The Dark Side of ETFs and Index Funds

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Abstract

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Abstract

Do popular investment products such as passive ETFs and index funds benefit individual investors? Using data from one of the largest brokerages in Germany, we find that retail investors worsen their portfolio performance after using these products compared with non-users. As these securities make market timing easier, we investigate whether this decrease in portfolio performance of the users is primarily due to bad market timing. Our answer is yes.

The Dark Side of ETFs and Index Funds

Some of the most successful retail investment products of the last twenty years are index-linked securities, such as passive Exchange Traded Funds (ETFs) and index funds.[1] The first retail index mutual fund was launched in 1976 by John Bogle in Vanguard.[2] In 2011, in the U.S., 383 index funds managed total net assets of $1.1 trillion. Of households that owned mutual funds, 33 percent owned at least one index mutual fund.[3] The first ETF was launched in Canada in 1990. In 2012, there were 4,731 ETFs with $2 trillion in assets (same size as hedge funds) and accounting for 16% of NYSE trading volume.[4]

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

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[1] Index-linked securities are instruments that aim to replicate the movements of an index of a particular market and therefore enable the investor to buy and sell a broadly diversified portfolio of securities. Passive ETF shareholders buy and sell shares in public markets anytime during the trading day, whereas shareholders in index mutual funds buy shares from the fund and sell them back to the fund at a net asset value determined once a day at market close. Unlike passive ETFs, active ETFs aim to outperform an index and are not the subject of this paper.

[2] The first index fund was called *First Index Investment Trust* and was based on the S&P 500 index. The fund was derisively known as "Bogle's Folly." By September 2011, the assets of the Vanguard index funds modeled on the S&P 500 Index totaled USD $200 billion. ("How the Index Fund Was Born," *Wall Street Journal*, September 3, 2011)

[3] 2012 *Investment Company Fact Book*

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

[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 retail 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.

The null hypothesis is that retail investors have benefited by using index-linked securities like ETFs. Classical finance theory supports this hypothesis. These products invest in well-diversified security baskets, and the benefits of diversification were formalized in seminal papers in finance.[7] Boldin and Cici (2010) reviewed the entire empirical literature to document the benefits of diversification. French (2008) measured these benefits for the case of mutual funds and concluded that "…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." These benefits of diversification may be more for retail investors, given that they significantly under-diversify[8]. The benefits may be even higher for ETFs because ETFs offer many advantages over mutual funds. First, the fees of ETFs are lower compared to mutual funds. Second, ETFs trade in real time as opposed to mutual funds whose price is determined at the end of the day. Third, ETFs may have tax advantages (Poterba and Shoven (2002)).

The alternate hypothesis is that retail investors have not benefited by using index-linked securities like ETFs. There is some evidence that investors might not be using these products effectively. Hortaçsu and Syverson (2004) found large fee dispersions even though the analyzed index funds were financially homogeneous. Similarly, Elton, Gruber and Busse (2004) documented that S&P 500 index funds have become commodities that differ from each other principally in price. They find that investors in these funds irrationally prefer more expensive funds. Choi, Laibson and Madrian (2010) confirmed this behavior in an experiment and found

[7] Markowitz (1952) suggested we diversify by buying optimal portfolios. Tobin (1958) suggested that we require only two optimal portfolios. In his capital asset pricing model (CAPM), Sharpe (1964) concluded that one of these two portfolios was the market portfolio.

[8] The portfolios of retail 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 country ("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)).

that more financially sophisticated investors pay fewer fees. Second, it is conceivable that though index-linked securities force the retail investor to buy a basket and, therefore, curb his temptation to pick stocks, these ETF products, because they are highly correlated with the index and are so easy to trade, may enhance his temptation to time the underlying index.[9] Third, it seems conceivable that investors may have difficulty choosing because the choice set contains securities linked to more than 200 different underlying indices (cf. Blackrock (2011)). Finally, many of these indices mimic not just well-diversified market baskets but sectors or industries.

