The Dark Side of ETFs

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OCTOBER 2013

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JEL classification: D14, G11, G28

Keywords: household finance, individual investors, ETFs, passive investing, active investing, security selection, market timing

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* Bhattacharya is affiliated with the Indiana University Kelley School of Business. Loos, Meyer, Hackethal and Kaesler are affiliated with Goethe University in Frankfurt. For useful comments and discussions, we thank Dimitris Georgarakos, Craig Holden, Roman Inderst, Jose Martinez, Andrei Shleifer, Noah Stoffman and Joachim Weber. Conference and seminar comments at American, Cincinnati, the EFA meetings in Cambridge, GWU, Goethe University, IIM Ahmedabad, IIM Bangalore, IIM Kolkata, Indiana, ISB Hyderabad, Lehigh, Minnesota, Vanderbilt, WHU Otto Beisheim School of Management and York significantly improved the paper.

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The Dark Side of ETFs

One of the most successful investment products of the last twenty years is the Exchange Traded Fund (ETF).[1] The first ETF was launched in Canada in 1990. In 2012, there were 4,731 ETFs with $2 trillion in assets (the same size as the hedge fund asset class), accounting for 16% of NYSE trading volume.[2]

This paper investigates whether these ETFs have benefited individual investors and, if not, why.[3] This is an important question to answer considering how popular ETFs are becoming even among individual investors.[4] Companies are actively seeking ways to include ETFs in 401(k) defined-contribution plans.[5] Even some regulators are promoting ETFs to individual investors.[6]

The null hypothesis is that individual investors have benefited by using passive ETFs. Classical finance theory supports this hypothesis. These products are linked to well-diversified security baskets, and the benefits of diversification have been formalized in seminal papers in

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[1] An ETF is an index-linked security. These are instruments that aim to replicate the movements of a particular market and therefore enable the investor to easily buy and sell a broadly diversified portfolio of securities. Investors can buy and sell ETF shares in public markets anytime during the trading day.

[2] "Exchange-traded funds: Twenty years young," *Economist*, Jan 26, 2013.

[3] In this paper, we look only at passive ETFs, which aim to mimic an index. Active ETFs, which aim to outperform an index, are not the subject of this paper.

[4] Charles Schwab, the biggest U.S. discount brokerage, offers more than 120 commission-free ETFs to individual investors (Schwab ETF OneSource).

[5] "Are ETFs and 401(k) Plans a Bad Fit?" *Wall Street Journal*, April 5, 2012.

[6] The Securities and Markets Stakeholder Group of the European Securities and Markets Authority (ESMA) states that "ETFs are a low cost and straightforward investment proposition for investors and as such, ESMA should investigate how to make indexed ETFs more offered to individual investors." (ESMA Report and Consultation paper – Guidelines on ETFs and other UCITS issues, 25 July 2012, http://www.esma.europa.eu/system/files/2012-474.pdf, p. 32).

finance.[7] Boldin and Cici (2010) reviewed the entire empirical literature on index-linked securities and discussed their benefits. French (2008) measured the benefits of passive investing and concluded, "the typical investor would increase his average annual return by 67 basis points over the 1980-2006 period if he switched to a passive market portfolio." Benefits of diversification and passive investing may be even more pronounced for individual investors, given that they significantly under-diversify and over-trade.[8] ETFs have other benefits. Their fees are lower compared to many other investment products. Second, ETFs trade in real time. Third, ETFs have tax advantages (Poterba and Shoven 2002).

The alternate hypothesis is that individual investors have not benefited by using index-linked securities like ETFs.[9] There is some evidence that investors may not be using index-linked products wisely. Hortaçsu and Syverson (2004) found large fee dispersions although the analyzed index funds were financially homogeneous. Similarly, Elton, Gruber and Busse (2004) showed that S&P 500 index funds have become commodities that differ from each other principally in price. However, they also found that investors in these funds irrationally prefer more expensive funds. Choi, Laibson and Madrian (2010) confirmed this behavior in an experiment and found that more financially sophisticated investors pay fewer fees. Second, it is conceivable that although ETFs force the individual investor to buy a basket and therefore curb

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[7] Markowitz (1952) suggested we diversify by buying optimal portfolios. Tobin (1958) suggested that we require only one optimal portfolio provided that a risk-free asset exists. In his capital asset pricing model (CAPM), Sharpe (1964) concluded that this optimal portfolio was the market portfolio.

[8] The portfolios of individual investors who participate in equity markets typically show sub-optimal degrees of diversification (e.g., Blume and Friend 1975; Kelly 1995; Goetzmann and Kumar 2008) and concentration on the home region ("home bias", e.g., French and Poterba 1991; Cooper and Kaplanis 1994; Lewis 1999; Huberman, 2001; Zhu 2002; Ahearne, Griever and Warnock 2004; and Calvet, Campbell and Sodini 2007). They are also shown to trade too much (Odean 1999; Barber and Odean 2000).

[9] As this paper is concerned with the performance effect of ETFs on individual investors, we treat all ETFs alike. Particularly, we do not differentiate whether ETFs are synthetic or fully replicating, despite the fact that synthetic ETFs may entail additional risk (Ramaswamy 2011).

his temptation to pick stocks, these securities, because they are highly correlated with the index and are easy to trade, may enhance his temptation to time the underlying index.[10] Third, it seems conceivable that investors may have difficulty choosing because ETFs are now linked to more than 200 different underlying indices (cf. Blackrock 2011). Moreover, many of these indices mimic not just well-diversified market baskets but sectors or industries. Fourth, issuers of ETFs may be subjected to conflicts of interest resulting in increased asset volatility and/or a (small) price discount (Cheng, Massa and Zhang 2013).

The key contribution of this paper (to our knowledge, the first of its kind) is that we use the individual trading data of a large number of individual investors to test the null hypothesis.[11]

Who uses ETFs? In terms of demographics, users of ETFs tend to be younger and have a shorter relationship with the brokerage bank. In terms of portfolio characteristics, users are wealthier in terms of both portfolio value and overall wealth. Müller and Weber (2010), using a survey methodology, reported comparable results.

However, the key question is what occurs once investors use ETFs. So we compare the portfolio performance of users with all non-users in a panel setting. The research design we employ is a generalization of the calendar-time portfolio approach. The panel setting allows us to control for investor fixed effects, and so we need not worry about the fact that the use of ETFs is dependent on time-invariant investor characteristics. The panel setting also allows us to control for time-varying portfolio characteristics, and so we need not worry about the fact that the use of ETFs is dependent on time-varying portfolio characteristics like portfolio performance

[10] In Germany, by 2009, the turnover in ETFs (data obtained from Deutsche Börse 2010) had become about the same as the turnover in stocks (data obtained from the World Federation of Exchanges 2013).

[11] In essence, we test whether the portfolio performance of individual investors improve after they use ETFs. An ex-ante test like the one proposed by Calvet, Campbell and Sodini (2007) will fail to incorporate the effects of trading.

until that point in time. The panel setting also allows us to control for year fixed effects, and so we need not worry about the fact that users of ETFs hold them at different points in time. We use Driscoll and Kraay (1998) standard errors to correct for cross-sectional correlation.

To measure the performance contribution of ETF holdings we not only look at raw returns but also at risk-adjusted returns using 1-, 4-, and 5- risk-factors. We then decompose returns into market timing and security selection. As market timing is defined only with respect to a benchmark, we use a global index (MSCI All Country World) as well as the broadest local index (CDAX) as our benchmarks. The first benchmark is for global investors and the second benchmark is for local investors, but since we do not know which investor is what type of investor, we use both indices for robustness.

Using the above research design, we find that portfolio performance, as measured by any of the above portfolio performance measures using any benchmark index, is always decreasing with an increased use of ETFs, sometimes significantly so. Our conclusion is that individual users of ETFs do not improve their portfolio performance by using ETFs.

We next analyze why there is no improvement in portfolio performance for the users during an ETF use. It could be because of the unwise use of ETFs or it could be because of the unwise use of the non-ETFs. To rule out the latter reason, we do a split portfolio analysis: we divide the users' portfolios into ETFs and non-ETFs. We analyze the performance of these two parts separately, compare them to the full portfolio, and test the differences at the single investor level. We find that the performance deterioration experienced by the users after ETF use is driven by the ETFs. We also find that the addition of ETFs makes the full portfolio less efficient (the Sharpe ratio of the full portfolio is lower than the Sharpe ratio of the non-ETF part). This means that investors not only have a worse performance in their ETF part as compared to their non-ETF part, but even the diversification benefit to the full portfolio that ETFs are supposed to bring is non-existent.

