the 1 percent level, all the estimations of the dummy variables are negative whilst 15 coefficients are statistically significant.

With reference to the Sharpe ratio and the trading price returns, the results on the predictability of ETFs' performance are weaker than the ones on raw returns, but they still indicate that the performance is partially predictable. More specifically, the constant estimations are all positive and four of them are significant at the 1 percent. Furthermore, 17 out of 20 δ_4 to δ_1 coefficients are negative and the rest three are positive but they are insignificant at any acceptable level. Finally, eight out of the 17 negative estimates are statistically significant at least at the 10 percent level. The results on Sharpe ratio estimated with the NAV returns do not differ significantly from the results in trading price terms. All the δ_0 estimations are positive and significant, 17 δ_4 to δ_1 coefficients are negative (nine of them are significant) and the rest three estimations, which are positive, are statistically insignificant.

When it comes to the last performance measure, the Sortino ratio, the results, both the ones derived from the price returns and those generated from the NAV returns, are basically in line with the results on raw return and Sharpe ratio even though their statistical significance is weaker than that of raw returns and Sharpe ratio. Specifically, all the ten individual constant estimates are positive and highly significant. The majority of the control variables estimates are negative (17 estimations in the case of price returns and 16 estimates in the case of NAV returns), the positive δ_4 to δ_1 estimations observed in Panel C are insignificant while there are five and six negative estimates in the case of price and NAV returns, respectively, which are significant at the 10 percent or better.

Overall, the regression analysis seems to be able enough to predict the future performance of ETFs. In addition, the raw return seems to be more predictable than the risk-adjusted performance. In any case, however, the lagged performance of ETFs is more or less indicative of the future returns. This argument is supported by the values of R^2 and F-statistics which are high enough and statistically significant for the majority of the performed annual regressions.

5. Concluding remarks

In this paper, we examine several properties related to the performance of ETFs. We do so using a sample of 50 iShares tracking various broad, sector and international capital market indexes and covering the six-year period 2002-2007. This period provides us with sufficient data to perform our empirical analysis.

The first issue we explore relates to the opportunities offered by ETFs to investors to receive returns above the market returns. In this approach, we use the S&P 500 Index as a proxy for market return because this is the most widely adopted market benchmark in academic research on the ability of active management to beat the market and offer investors above-average performance. Even though ETFs are basically passive investing products, there are reports arguing that investors can apply more active investing strategies by building a portfolio consisted of a wide range of assets belonging both to large- and small-cap stocks, growth and value stocks, domestic and international stocks and developed and emerging market stocks so as to obtain a positive alpha. The results reveal that the majority of the selected ETFs outperform the market, either when the raw return is considered or the risk-adjusted performance expressed by the Sharpe ratio and the Sortino ratio is taken into account. In addition, the outperformance of ETFs holds both at the annual and the aggregate levels. In addition to the comparison between the ETF and market performances, we search for persistence patterns in ETFs' outperformance in regard of the market. The applied regression analysis demonstrates that the return superiority of ETFs persists at the short-term level.

The following property of ETFs examined concerns their ability to accurately replicate the performance of the underlying benchmarks, the persistence in the tracking inefficiency and the factors that explain this persistence. On the first hand, we estimate an aggregate tracking error of 0.626 percent (when the trading prices of ETFs used to compute returns) and a corresponding tracking error of 0.138 percent (in NAV return terms). Regression analysis on annual tracking error records shows that tracking error is strongly persistent at the short-term level. In order to explain why tracking error persists, we regress tracking error on operational elements, such as expenses and risk, and non-operational features, such as age, finding that these factors are meaningful in determining the tracking error of ETFs and explaining its persistence through time.

In the last step, we search for predicable patterns in ETFs' performance. More specifically, we assess whether the ranking of ETFs' performance in a specific can be indicative of future rankings. The results of the analysis provide strong evidence on return predictability. In particular, the top-performing ETFs in a specific year continue to perform well in the subsequent years while there is also evidence that they continue to outperform their inferior counterparts.

Notes

1. Powershares launched the first four US-based actively managed ETFs on April 30, 2008.
2. Yannick, Daniel, "Leverage opportunities in alpha generation with exchange-traded funds", Societe Generale Corporate and Investment Banking.
3. It is a fact that, in general, the expense ratios of ETFs are materially low with respect to the expense ratios charged by open-ended index funds or the actively managed mutual funds and, as a result, they do not fluctuate significantly through time.
4. The higher tracking error estimates concerns the ETFs that invest in international capital markets while the lowest tracking errors relates to the domestically invested (either in broad or sector market indexes) ETFs. This trend might be due to higher expenses charged by international ETFs, the time difference between the trading hours of USA and local markets out of the USA, and the greater risk to which international ETFs are usually exposed. The impact of some of these factors is examined in a subsequent section. The tracking error superiority of international ETFs is not clearly reported in Table IV. However, the corresponding tracking error estimates are available upon request.

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