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 retail investors to test the null hypothesis.[10]

Our first set of findings is as follows. Investors who start to use these products are more likely to be female and younger than investors who do not use them. In the pre-period where none of our investors use these products, those who will become users trade more often, have higher portfolio values, and more idiosyncratic risk in their portfolios. Their portfolio performance is higher, but not significantly so. Müller and Weber (2010), using a survey methodology, reported similar results. Barber and Odean (2002) reported similar evidence in a study on online investors vs. phone-based investors.

However, the key question is what occurs after use. So we compare the portfolio characteristics of users before and after the first use with a matched sample of non-users. The first issue we confront is how to do the match. In the tests reported in the paper, we match a user to a non-user using all investor-specific variables that are significantly different between these

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

[10] In essence we ask whether index-linked securities improve the portfolio performance of private investors or whether existing conceptual benefits are neutralized by (bad) trading decisions of private investors. An ex-ante test like the one proposed by Calvet, Campbell and Sodini (2007) will fail to incorporate the effects of trading.

two groups. In the Internet Appendix, for robustness, we also match a user to a non-user with a similar size of portfolio, as in Barber and Odean (2002). As to which variable(s) to use for matching is always a controversial issue, for further robustness, we group all users and non-users together, and use a multivariate difference-of-difference specification with investor-specific controls. This test does not require matching, but this test can only be done in event time. The results of this further robustness test are shown in the Internet Appendix. The second issue we confront is how to measure portfolio performance. We use many measures – raw returns, market-adjusted returns and alphas from a 1-and 4- factor model. The third issue we confront is the choice of the benchmark index. We use a global index (MSCI All Country World Index) as well as the broadest local index (CDAX) for benchmarking.

The second set of findings is about the portfolio performance of the user. Changes in portfolio performance, as measured by changes in any of the above portfolio performance measures using any benchmark index, are always lower for users than non-users. The difference-in-difference multivariate method described in the Internet Appendix does not use matching, and we find broadly similar results. Our overall conclusion is that individual users of index-linked securities worsen their portfolio performance compared with non-users.

Unwise use of these index-linked securities may explain the worsening of the portfolio performance of the users after use. Another reason could be that the returns of the other securities deteriorate. To rule out the latter reason, we divide users' portfolios into a "passive-part" consisting of ETFs and index funds and an "active-part" consisting of all other products. 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 use is driven by an underperforming "passive-part". We also find that the addition of ETFs and index funds makes the "full-portfolio" less efficient (the Sharpe

ratio of the "full-portfolio" is lower than the Sharpe ratio of the "active-part"). This means that these index-linked securities not only have bad performance on their own, but even their diversification benefit does not exist.

Now that we have established that the cause of performance deterioration experienced by the users after use is their use of index-linked securities, we go on to investigate how they use or rather misuse these products. As in Odean (1999), we check all purchases and sales transactions in ETFs and index funds to measure security selection and market timing skills. We find that the returns following purchases are significantly lower than returns following sales for a 1 month, 6 month or a 12 month horizon. If we decompose these returns into the market return (market timing) and the market-adjusted return (security selection), we find that the deterioration in returns is coming from the market return, which is the return that measures market timing. On the other hand, market-adjusted returns, which really measure security selection, are often improving after use. Results are similar if we use CDAX or MSCI. Results do not change if we do the above analysis at the level of the investor. Results do not change if we take a full-portfolio perspective and implement a holdings-based approach developed by Jiang, Yao and Yu (2007) to measure market timing and Elton, Gruber and Blake (2011) to measure security selection. This analysis is cross-correlation robust, because it is done in calendar-time. The last set of results is reported in the Internet Appendix.

We conclude from the above results that bad market timing and not bad security selection is responsible for the performance deterioration experienced by the users of index-linked securities like ETFs.

By definition, trading in index-linked securities 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 index-linked securities have non-negative security selection skills after using these

products. The more interesting result is that the tests show that users of index-linked securities worsen their market timing ability by using these products. The reason must be that the users employ these easy-to-trade index-linked securities that are highly correlated with the market[11] to make bets on market phases, and they bet wrong.

Section I provides an overview of the market for index-linked securities in Germany. Section II details the data and research design. Section III examines which retail customers are most likely to use ETFs and then explains how we generate a matched sample of non-users of ETFs. Section IV investigates whether the users improve their portfolio performance compared with the matched sample of non-users and finds that the answer is no. Section V examines why users do not improve their relative portfolio performance. Section VI concludes.