Now that we have established that the cause of performance deterioration experienced by users is their use of ETFs, we go on to investigate how they use, or rather misuse, these products. As in Odean (1999), we use all purchases and sales transactions in ETFs to measure security selection and market timing skills. We find that the returns following ETF purchases are significantly lower than returns following ETF sales. If we decompose these buy and sell returns into the return due to market movements (market timing) and the residual return (security selection), we find that the deterioration in buy minus sell returns is coming from market timing. On the other hand, security selection often improves after ETF use. Results are similar for both CDAX and MSCI World All Country benchmarks.

It could be that market timing is very bad and security selection is slightly good with ETFs, but an investor may show the same type of performance decomposition in the non-ETF part of the portfolio as well. To rule this out, we repeat our analysis for the non-ETF part of the portfolios of the users. If we decompose the non-ETF buy and sell returns into the return due to market movements (market timing) and the residual return (security selection), we find that the returns to market timing are much worse for ETF transactions than for non-ETF transactions. Results are similar for both CDAX and MSCI World All Country.

A final concern of our interpretation is that individual investors may not be using the ETFs for market timing but are using the ETFs as cash. If so, a positive (negative) liquidity shock leads to the purchase (sale) of an ETF, and if these liquidity shocks are negatively correlated with future market returns, we may erroneously conclude bad market timing after ETF use. We find the opposite: a sale (purchase) of an ETF actually is associated with a rise (fall) in the portfolio value.

The above results allow us to conclude that the slight drop in portfolio performance after ETF use that we observe is because the bad market timing with ETFs is being somewhat ameliorated by good security selection with ETFs and non-ETFs.

By definition, trading in ETFs is trading in baskets. This should prevent individual investors from making wrong stock picks, and so it should not be surprising to find that users of ETFs linked to broad indices should improve their security selection skills after using these products. The result that is surprising is that our tests show that users of ETFs worsen their market timing ability by using these products. The reason must be that users employ these easy-to-trade securities that are highly correlated with the market to make bets on market phases, and they bet wrong.[12]

Section I details the data. Section II examines which individual customers are most likely to use ETFs. Section III investigates whether users improve their portfolio performance compared with non-users and finds that the answer is no. Section IV examines why users do not improve their relative portfolio performance. Section V concludes.

I. Data

a. ETFs and Index-linked Securities in Germany

As in the U.S., in Germany individuals who want to invest in index-linked securities may choose Exchange Traded Funds (ETFs) and/or index mutual funds.

[12] In our sample, the average correlation of an ETF is 55% with CDAX and 49% with MSCI World All Country. Compare this to the average correlation of the other securities, which is 25% with CDAX and 24% with MSCI World All Country.

Panel A in Table I summarizes the market for index-linked securities in Germany. Panel B in Table I provides the same data for the U.S. Panel C in Table I provides the same for our German sample. For each of the three panels, index-linked securities are compared with the active mutual fund market. As a result of data availability, the three panels represent a snapshot of the market at different times. For Germany and the U.S., the data for the end of 2011 are available, whereas these data for our sample are available only for the end of 2009.

[INSERT TABLE I ABOUT HERE]

The last column in Table I, Panels A and B, shows that the total assets under management invested in index-linked securities relative to total active mutual fund investments, a ratio of about 20%, is comparable between Germany and the U.S. Panels A and B also tell us that the market in the U.S., as expected, is much larger as measured by assets under management or the number of index-linked products offered. Interestingly, in terms of assets under management, the market splits almost evenly between passive ETFs and index mutual funds in the U.S., whereas in Germany, passive ETFs comprise 84% of the market.

If Panel A (Germany) is compared with Panel C (our sample) in Table I, in terms of the proportion of assets under management in each security class, our sample seems to be representative of the entire German market.

b. ETFs

We focus only on ETFs in this paper for two reasons. First, as can be seen in Table I, ETFs are the predominant index-linked security in Germany as well as in our sample. Second, as the construction and trading of index funds are different from ETFs, we do not want to bundle the two together. Among ETFs, equity-based ETFs form about 80% of all ETFs in Germany

(Deutsche Börse (2010)). In our sample, equity-based ETFs are even more important and make up 83%.

Table II shows how individual investors in our sample actually use the ETFs.

[INSERT TABLE II ABOUT HERE]

Panel A of Table II tells us that the individual investors in our sample have many choices when it comes to selecting ETFs. It is a very fragmented market. Although the top 10 benchmark indices constitute over 60% of the assets under management in ETFs, 207 other benchmark indices make up the remainder. Notice that the popular indices are connected to Germany, Europe and the World, which motivates us to use the local German index, CDAX, and a global index, MSCI World All Country, as our two choices of benchmark indices.

Panel B of Table II examines the regional allocations of these ETFs. Germany is the most popular, followed by Europe. German individual investors, like individual investors all over the world, exhibit home bias.

Panel C of Table II examines the asset class of ETFs. We find that ETFs based on equity indices dominate (83.4% of assets under management), which further justifies our use of equity indices like MSCI World All Country and CDAX as benchmarks. However, as there are a few bond and commodity based ETFs as well, we also use a 5-factor model in our main test for robustness.

Panel A told us that many German ETFs are linked to narrow indices; so it is likely that they also offer more choices for timing certain asset classes, sectors or countries, rather than opportunities for broad diversification. If so, their beta loadings with respect to our benchmarks, MSCI World All Country and CDAX, could be very different from 1. To analyze this issue, in Panel D of Table II, we show the beta loadings of all ETFs with respect to the MSCI World All

Country and the CDAX. The beta loadings are 0.87 and 0.70 and they are statistically significantly different from 1. However, if we narrow our sample to equity ETFs, the beta loading with respect to MSCI World All Country cannot be distinguished from 1, but the beta loading with respect to CDAX is still different from 1. Panel D of Table II also tells us that the tracking errors are high. But the most important thing that Panel D of Table II tells us is that, though many of these ETFs may not be tracking the MSCI World All Country or CDAX perfectly, they are not bad investment products because their alphas with respect to the indices are indistinguishable from zero.

c. Individual Investors

The brokerage that we work with was founded as a direct bank with a focus on offering brokerage services via telephone and the Internet. In 2009, to retain existing customers and attract new ones, the brokerage introduced a financial advisory service, which offered free financial advice to a random sample of about 8,000 investors. Approximately 96% of these individual investors refused the financial advice and continued trading as before.[13] Our starting sample is these 7,761 investors. The knowledge that these investors refused to opt for advice assures us that our sample is composed of self-directed investors whose decisions are not distorted by a third party. As we are focusing on ETFs, we remove investors who use index mutual funds. We additionally restrict our sample to investors who on average have at least 5,000 Euros in their portfolios. We do so to avoid a bias introduced by small play money accounts. Our final sample comprises 6,956 investors in an unbalanced panel that begins on August 2005 and ends on March 2010. Of these 6.656 investors, 1,087 investors traded at least

[13] Bhattacharya et al. (2012) analyze the same sample with a focus on the 5% of the individual customers who accepted the advice.

one ETF in this sample period – the “users” – and 5,869 investors who traded no indexed-linked security in this sample period – the “non-users”.

[INSERT FIGURE 1 ABOUT HERE]

The dashed gray line in Figure 1 shows the growing popularity of ETFs in our sample. The solid black line in Figure 1 shows the share of ETFs in the portfolio of an average individual investor. It seems that once investors have switched to ETFs, their weight in the portfolio hardly exceeds 20%. The sharp increase in ETF-share in December 2008 is supposedly related to a tax change in Germany. From 2009 onwards, all capital gains and losses, irrespective of the holding period, are subject to taxation. Gains and losses from securities purchased before the end of 2008, if held for longer than 1 year, are tax free. Thus, it is possible that some investors switched to ETFs to ensure a tax advantage. Because stock returns were above average in 2009, the effect of switching to ETFs for tax reasons in this year would show up as s spurious benefit of ETF usage. In order to mitigate this effect, we include year fixed-effects. The positive bias may still remain after the inclusion of year fixed-effects, but this positive bias goes against our results because our results show ETF usage to negatively affect portfolio performance.

We collected data on client demographics, monthly position statements and daily transaction records for both users and non-users in the sample period. Client demographics were collected from the bank and are comprised of gender, age and micro geographic status. The micro geographic status variable measures the average wealth level of individuals who inhabit a given micro area (street level address). The variable has nine categories, with category nine comprising the wealthiest individuals. This variable is provided by a specialized data service that uses several factors (such as house type and size, dominant car brands, rent per square meter and the unemployment rate) to construct the variable.

In addition, account characteristics were provided by the bank. For all of the customers, we possess monthly position statements, daily transaction data and account transfers for the period August 2005 to March 2010. The account opening date enables us to compute the length of the relationship between a customer and the brokerage. Monthly position statements combined with transactions, transfers and securities' returns enable us to compute daily position statements and the average risky portfolio value over the entire period. In addition, we have information on the cash accounts of each customer at the beginning and the end of our sample period, which enables us to calculate the risky share as the risky portfolio value divided by financial wealth with the brokerage (risky portfolio value plus cash value). We use our transaction records to calculate portfolio turnover and number of trades per month, as in Barber and Odean (2002). We also obtain monthly return series for the following factors: a market factor (CDAX or MSCI World All Country), a bond factor (RDAX or JP Morgan Global Bond), small minus big (SMB), high minus low (HML) and the momentum factor (MOM). The sources of this data are given in Table III.

[INSERT TABLE III ABOUT HERE]

We first infer the daily holdings from the monthly position statements, security transactions and account transfers. To obtain the next end-of-day holdings, we multiply the end-of-day value of each holding by the corresponding price return (excluding dividends but considering any capital actions) for that security. These holdings are then properly adjusted for any sales, purchases and account transfers that occurred that same day. We repeat this procedure for each security and investor for each trading day in a given month. The holdings on the last day of each month are then reconciled with the true holdings obtained from the brokerage.

Second, we compute daily portfolio returns as the weighted average of the returns of all of the securities held, purchased or sold by the investor on that day. We use total return data (including dividends) for securities without transactions on that day. For securities that are either purchased or sold, we consider exact transaction prices to compute returns. We weight each security's return to calculate the investors' daily portfolio returns. All of the holdings and sales are weighted using euro values on the basis of the previous day's closing prices. All of the purchases are weighted using the transaction value in euros.

Finally, we calculate daily portfolio returns before (gross) and after (net) direct transaction costs. The difference between gross and net returns is because of brokerage fees and bank commissions. In line with Seasholes and Zhu (2010) we winsorize the resulting return series at the 0.05%-level. We show results using only net returns. However, our results are independent of whether we use gross or net returns. This shows that the results are not influenced by excessive trading by individual investors in ETFs or other assets or by lower fees of ETFs.

II. Who uses ETFs?

Table IV provides summary statistics about the investors in our sample. This table divides the sample group into users and non-users. The p-values of the t-tests from our tests for the equality of variables across these two groups are provided in the last column.

[INSERT TABLE IV ABOUT HERE]

Table IV shows that users and non-users differ. In this univariate setting, users of ETFs seem to be slightly younger and wealthier. Moreover, they have a shorter relationship with this bank, higher risky portfolio value during the sample period, a higher share of their portfolio in risky securities at the end of the sample period, and they trade more often during the sample period. We do not find any differences in alphas, which is consistent with the view that there are no significant differences in skill or sophistication between users and non-users.

[INSERT TABLE V ABOUT HERE]

Table V formally tests the findings of Table IV in a multivariate probit model. The dependent variable is set to one if an investor opted to use ETFs at least once in our sample period and is set to zero otherwise. The independent variables are the time-invariant variables that we know at the start of our sample. Table V tells us that it is really younger and wealthier (in terms of portfolio value) investors who are more likely to use ETFs. This is consistent with numerous findings in the marketing literature (see, for example, Dickerson and Gentry (1983)) that document early adopters to be younger and wealthier.

III. Does the Use of ETFs Improve Users' Portfolio Performance?

We now address the most important question of our study: do users benefit from ETFs?

In order to address this question, our analysis uses data from all users as well as all non-users in our entire sample period. Our primary research design is to estimate the following model using a generalized calendar time approach with investor fixed-effects and time fixed-effects:

$$r_{i,t} = \alpha_i + \beta_1 * \boldsymbol{ETF_{i,t}} + \beta_2 * \boldsymbol{MF_t} + \beta_3 * \boldsymbol{IC_{i,(t-1-t-126)}} + \beta_4 * \boldsymbol{TF_t} + \beta_5 * \left(\boldsymbol{MF}_t * \boldsymbol{IC}_{i,(t-1-t-126)}\right) + \beta_6 * \left(\boldsymbol{MF}_t * \boldsymbol{ETF}_{i,t}\right) + \beta_7 * (\boldsymbol{MF}_t * \boldsymbol{TF}_t) + \varepsilon_j \quad (1)$$

where $r_{i,t}$ is the excess net return on investor i's portfolio in time period t. α_i denotes the fixed-effects of investor i. $\boldsymbol{ETF_{i,t}}$ is a continuous variable measuring the fraction of the portfolio investor i has invested in ETFs in time period t. $\boldsymbol{MF_t}$ is a vector representing the return of the market factors in time period t. Depending on the specification, this vector may contain nothing or just the market index (MSCI World All Country or CDAX) or the additional factors like SMB (small-minus-big), HML (high-minus-low), MOM (Momentum factor) or a bond factor. $\boldsymbol{IC}_{\boldsymbol{i},(\boldsymbol{t-1-t-126})}$ is a vector of time varying characteristics (log of the portfolio value, alpha, turnover and number of trades) of investor i over the time period from t-126 (days) to t-1. $\boldsymbol{TF_t}$ represents a vector with time (year) fixed effects. We follow Hoechle, Schmid and Zimmerman (2009) and include interaction terms between the investor characteristics ($\boldsymbol{ETF_{i,t}}$ and $\boldsymbol{IC}_{\boldsymbol{i},(\boldsymbol{t-1-t-126})}$) and the market variables ($\boldsymbol{MF}_t$) to maintain the fundamental structure of the regression model.

The coefficient, β_1, is our coefficient of interest. It measures the marginal effect on portfolio performance when the fraction of ETF use increases. If we run the above equation without $\boldsymbol{MF}_t$, this coefficient measure the portfolio performance increase without risk-adjusting, whereas if we run the above equation with $\boldsymbol{MF}_t$, this coefficient measures the portfolio performance increase after risk-adjustment. The β_2 coefficients are therefore the betas or factor sensitivities with respect to the risk factors. Note that we allow different factor sensitivities for users and non-users.

Finally, though investor fixed effects control for all time-invariant characteristics of investors, the criticism remains that the choice of using an ETF is still endogenous because we have not controlled for the time-varying characteristics of an investor. To mitigate this, we control for the time-varying characteristics of the investor that we have discovered to have an effect on the choice of using an ETF in Table V. This was log portfolio value. We add number of trades and portfolio turnover as two measures of trading behavior. We also add past performance measured by a 1-factor alpha with the CDAX as the benchmark. We use the rolling moving average of the past 126 trading days for each of these four variables. The β_3 coefficients are therefore the coefficients with respect to these time-varying characteristics of an investor. Note that we allow these coefficients to differ across the risk factors by interacting the factors with the time-varying characteristics.

Model (1) has many advantages. First, as shown by Hoechle, Schmid and Zimmerman (2009), it is a generalization of the calendar time specification where investors are of different types. The calendar time specification is preferred in the literature to the event time specification.[14] Second, by putting equal weight on investors as well as dates, it does address a criticism of the calendar time approach, which is that this approach puts more emphasis on dates than investors. Third, by using fixed effects and controlling for time-varying characteristics that seem to matter, it mitigates the endogeneity issue. Fourth, in our context, it is better than the alternate technique, which is the matching technique.[15] Fifth, and finally, the estimation uses OLS and allows applying Driscoll and Kraay (1998) standard errors, which have been shown to be particularly robust to cross-correlation.

Table VI gives us the results.

[INSERT TABLE VI ABOUT HERE]

[14] Papers by Fama (1998) and Mitchell and Stafford (2000) argue strongly in favor of the calendar-time approach. Seasholes and Zhu (2010) lay out four advantages of the calendar time approach that are particularly relevant in our case: calendar time portfolios do not suffer from cross-correlation problems, dampen the effect of small stocks on returns, allow the study of geographic effects, and use a data set's entire time series. However, calendar-time approaches are also criticized in the literature. Loughran and Ritter (2000) note that in unbalanced panels the calendar-time approach underweights observations from periods with a large number of observations and over-weights observations from periods with a small number of observations. Loughran and Ritter (2000) argue that "tests that weight firms equally should have more power than tests that weight each time period equally."