I. Index-linked Securities in Germany

In Germany, investors may invest in index-linked securities in ways that are broadly similar to the ways that U.S. investors invest. In both countries, investors may choose between Exchange Traded Funds (ETFs) and index mutual funds. ETFs can be traded throughout the day like a stock, whereas traditional index mutual funds receive a quote once per trading day. In terms of costs, ETFs are more cost efficient for lump-sum investments or frequent but large contributions because the costs are ordinary brokerage fees or commissions. For smaller regular contributions, index mutual funds are more cost efficient. Unfortunately, a significant number of index mutual funds require high investment minimums.[12]

Panel A in Table I summarizes the market for index-linked securities in Germany. Panel B in Table I provides the same for the U.S. Panel C in Table I provides the same for our German

[11] In our sample, the average correlation of an index-linked security is 55% with CDAX and is 49% with MSCI. Compare this to the average correlation of the other securities, which is 25% with CDAX and is 24% MSCI.

[12] http://www.nytimes.com/2008/12/16/your-money/mutual-funds-and-etfs/primerETF.html?adxnnl=1&ref=mutualfundsandetfs&adxnnlx=1328879020-V+1tlYil7+LKBnbL3ZptRA

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 (AUM) invested in index-linked securities relative to total active mutual fund investments are comparable between Germany and the U.S., and is about 20%. Panels A and B also tell us that the market in the U.S. is much larger as measured by assets under management or the number of index-linked products offered. Interestingly, in terms of AUM, the market splits almost evenly between passive ETFs and index mutual funds in the U.S., whereas in Germany, passive ETFs comprise 81% of the market.

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

Table II examines the index-linked securities that retail investors in our sample actually use.

[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 and index funds: 140 securities. It is a very fragmented market. Though the top 6 securities constitute roughly half of assets under management, the other 134 securities make up the other half. This allows us to make two points. First, the popular indices are connected to Germany, to Europe and to the World, which motivates us to use the local German index, CDAX, and a Global index, MSCI, as our two choices of benchmark indices.

Second, as so many of these securities are linked to such narrow sectors, it is more likely that they offer choices for sector selection rather than opportunities for broad diversification.

Panel B of Table II examines the regional allocations of these index-linked securities. Germany is the most popular followed by Europe. Panel C of Table II examines the asset allocations of these index-linked securities. Most (about 87%) of these securities are equity-based. This again motivates us to use benchmarks based on equity indices like CDAX or MSCI.

II. Data and Research Design

A. Data

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 8,000 of its several hundred thousand retail investors. Approximately 95% of these retail investors refused the financial advice and continued trading as before.[13] Our sample is this 95%. 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.

We collected data on client demographics, monthly position statements, daily transaction records and the characteristics of all of the index-linked securities that these investors traded from August 2005 to March 2010. As in Barber and Odean (2002), we required the investors included in our analysis to have a position in each month of the study period.

Figure 1 provides a time line.

[INSERT FIGURE 1 ABOUT HERE]

[13] Bhattacharya et al. (2012) analyze the 5% of the retail customers who accepted the advice.

We chose August 2006 to March 2009 as our switch period. This means that we chose only users who made their first trade in index-linked securities between August 2006 (one year after the sample period began) and March 2009 (one year before the sample period ended). This approach provided us with 4139 customers, 473 of whom traded at least one index-linked security in the period August 2006 to March 2009 and 3,075 non-users who did not trade any index-linked security in the period August 2005 to March 2010. The period August 2005 to August 2006 is a clean period before switches, a period we use for matching and for generating other control variables. The period March 2009 to March 2010 is a clean period after switches, a period we need to measure portfolio performance of our last switcher.

Table III describes the data we collected.

[INSERT TABLE III ABOUT HERE]

Client demographics were collected from the bank and comprise gender, age and micro geographic status. The micro geographic status variable measures the average wealth level of the 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, trades per month and the average turnover per trade in euros, as in Barber and Odean (2002). We also obtain monthly return series for the following factors: a market factor (CDAX or MSCI), small minus big (SMB), high minus low (HML) and the momentum factor (MOM). The source of this data is given in Table III.