[15] Matching is difficult in our context because user and non-user characteristics change every day. Even if it was possible, matching is always contentious because results are very dependent on the matching technique, and no consensus exists as to the best technique to use. Finally, specification (1) uses all non-users and not just matched non-users. A previous version of this paper used the matching technique. The results were similar.

The first column gives the results for raw returns. The other columns give the results for risk-adjusted returns. The second column risk adjusts using the one-factor MSCI World All Country, the third column risk adjusts using the MSCI World All Country factor and a world bond factor, the fourth column risk adjusts using the 1-factor CDAX, the fifth column risk adjusts using the CDAX factor and a local German bond factor, the sixth column risk adjusts using the 4-factor model that uses the CDAX factor, and the seventh column risk adjusts using the 5-factor model that uses the CDAX factor and a local German bond factor.

In all these columns, we notice that the portfolio performance of the user decreases as his usage of ETF increases. In the last four columns, this decrease is statistically significant. Our conservative conclusion is that individual investors do not improve their portfolio performance after using ETFs.

IV. Why Does Portfolio Performance Not Improve for the Users?

This section delves into possible reasons why users of ETFs do not improve their portfolio performance.

Unwise use of ETFs may explain the worsening of users' portfolio performance. Another reason could be that the returns of other securities deteriorate. To rule out the latter reason, we now compare the ETF part and the non-ETF part and the performance of the full (ETFs plus non-ETFs) portfolio of users. In order to perform a fair comparison, two minor adjustments are made. First, to be included in this comparison, we require each user to have a non-consecutive minimum holding period of an ETF for at least 6 months.[16] Second, all performance measures

[16] Our results are robust to not using this screen.

are calculated only when an investor holds both ETFs and non-ETFs simultaneously, thereby ruling out biases that might originate from differences in market phases or time periods.

[INSERT TABLE VII ABOUT HERE]

Table VII reports some descriptive statistics. Comparing the ETF part of the portfolio with the non-ETF part, columns (1) vs. (2), all performance measures show a statistically significant underperformance of the ETF part versus the non-ETF part. Raw returns, both gross and net, are lower (gross: 7% vs. 11.8%, net: 5.4% vs. 11%), the standard deviation is higher (25.5% vs. 21.6%), and the Sharpe ratio is lower (gross: 0.267 vs. 0.605, net: 0.193 vs. 0.559).

It is, however, still possible for investors to combine ETF securities with other securities in such a way as to end up with a more efficient full portfolio overall. This can be analyzed when comparing the performance of the non-ETF part with the full portfolio including the ETF part, i.e., column (2) vs. (3).

We notice in this comparison that the risks are lower in the full portfolio in terms of standard deviation, which implies that ETFs seem to have positively affected the diversification of the full portfolio. However, in terms of performance, the inclusion of these ETFs results in a total portfolio performance that is worse in terms of raw returns. It can be concluded that ETFs definitely do not help investors improve the performance of their portfolios. What is more interesting is that the Sharpe ratio deteriorates, which implies that ETFs do not even help these users to improve the efficiency of their portfolios.

We now explore the difference in performance between the ETF part and the non-ETF part of a user's portfolio more formally. We again narrow our sample to just users. We then run a panel regression where the dependent variable is the difference in daily return between the ETF part and the non-ETF part of a user's portfolio. The independent variables are simply appropriate permutations and combinations of the MSCI World All Country factor, the CDAX factor, a world bond factor, a German bond factor, the SMB factor, the HML factor and the Momentum factor. Table VIII reports the results.

[INSERT TABLE VIII ABOUT HERE]

The constant term in all models in Table VIII is negative and significant. This tells us that the ETF part has lower return than the non-ETF part, both in terms of raw returns, and in terms of risk-adjusted returns, however you adjust risk. We conclude that the performance of the ETFs in a user's portfolio was worse than the performance of the rest of the portfolio. This means that the unwise use of ETFs explains the worsening of users' portfolio performance and not the worsening of the returns of the other securities.

Is the drop in portfolio performance of the users due to the fact that they start trading too much after ETF use? We examine this question formally. We run a panel regression where the dependent variables are different measures of trading activity – turnover of purchases, turnover of sales, turnover of portfolio, number of trades and turnover per trade. We use all users and non-users. The independent variables are the same as that used in estimation (1) except the risk factors. The estimation is done in a similar fashion. Table IX reports the results.

[INSERT TABLE IX ABOUT HERE]

Table IX tells us that overall trading behavior did not change for users when they are using ETFs. It is true that their sell turnover and number of trades is lower when they are holding ETFs, but their Euro flow per trade increased, keeping turnover unchanged. These results tell us that trading behavior of ETF users remains about the same when holding ETFs, and their trading behavior in the ETF part and the non-ETF part is about the same.

Is the drop in in portfolio performance of the users due to the fact that ETFs are bad investment products? The answer is no. Recall from Panel D of Table II that, though many of the ETFs do not track the MSCI World All Country or CDAX well, they are not bad investment products because their alphas with respect to the indices are indistinguishable from zero.

Now that we have ruled out three possibilities than can explain the portfolio performance deterioration of ETF users after use – unwise non-ETF trading after use, excessive trading after use, choice of bad ETFs – we go on to explore another possibility. The negative performance contribution of ETFs might stem from choices of which securities to buy or to sell (security selection) or choices of when to buy or to sell a security (market timing).

We use a measure proposed by Odean (1999) to decompose returns into returns due to market timing and security selection. Odean (1999) analyzes the returns to purchases and sales of securities over three defined holding periods. By referring to Benartzi and Thaler (1995), who show that the average holding period in the US is about a year, Odean (1999) chooses holding periods of 84, 252 and 504 trading days.

Odean (1999) then subtracts a benchmark return from the returns of securities bought and sold. The performance difference of these market-adjusted returns between purchases and sales over a holding period is attributed to security selection. The difference of market returns during purchases and sales over a holding period is a measure of market timing. This is because a good market timer buys when the market is low and sells when the market is high. The day of the transaction is excluded to avoid a potential bid-ask spread bias.

We follow Odean (1999) with some changes. In our sample, the average holding period is 121 days. So we set our holding periods to 20 (1 month), 126 (1/2 year) and 252 (1 year) trading days. Second, in contrast to the bootstrapping approach Odean (1999) adopts to cope with cross-correlation, we again use cross-correlation robust Driscoll and Kraay (1998) standard errors, when reporting significances[17].

The research design is a panel regression where the dependent variable is raw return of a security over a T day holding period, or the market-adjusted return of a security (this measures security selection) over a T day holding period, or market return (this measures market timing) over a T day holding period. The MSCI World All Country and the CDAX are used as proxies for the market. T is 20 days, or 126 days, or 252 days. The independent variables of the panel regressions are: an ETF dummy (ETF security = 1 and non-ETF security =0), a type of transaction dummy (purchase = 1 and sale = 0) and the interaction between these two dummies. Let the respective coefficients of these four coefficients be a, b, c and d, respectively. The coefficient, a, is the constant term.

[INSERT TABLE X ABOUT HERE]

Table X gives the results. Panel A reports results for a holding period of 20 days, whereas Panels B and C report results for holding periods of 126 and 252 days, respectively.

Section 1 of the panels show us the estimated coefficients, a, b, c and d, of the panel regressions. Section 2 of the panels shows us a T-day holding period return for an ETF purchase (a+b+c+d), a T-day holding period return for an ETF sale (a+b), and a T-day holding period return of an ETF purchase minus an ETF sale (c+d). Section 3 of the panels shows us a T-day holding period return for a non-ETF purchase (a+c), a T-day holding period return for a non-ETF sale (a), and a T-day holding period return of a non-ETF purchase minus a non-ETF sale (c).

[17] Using other standard-error corrections like clustering on the trading day does not alter results. These additional tables are available upon request.

If we look at the (c+d) in Section 2 in Column 1 in panel A, we notice that investors make rather poor investment decisions with respect to their ETFs. The ETFs they sell outperform the ETFs they buy. The difference between ETFs buys and sells, however, is not significant in the other panels B or C.

While the above result is somewhat interesting, the more interesting result is what we observe when we decompose the raw returns into market timing and security selection. Let us examine columns (2) and (4). In Panel A, in Section 2, we notice that the returns to security selection in ETFs, c+d, is significantly positive in the CDAX case but negative insignificant in the MSCI case; in Panel B, in Section 2, we notice that the returns to security selection in ETFs, c+d, is significantly positive in the CDAX case but positive insignificant in the MSCI case; in Panel C, in Section 2, we notice that the returns to security selection in ETFs, c+d, is significantly positive in both the CDAX case and the MSCI case.

The most interesting result is the returns to market timing. Let us examine columns (3) and (5). In Panel A, in Section 2, we notice that the returns to market timing in ETFs, c+d, is significantly negative in the CDAX case but negative insignificant in the MSCI case; in Panel B, in Section 2, we notice that the returns to market timing in ETFs, c+d, is significantly negative in both the CDAX case as well as the MSCI case; in Panel C, in Section 2, we notice that the returns to market timing in ETFs, c+d, is negative insignificant in both the CDAX case and the MSCI case.

It can be argued that our results are biased because we neglect the non-ETF part of a user's portfolio. It could be that the market timing is worse for the non-ETF part of a user's portfolio as well. To address these concerns, Section 3 in Table X gives the results for the non-ETF part of a user's portfolio over the three holding periods.

If we look at columns (2) and (4) in all three panels, we find that the security selection component in the non-ETF part, c, in Section 3, is better and far larger than the security selection in the ETF part, c+d, in Section 2. More interestingly, if we look at columns (3) and (5) in all three panels, we find that market timing component in the non-ETF part, c, in Section 3, is also better and far larger than the market timing component in the ETF part, c+d, in Section 2. Moreover, comparing security selection component with the market timing component, it is apparent in Section 2 that the large negative market timing component explains the overall mostly negative returns of the ETF part, whereas large positive security selection component explains the overall positive returns of the non-ETF part in Section 3.

A final concern is that individual investors may not be using the ETFs for market timing but are using the ETFs as cash. If so, a positive (negative) liquidity shock leads to the purchase (sale) of an ETF, and if these liquidity shocks are negatively correlated with future market returns, we may erroneously conclude bad market timing after ETF use.

[INSERT TABLE XI ABOUT HERE]

Table XI reports the results of a panel regression where the dependent variable is the portfolio value of an investor in a day. The independent variable of interest is a dummy variable that equals 1 in the period [5,10] after a purchase, that equals -1 in the period [5,10] after a sale, and equals 0 for all other days. We find that the sale (purchase) of an ETF is associated with a rise (fall) in the portfolio value. If the ETF was being used as a store of cash, we should have found the reverse: the sale (purchase) of an ETF should have been associated with a fall (rise) in the portfolio value.

V. Conclusion

This paper investigates whether individual investors benefit from using ETFs. Our findings are as follows. In terms of demographics, users of ETFs tend to be younger and have a shorter relationship with this bank. In terms of portfolio characteristics, users are wealthier in terms of both portfolio value and overall wealth. We then go on to find that the portfolio performance of individual users relative to non-users of ETFs slightly worsens after use. As these securities make market timing easier, we investigate whether this is primarily due to bad market timing. Our answer is yes. We find that the improvement in security selection caused by the use of ETFs is frittered away by bad market timing.

Our paper thus records a dark side of ETFs for individual investors. These products encourage the temptation of market timing, a fact that should make regulators, consumer protection agencies, companies with 401k plans, and financial economists more cautious when recommending their use.

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Figure 1

The use of ETFs in our sample

The figure presents the usage of ETFs over time. The solid line (left axis) shows the average share of ETFs in terms of euros in the portfolios of users (*ETF share in %*). The dashed line (right axis) shows the cumulative number of users at that point in time.

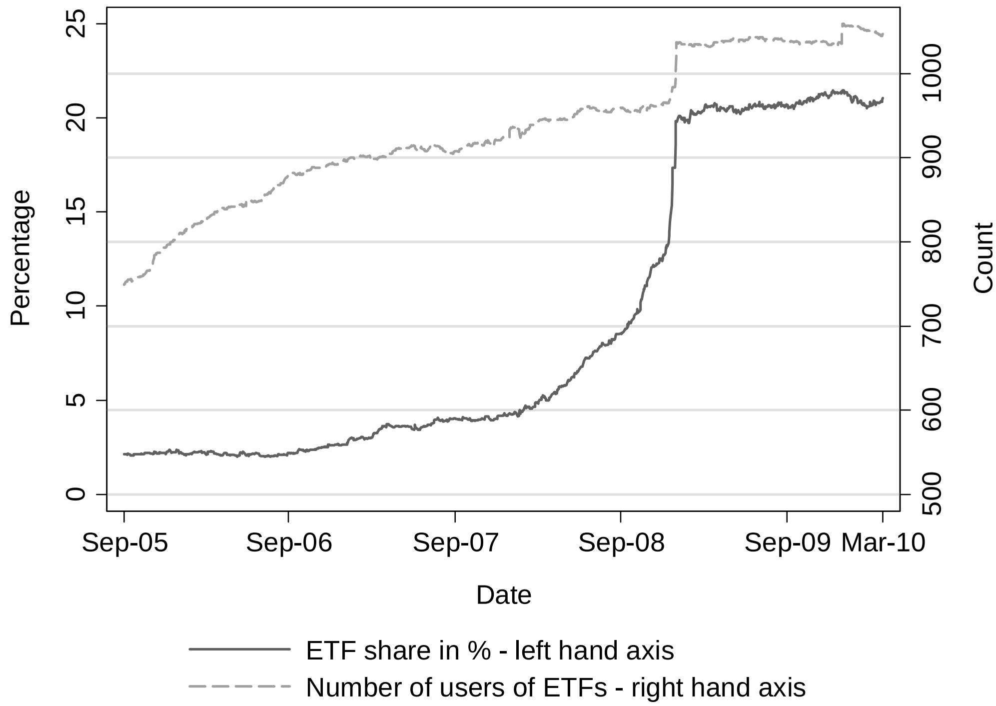

Table I

Usage of index-linked securities – an overview

Table I provides an overview of the markets for ETFs and index funds in Germany (Panel A), the U.S. (Panel B) and within our sample (Panel C). For all panels, the latest available year-end data have been used. We report number of products as well as assets under management (AUM) in absolute and percentage terms. The last two columns compare ETFs and index funds with active mutual funds in terms of number of available products and assets under management.

	Index-linked securities				As % of active mutual funds	
	# of products	%	AUM in € m	%	# of products	AUM
Panel A: Index-linked securities in Germany[1]						
Passive ETFs	826	86%	99,311	84%		
Index mutual funds	135	14%	18,353	16%		
Total	961	100%	117,664	100%	17%	20%
Panel B: Index-linked securities in the US[2]						
Passive ETFs	1,028	73%	934,216	46%		
Index mutual funds	383	27%	1,094,296	54%		
Total	1,411	100%	2,028,512	100%	23%	21%
Panel C: Index-linked securities held by our investors[3]						
Passive ETFs	279	90%	17	95%		
Index mutual funds	30	10%	1	5%		
Total	309	100%	18	100%	17%	16%

[1] As of December 31, 2011. Sources: BVI, Deutsche Börse.

[2] As of December 31, 2011. Source: Investment Company Institute Factbook 2012.

[3] As of December 31, 2009. This table focuses on the same set of investors as in the remainder of the paper, except for investors who hold index mutual funds. In what follows these investors are excluded.

Table II
What kind of ETFs do investors buy?

Panel A: This shows the average amount of Euros invested per day in a passive ETF as a percentage of the total average amount of Euros invested per day in all ETFs.

Benchmark index	Share in %
DAX	24.1%
EURO STOXX 50	9.7%
MSCI Emerging Markets	5.9%
MSCI World	5.2%
EONIA	4.6%
ShortDAX	3.2%
STOXX Europe 600	2.9%
EURO STOXX Select Dividend 30	2.7%
LevDAX	2.5%
STOXX Europe 600 Basic Resources	2.1%
Other (207 indices)	37.0%
Total	100.0%

Panel B: This shows the average amount of Euros invested per day in a region using passive ETFs as a percentage of the total average amount of Euros invested per day in all ETFs.

Country / region	Share in %
Germany	34.4%
Europe	33.4%
Emerging markets	9.4%
World	9.3%
USA	5.4%
China	2.3%
Japan	1.2%
Russia	1.0%
Brazil	1.0%
Asia	0.7%
Other	1.9%
Total	100.0%

Panel C: This shows the average amount of Euros invested per day in an asset class using passive ETFs as a percentage of the total average amount of Euros invested per day in all ETFs.