The investors in our sample were continuously switching to index-linked securities between August 2006 and March 2009.

[INSERT FIGURE 2 ABOUT HERE]

The dashed black line in Figure 2 shows the growing popularity of index-linked securities in our sample. The slightly steeper increase at the end of 2008 might be the result of the introduction of a withholding tax in Germany on January 1, 2009, which causes investors to purchase securities that they plan to hold for the longer term. The solid gray line in Figure 2 shows the share of index-linked securities in the portfolio of an average retail investor. It seems that once investors have switched to index-linked securities, their weight in the portfolio hovers between 10% and 20%.

B. Research Design

Our analysis focuses on 473 investors who decide to start using index-linked securities. Our primary research design is to use a matched-pair design in calendar-time and measure the difference-in-differences before and after. The details are as follows. A user is matched to a unique non-user using all investor-specific variables that are significantly different between these two groups. In the Internet Appendix, we use another matching method (portfolio-size matched as in Barber and Odean (2002)) for robustness.

As in Barber and Odean (2002) and Seasholes and Zhu (2010), we construct portfolios in calendar-time. Two distinct time series of returns for users are constructed. On each calendar day, we calculate the average of the daily returns of the investors who have not yet bought their first index-linked security, and the average of the daily returns of the investors after they have bought their first index-linked security. For the sample of matched investors, we construct two analogous time series of returns.

As methods of matching are controversial, as robustness, we use an alternate research design that does not require matching. Here we use a pooled multivariate difference-in-difference regression, where we compare every user with all of the non-users. Investor-specific variables are used as controls. To compute these investor-specific control variables, we use a period of twelve months prior to the first switch to calculate these variables. This test has two advantages – we do not have to worry about how we match, and we use data of all non-users and not just the matched non-user – but it does have the disadvantage that it can be done only in event time. [14,15] The results of these multivariate tests are shown in the Internet Appendix.

[14] Papers by Fama (1998) and Mitchell and Stafford (2000) strongly argue 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 to study 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". In our case, results from the two approaches may differ, because the number of investors who switch to index-linked securities increases over time.

[15] To address the cross-correlation problem in event time, we use Driscoll and Kraay (1998) standard errors, which perform best with potentially cross-correlated return series (Hoechle, Schmid, and Zimmermann (2009)). Note, however, that as the investors in our sample gradually switch to index-linked securities and do not cluster at any particular date or period, problems with cross-correlation are mitigated (cf. Binder (1998)).

B1. Return Calculations

We first infer the daily holdings from the monthly position statements, security transactions and account transfers. We possess end-of-day holdings for the last day in each month. 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 can be best explained by brokerage fees and bank commissions. We find that our results are independent of whether we use gross or net returns, which shows that our results are not influenced by excessive trading by individual investors after the adoption of index-linked securities or the simple necessity to bear the set-up costs of a portfolio of index-linked securities or by the higher tax efficiency of these securities.

B2. Performance Measures

To measure the impact of the use of index-linked securities on the portfolio performance of individual investors, we employ a number of widely used and accepted performance measures: raw returns, market-adjusted returns, Sharpe ratios, 1-factor alphas (Jensen's alphas), and Carhart 4-factor alphas.

Raw returns are simply mean returns over the respective time periods. Market-adjusted returns are calculated by subtracting the return of a broad market index (CDAX or MSCI) from the return earned by an investor. The Sharpe ratio, which we can only use in event time and the results shown in the Internet Appendix, is the excess returns on individual investor portfolios divided by the standard deviation of these excess returns. Portfolio excess returns are daily portfolio returns minus the risk-free rate, which we assume to be equal to the three-month money-market rate.

In addition, we use different alpha measures to control for several risk factors. First, we compute Jensen's (1968) alpha using daily data.

$$R_{j,t} - R_{f,t} = \alpha_j + \beta_j \times (R_{m,t} - R_{f,t}) + \varepsilon_{j,t} \quad (1)$$

where $R_{j,t}$ is the return on investor j's portfolio, $R_{f,t}$ is the three-month money-market rate, $R_{m,t}$ is the return on a broad stock-market index and β_j is the average stock-market beta of investor j during the observation period. We first use the local CDAX market benchmark because it is the broadest German index available that includes more than 600 stocks. This approach does not penalize investors for their home bias. To account for that, instead of the CDAX, we also use a global market index (the MSCI All Country World Index).