Asset class	Share in %
Equity	83.4%
Bonds	12.2%
Commodities	4.3%
Other	0.1%
Total	100.0%

Panel D: This shows the distribution of beta, alpha and tracking error of all ETFs (top panel) and ETFs based on equity indices (bottom panel) that investors in our sample use. Beta, alpha and tracking error (RMSE) result from a regression of ETF returns on the MSCI World All Country index or the German benchmark index CDAX and are being estimated separately for each ETF. Reported p-values result from a t-test of Betas and alphas against 1 and 0, respectively. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

	All ETFs							
Metric	N	Mean	p-Value	Median	10%	25%	75%	90%
Benchmark: MSCI World All Country								
Beta	353	0.87	.000***	1.05	-0.05	0.61	1.23	1.54
Alpha in % p.a.	353	-0.03	.960	-0.20	-10.09	-4.75	4.28	11.25
Tracking Error in % p.a.	353	27.78		22.75	10.38	17.31	32.39	41.32
Benchmark: CDAX								
Beta	353	0.70	.000***	0.83	-0.04	0.45	1.03	1.25
Alpha in % p.a.	353	-0.76	.213	-0.64	-12.49	-6.42	3.92	10.92
Tracking Error in % p.a.	353	26.34		21.39	9.63	15.89	30.43	41.00

	ETFs on Equity Indices							
Metric	N	Mean	p-Value	Median	10%	25%	75%	90%
Benchmark: MSCI World All Country								
Beta	284	1.03	.353	1.09	0.64	0.95	1.30	1.57
Alpha in % p.a.	284	-0.03	.967	-0.74	-9.75	-4.87	5.06	13.05
Tracking Error in % p.a.	284	30.34		24.38	16.33	18.94	33.58	43.38
Benchmark: CDAX								
Beta	284	0.83	.000***	0.90	0.47	0.72	1.07	1.28
Alpha in % p.a.	284	-0.97	.178	-2.16	-12.89	-6.80	4.47	12.06
Tracking Error in % p.a.	284	28.59		22.59	14.30	17.79	31.49	42.69

Table III
Data collected

Table III summarizes the data collected during the course of the study.

Type of data	Data	Frequency	Source of data
Client demographics	Gender	Time-invariant	Bank
	Date of birth (measure of age)	Time-invariant	Bank
	Microgeographic status (measure of wealth)	Time-invariant	Bank
Portfolio characteristics	Actual position statements	Monthly	Bank
	Actual transactions and transfers	Daily	Bank
	Cash	On start and end of dataset	Bank
	Account opening date (measure of length of relationship)	Time invariant	Bank
Market data	German Fama and French (1993) & Carhart (1997) factors	Daily	Datastream / own calculation
	MSCI World All Country (Jensen (1968)	Daily	Datastream
	CDAX (Jensen (1968)	Daily	Datastream
	RDAX	Daily	Datastream
	JP Morgan Global Bond	Daily	Datastream
	Individual security prices	Daily	Datastream
	Individual security properties	Time-invariant	Bank / Deutsche Börse

Table IV
Summary statistics for "Users" and "Non-users"

Table IV reports summary statistics on client demographics, investor characteristics and portfolio characteristics. The columns "Users" and "Non-users" present means, medians and the number of observations for the respective clients in each group. The last column reports the p-values of a difference of means t-test. Client demographics are comprised of statistics on the share of male clients (*Gender*), the age of clients (*Age*) and the wealth of a client measured by the micro-geographic status rating, one through nine, assessed by an external agency (*Wealth*). Investor characteristics are comprised of statistics on the number of years the client has been with the bank (*Length of relationship*) and the proportion of risky assets (*Risky share*) held with this brokerage at the beginning (*08/2005*) and at the end (*03/2010*) of our sample period. Portfolio characteristics are comprised of statistics on the average risky portfolio value (*Average risky portfolio value*) of the customer during our observation period (*08/2005 – 03/2010*), the average number of trades per month (*Average number of trades*), the average portfolio turnover per month (*Average portfolio turnover*) and alphas net of transaction costs for the MSCI World All Country and the CDAX (*Alpha*). Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

		Users			All non-users			*t*-test (user vs. all)
Metric	Measurement units	Mean	Median	*N*	Mean	Median	*N*	*P*-value
Client demographics								
Gender	Dummy = 1 if male	80.9	100.0	1087	82.0	100.0	5,869	.377
Age	Years	47.9	46.0	1087	49.8	48.0	5,869	.000***
Wealth	Microgeoraphic status	6.5	7.0	958	6.3	6.0	5,164	.014**
Investor characteristics								
Length of relationship with the bank	Years since account opening	7.2	8.1	1,087	7.6	8.9	5,869	.000***
Risky share *(08/2005)*	%	81.6	85.5	761	95.5	86.1	4,418	.651
Risky share *(03/2010)*	%	78.0	86.8	1050	73.4	82.2	5,381	.000***
Portfolio characteristics								
Average risky portfolio value *(08/2005 - 03/2010)*	€ thousands	60.8	42.5	1,087	51.1	34.8	5,869	.000***
Average number of trades *(08/2005 - 03/2010)*	Trades per month	2.3	1.5	1087	1.8	1.0	5,869	.000***
Average portfolio turnover *(08/2005 - 03/2010)*	%, monthly	6.1	3.7	1087	6.0	3.2	5,869	.779
Alpha (*net*) MSCI World All Country *(08/2005 - 03/2010)*	%, yearly	-2.4	-1.0	1087	-2.1	-0.9	5,869	.816
Alpha (*net*) CDAX *(08/2005 - 03/2010)*	%, yearly	-3.2	-2.3	1087	-3.9	-2.8	5,869	.286

Table V

Who uses ETFs? A probit test

Table V reports the marginal effects of a probit regression. The dependent variable for the probit regression is a dummy (*Dummy user*) that is set to one for individual investors that held at least one ETF within the sample period. For the estimation of the probit model, our independent variables are time-invariant or measured at the beginning (*08/2005*) of our sample period or at the first day (*first day*) an investor enters our sample. The independent variables are the following: a dummy that is equal to 1 if a client is male (*Dummy male*), the age of a client (*Age*), a dummy that is equal to 1 if a client falls into categories 1 to 3 of a micro-geographic status rating by an external agency (*Dummy low wealth*), a dummy that is equal to 1 if a client falls into categories 7 to 9 of the micro-geographic status (*Dummy high wealth*), years the client has been with the bank (*Length of relationship*), the risky portfolio value in Euros of the investor (L*og portfolio value*) and the proportion of risky assets in the account (*Risky share*). Heteroscedasticity robust p-values are in parentheses. The number of observations and pseudo R-squared values are reported as well. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

	Dummy user			
	(1)	(2)	(3)	(4)
Dummy male	-0.012	-0.012	-0.006	-0.013
	(0.299)	(0.288)	(0.579)	(0.320)
Age *(08/2005)*	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Dummy low wealth *(08/2005)*	-0.009	-0.009	-0.010	-0.012
	(0.649)	(0.648)	(0.610)	(0.588)
Dummy high wealth *(08/2005)*	0.015*	0.015*	0.014	0.005
	(0.097)	(0.099)	(0.115)	(0.599)
Log portfolio value *(first day)*		0.003	0.006**	0.015***
		(0.276)	(0.029)	(0.001)
Length of relationship *(08/2005)*			-0.005***	-0.002
			(0.001)	(0.505)
Risky share *(08/2005)*				-0.000
				(0.603)
Observations	6,956	6,952	6,952	5,177
Pseudo-R^2	0.00466	0.00485	0.00682	0.00616

Table VI

Does the use of ETFs improve portfolio performance?

Table VI reports estimates of a panel regression where the dependent variable is net return of an investor (model 1) or systematic risk-adjusted net return of an investor (models 2 through 7). The independent variable of interest is *Use of ETFs (continuous)*, which equals the fraction of the investor's portfolio that is invested in ETFs on day t. The other independent variables are the time-varying risk factors (MSCI All World, World Bond, CDAX, German Bond, CDAX (SMB), CDAX (HML) and CDAX (MOM) and time-varying portfolio characteristics (the log of the risky portfolio value in Euros (*Log portfolio value*), the systematic risk-adjusted return (*Alpha*), portfolio turnover, and average number of trades). All these time-varying portfolio characteristics are a rolling moving average calculated on a daily basis at t=0 over the prior 126 days from t-1 to t-126 (*126 days MA*). Alpha comes from a regression of excess, net portfolio return on the German benchmark index CDAX, and is estimated separately for each investor. Driscoll and Kraay (1998) standard errors, which are robust to temporal and cross-sectional dependence, are used to calculate the p-values shown in parentheses. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less. The number of observations and groups are reported as well.

	Performance						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Net return	Excess net return	Excess net return	Excess net return	Excess net return	Excess net return	Excess net return
Use of ETFs (continuous)	-7.965	-4.000	-2.476	-11.102*	-11.995**	-10.011**	-9.769*
	(0.503)	(0.556)	(0.706)	(0.053)	(0.033)	(0.048)	(0.057)
MSCI World All Country excess return		0.980***	0.923***				
		(0.000)	(0.000)				
World bond index excess return			-1.003***				
			(0.000)				
CDAX excess return				0.725***	0.761***	0.508***	0.524***
				(0.000)	(0.000)	(0.000)	(0.000)
German bond index excess return					1.163		0.768*
					(0.128)		(0.096)
CDAX (SMB)						-0.149	-0.173
						(0.157)	(0.112)
CDAX (HML)						0.349***	0.321***
						(0.000)	(0.000)
CDAX (MOM)						-0.061	-0.053
						(0.381)	(0.422)
Log portfolio value 126 days MA	0.241	0.444	0.765	1.156	1.401*	1.732**	1.878***
	(0.869)	(0.591)	(0.314)	(0.127)	(0.060)	(0.015)	(0.008)
Alpha (net) 126 days MA	-0.203	-0.174	-0.159	-0.279*	-0.283**	-0.246**	-0.252**
	(0.553)	(0.290)	(0.282)	(0.052)	(0.032)	(0.022)	(0.014)
Portfolio turnover 126 days MA	-25.526	-28.873	-38.667	-36.480	-42.703	-35.171	-42.306
	(0.737)	(0.632)	(0.500)	(0.527)	(0.451)	(0.534)	(0.448)
Average number of trades 126 days MA	-31.442	-21.901**	-28.450***	-20.992**	-20.898***	-23.567***	-23.131***
	(0.117)	(0.036)	(0.002)	(0.011)	(0.009)	(0.001)	(0.001)
Constant	24.347	-10.741	7.919	14.935	3.826	17.107**	10.452
	(0.426)	(0.439)	(0.223)	(0.147)	(0.710)	(0.023)	(0.190)
Observations	5,984,911	5,984,911	5,984,911	5,984,911	5,984,911	5,984,911	5,984,911
Number of groups	6,729	6,729	6,729	6,729	6,729	6,729	6,729
Investor fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interaction terms included	No	Yes	Yes	Yes	Yes	Yes	Yes

Table VII

How does the ETF part of a user's portfolio perform with respect to his non-ETF part? Univariate Tests

Table VII compares the performance of ETFs ((1) *ETF part*) with all other securities ((2) n*on-ETF part*) and the joint portfolio ((3) *Full portfolio*). All measures are calculated only when an investor holds ETFs as well as other (non-ETF) securities. These ETF holding periods differ for each investor. The following performance metrics are used: Raw return (*Return gross and net*) and its respective standard deviation (*Standard deviation gross and net*) and the ratio of excess returns and excess standard deviations (*Sharpe ratio gross and net*). The performances of these return series are compared using a t-test on a difference of means. P-values are reported on the right hand side of table VII. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less. Different counts of observations compared to other tables are attributable to the exclusion of all investors with less than a 6-month ETF holding period.

	ETFs holding period			t-test (p-value)			
	(1) ETF part	(2) Non-ETF part	(3) Full portfolio	(1) vs. (2)	(1) vs. (3)	(2) vs. (3)	N
Return, gross	7.0	11.8	11.4	.000***	.000***	.091*	940
Return, net	5.4	11.0	10.5	.000***	.000***	.063*	940
Standard deviation, gross	25.46	21.56	20.31	.000***	.000***	.000***	940
Standard deviation, net	25.53	21.57	20.32	.000***	.000***	.000***	940
Sharpe ratio, gross	0.267	0.605	0.577	.000***	.000***	.067*	940
Sharpe ratio, net	0.193	0.559	0.527	.000***	.000***	.039**	940

Table VIII

How does the ETF part of a user's portfolio perform with respect to his non-ETF part? Multivariate Tests

Table VIII reports estimates of a panel regression where the dependent variable is the net difference return between an individual's ETF and non-ETF portfolio return. The independent variable of interest is the constant term. Model 1 does not adjust for risk, but models 2 through 7 do. The time-varying risk factors used are MSCI All World, World Bond, CDAX, German Bond, CDAX (SMB), CDAX (HML) and CDAX (MOM). Driscoll and Kraay standard errors, which are robust to temporal and cross-sectional dependence, are used to calculate the p-values shown in parentheses. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less. The number of observations and groups are reported as well.

	Performance						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF	Net difference return ETF - non-ETF
Constant	-5.764***	-6.286***	-5.661**	-6.184**	-4.450*	-5.171**	-4.323**
	(0.007)	(0.005)	(0.018)	(0.015)	(0.066)	(0.017)	(0.044)
MSCI World All Country excess return		0.094***	0.073***				
		(0.000)	(0.000)				
World bond index excess return			-0.206***				
			(0.000)				
CDAX excess return				0.137***	0.125***	0.095***	0.092***
				(0.000)	(0.000)	(0.000)	(0.000)
German bond index excess return					-0.554**		-0.189***
					(0.022)		(0.004)
CDAX (SMB)						-0.129***	-0.121***
						(0.000)	(0.000)
CDAX (HML)						-0.028	-0.026
						(0.226)	(0.258)
CDAX (MOM)						0.094***	0.090***
						(0.000)	(0.000)
Observations	395,352	395,352	395,352	395,352	395,352	395,352	395,352
R-squared	0.000	0.006	0.011	0.022	0.024	0.029	0.029
Number of groups	1,056	1,056	1,056	1,056	1,056	1,056	1,056
Interaction terms included	No	Yes	Yes	Yes	Yes	Yes	Yes

Table IX

Does the use of ETFs change trading behavior?

Table IX reports panel regression results with the dependent variable being different measures of trading activity: turnover of purchases, turnover of sales, turnover of portfolio, number of trades, and turnover per trade. The independent variable of interest is *Use of ETFs (continuous)*, which equals the fraction of the investor's portfolio that is invested in ETFs on day t. The other independent variables are the time-varying risk factors (MSCI All World, World Bond, CDAX, German Bond, CDAX (SMB), CDAX (HML) and CDAX (MOM) and time-varying portfolio characteristics (the log of the risky portfolio value in Euros (*Log portfolio value*), the systematic risk-adjusted return (*Alpha*), portfolio turnover, and average number of trades). All these time-varying portfolio characteristics are a rolling moving average calculated on a daily basis at t=0 over the prior 126 days from t-1 to t-126 (*126 days MA*). Alpha comes from a regression of excess, net portfolio return on the German benchmark index CDAX, and is estimated separately for each investor. Driscoll and Kraay standard errors, which are robust to temporal and cross-sectional dependence, are used to calculate the p-values shown in parentheses. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less. The number of observations and groups are reported as well.

	Trading behavior				
	(1)	(2)	(3)	(4)	(6)
	Turnover Purchases	Turnover Sales	Turnover Portfolio	# of Trades	Turnover per trade in €
Use of ETFs (continuous)	-0.570	-0.851*	-0.711	-0.023***	2,968.304***
	(0.532)	(0.097)	(0.186)	(0.000)	(0.000)
Log portfolio value 126 days MA	0.287*	-0.016	0.135	0.003***	1,016.247***
	(0.100)	(0.767)	(0.148)	(0.000)	(0.000)
Alpha (net) 126 days MA	-0.003	0.001	-0.001	0.000***	10.049***
	(0.296)	(0.437)	(0.598)	(0.000)	(0.000)
Portfolio turnover 126 days MA	-392.377	-120.131***	-256.254*	-0.120	-100,311.517***
	(0.145)	(0.002)	(0.059)	(0.363)	(0.000)
Average number of trades 126 days MA	2.756	0.534	1.645	0.613***	1,078.081***
	(0.164)	(0.513)	(0.182)	(0.000)	(0.000)
Constant	7.448***	6.113***	6.780***	0.061***	4,077.995***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	5,984,793	5,984,793	5,984,793	5,984,921	264,364
Number of groups	6,729	6,729	6,729	6,729	6,611
Investor fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes

Table X
Average returns following purchases and sales of ETFs

Section 1 of Table X reports results from an OLS regression of holding period returns (HPRs) following a trade for a 20 (Panel A), 126 (Panel B) and 252 (Panel C) trading day holding period. The holding period return, which is the dependent variable, is measured in three ways: raw returns in model 1, market-adjusted returns (raw returns minus market returns) in models 2 and 4, and market returns in models 3 and 5. We use the CDAX (models 2 and 3) and the MSCI World All Country (models 4 and 5) as proxies for the market portfolio. The independent variables are ETF dummy (ETF = 1, non-ETF=0), type of transaction dummy (purchase= 1 and sales =0) and an interaction between these two dummies. In section 2 (HPRs to ETF trades) and section 3 (HPRs to non-ETF trades), we focus on the appropriate coefficients of interest, and perform Wald post estimation tests to check if they can be distinguished from zero. The number of observations (= # of trades * trading days), number of groups (all trades) as well as number and direction of trades in ETFs and non-ETF securities are reported. Driscoll and Kraay standard errors, which are robust to temporal and cross-sectional dependence, are used to calculate the p-values shown in parentheses Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

Panel A: 20 trading days (~1 month)

			Performance				
			(1)	(2)	(3)	(4)	(5)
	Independent variables (indicator)	# of trades	Return	Return - CDAX (Selection)	CDAX (Market timing)	Return - MSCI (Selection)	MSCI (Market timing)
Section 1: Coefficient estimates							
Constant	a		-54.540***	-61.233***	6.693***	-56.128***	1.588**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.033)
ETF dummy (*ETF = 1*)	b		51.194***	54.021***	-2.828	46.326***	4.868
			(0.000)	(0.000)	(0.445)	(0.000)	(0.139)
Type of transaction dummy (*Purchase = 1*)	c		18.274***	22.793***	-4.518***	21.461***	-3.186***
			(0.001)	(0.000)	(0.001)	(0.000)	(0.003)
Interaction ETF dummy * Type of transaction dummy	d		-29.443***	-10.723	-18.719**	-23.023***	-6.420
			(0.000)	(0.254)	(0.035)	(0.001)	(0.249)
Observations			2,145,850	2,145,850	2,145,850	2,145,850	2,145,850
Number of groups			107,928	107,928	107,928	107,928	107,928
Section 2: Holding period returns to ETF trades							
Purchases	a+b+c+d	6035	-14.514**	4.858	-19.372***	-11.364***	-3.150
			(0.015)	(0.141)	(0.007)	(0.001)	(0.535)
Sales	a+b	1738	-3.346	-7.212***	3.866	-9.802***	6.456**
			(0.327)	(0.003)	(0.310)	(0.000)	(0.032)
Purchases - Sales	c+d		-11.168*	12.069**	-23.237***	-1.562	-9.606
			(0.088)	(0.011)	(0.006)	(0.717)	(0.101)
Section 3: Holding period returns to non-ETF trades							
Purchases	a+c	65937	-36.265***	-38.440***	2.175**	-34.667***	-1.598
			(0.000)	(0.000)	(0.014)	(0.000)	(0.158)
Sales	a	34218	-54.540***	-61.233***	6.693***	-56.128***	1.588**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.033)
Purchases - Sales	c		18.274***	22.793***	-4.518***	21.461***	-3.186***
			(0.001)	(0.000)	(0.001)	(0.000)	(0.003)

Panel B: 126 trading days (~1/2 year)

	Independent variables (indicator)	# of trades	Performance (1) Return	(2) Return - CDAX (Selection)	(3) CDAX (Market timing)	(4) Return - MSCI (Selection)	(5) MSCI (Market timing)
Section 1: Coefficient estimates							
Constant	a		-30.476***	-34.286***	3.810***	-29.414***	-1.062
			(0.000)	(0.000)	(0.000)	(0.000)	(0.115)
ETF dummy (*ETF = 1*)	b		31.548***	28.897***	2.651	22.299***	9.250***
			(0.000)	(0.000)	(0.197)	(0.000)	(0.000)
Type of transaction dummy (*Purchase = 1*)	c		7.875***	10.066***	-2.191***	9.155***	-1.279*
			(0.000)	(0.000)	(0.005)	(0.000)	(0.052)
Interaction ETF dummy * Type of transaction dummy	d		-11.159***	-4.932**	-6.227	-7.321***	-3.838
			(0.001)	(0.042)	(0.133)	(0.001)	(0.208)
Observations			13,005,946	13,005,946	13,005,946	13,005,946	13,005,946
Number of groups			107,928	107,928	107,928	107,928	107,928
Section 2: Holding period returns to ETF trades							
Purchases	a+b+c+d	6035	-2.211	-0.255	-1.956	-5.282***	3.071
			(0.490)	(0.839)	(0.630)	(0.000)	(0.320)
Sales	a+b	1738	1.072	-5.389***	6.462***	-7.116***	8.188***
			(0.491)	(0.000)	(0.001)	(0.000)	(0.000)
Purchases - Sales	c+d		-3.283	5.134***	-8.417**	1.834	-5.117*
			(0.288)	(0.008)	(0.045)	(0.164)	(0.096)
Section 3: Holding period returns to non-ETF trades							
Purchases	a+c	65937	-22.601***	-24.220***	1.620***	-20.260***	-2.341***
			(0.000)	(0.000)	(0.008)	(0.000)	(0.000)
Sales	a	34218	-30.476***	-34.286***	3.810***	-29.414***	-1.062
			(0.000)	(0.000)	(0.000)	(0.000)	(0.115)
Purchases - Sales	c		7.875***	10.066***	-2.191***	9.155***	-1.279*
			(0.000)	(0.000)	(0.005)	(0.000)	(0.052)

Panel C: 252 trading days (~1 year)

	Independent variables (indicator)	# of trades	Performance (1) Return	(2) Return - CDAX (Selection)	(3) CDAX (Market timing)	(4) Return - MSCI (Selection)	(5) MSCI (Market timing)
Section 1: Coefficient estimates							
Constant	a		-24.322***	-25.974***	1.652**	-21.650***	-2.672***
			(0.000)	(0.000)	(0.036)	(0.000)	(0.000)
ETF dummy (*ETF = 1*)	b		27.110***	19.589***	7.521***	14.136***	12.974***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Type of transaction dummy (*Purchase = 1*)	c		5.907***	6.767***	-0.861	5.837***	0.070
			(0.000)	(0.000)	(0.225)	(0.000)	(0.907)
Interaction ETF dummy * Type of transaction dummy	d		-4.500*	-2.026	-2.473	-2.984**	-1.516
			(0.056)	(0.187)	(0.351)	(0.046)	(0.443)
Observations			24,851,616	24,851,616	24,851,616	24,851,616	24,851,616
Number of groups			107,928	107,928	107,928	107,928	107,928
Section 2: Holding period returns to ETF trades							
Purchases	a+b+c+d	6035	4.196*	-1.643**	5.839**	-4.661***	8.856***
			(0.071)	(0.043)	(0.040)	(0.000)	(0.000)
Sales	a+b	1738	2.789**	-6.385***	9.173***	-7.514***	10.303***
			(0.018)	(0.000)	(0.000)	(0.000)	(0.000)
Purchases - Sales	c+d		1.407	4.741***	-3.334	2.853***	-1.446
			(0.520)	(0.000)	(0.232)	(0.003)	(0.486)
Section 3: Holding period returns to non-ETF trades							
Purchases	a+c	65937	-18.415***	-19.206***	0.792	-15.813***	-2.602***
			(0.000)	(0.000)	(0.144)	(0.000)	(0.000)
Sales	a	34218	-24.322***	-25.974***	1.652**	-21.650***	-2.672***
			(0.000)	(0.000)	(0.036)	(0.000)	(0.000)
Purchases - Sales	c		5.907***	6.767***	-0.861	5.837***	0.070
			(0.000)	(0.000)	(0.225)	(0.000)	(0.907)

Table XI
Are ETFs used to park liquidity?

Table XI reports estimates of a panel regression where the dependent variable is the change of portfolio value from day t to day t+5. The dependent variable in model 1 is purchase of ETF (purchase of ETF=1 if ETF is purchased 5 days before t, otherwise=0). The dependent variable in model 2 is sale of ETF (sale of ETF=1 if ETF is sold 5 days before t, otherwise=0). Driscoll and Kraay standard errors, which are robust to temporal and cross-sectional dependence, are used to calculate the p-values shown in parentheses. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less. The number of observations and groups are reported as well.

	Portfolio value	
	(1)	(2)
Purchase of ETF	-1,462.406*	
	(0.084)	
Sale of ETF		5,506.790***
		(0.000)
Constant	62,804.073***	62,789.070***
	(0.000)	(0.000)
Observations	7,087,525	7,087,525
Number of groups	6,956	6,956
Investor fixed effect	Yes	Yes
Year fixed effect	Yes	Yes