To control for other factors in addition to the market factor, we compute the 4-factor alpha as in Carhart (1997), who uses the Fama and French (1993) factors and adds momentum as an additional factor.

The 4-factor model is calculated as follows:

$$R_{j,t} - R_{f,t} = \alpha_j + \beta_j \times (R_{m,t} - R_{f,t}) + \\ + s_j \times SMB_t + h_j \times HML_t + m_j \times MOM_t + \varepsilon_{j,t} \quad (2)$$

where $R_{j,t}$ is the return on investor j's portfolio, $R_{f,t}$ is the three-month money-market rate, $R_{m,t}$ is the return on a broad stock-market index (CDAX or MSCI), SMB_t and HML_t are the returns for the size and value-growth portfolios in accord with Fama and French (1993) and MOM_t is the one-year momentum return from Carhart (1997).

B3. Split Portfolios

To find out whether the change in the portfolio performance of the users can be attributed to their use of index-linked securities, we divide users' portfolios into a "passive-part" consisting of ETFs and index funds and an "active-part" consisting of all other products. For both parts, we rerun our return calculation, which gives us a return on the passive as well as on the active part. This split allows us to see which part of the portfolio drives the performance.

It is possible that the passive part may underperform the active part but, combined with the other securities, they may improve the efficiency of the total portfolio. This can be checked by comparing the Sharpe ratio of the "full portfolio" with the Sharpe ratio of the "active part," If the former Sharpe ratio is higher (lower) than the latter Sharpe ratio, the efficiency of the total portfolio is increasing (decreasing) with the addition of index-linked securities.

B4. Market Timing and Security Selection in Index-Linked Securities

As the previous analysis will reveal, it is trading in the passive part that is suboptimal. A natural next question to ask is about the sources of performance within the passive part of the portfolio. Abnormal performance 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 implement the methodology suggested by Odean (1999). Odean (1999) analyzes the returns to purchases and sales of securities over three defined holding periods. These holding periods are set to 84, 252 and 504 trading days. The performance difference of returns between purchases and sales over this holding period is a measure of investment skill. 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 this holding period is solely due to security selection. The difference of market returns during purchases and sales over this holding period is a measure of market timing. Odean (1999) and we exclude the day of the transaction to avoid the bid-ask spread bias. As holding periods of individual securities may overlap, the returns may not necessarily be independent, and so there may be a bias in standard statistical significance tests which require independence. Odean (1999) deals with this by creating an empirical distribution.

We follow the methodology of Odean (1999) with some exceptions. First, because of a smaller holding period in our sample – the average holding period of investors in our sample is 121 days[16] – we use holding-periods of 30, 126 and 252 trading days. Second, our benchmarks are different. We use MSCI and CDAX, as benchmarks. Third, instead of creating an empirical distribution as suggested by Odean (1999), we treat either all transactions as being independent, or to avoid that our results are biased by more frequent traders, we only treat transactions of one investor as independent, calculate all statistics for this investor, and then average over investors.

In the Internet Appendix, as a robustness check, we describe and present the results of an analysis of market timing (following Jiang, Yao and Yu (2007)) and security selection (following Elton, Gruber and Blake (2012)) on the full portfolio level. Their analysis is robust to potential

[16] This holding period is shorter than the estimated investment horizon of one year that was done by Benartzi and Thaler (1995).

biases induced by cross-correlation. In the context of our paper, as we are exploring what drives the performance of investors in the passive part, the Odean (1999) method seems more relevant.

III. Who Uses ETFs and Other Index Funds?

A total of 473 customers from the 4,139 customers in our sample invested in at least one index-linked security in the period August 2006 to March 2009. Table IV provides summary statistics. This table divides the sample group into customers who use these products and those who do not. 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 index-linked securities tend to be female (18.8% vs. 15.6%) and tend seem to be slightly younger (48.9 vs. 50.4 years). Moreover, users of index-linked securities tend to have a higher risky portfolio as well as higher share of their portfolio in risky securities. They trade more often, and have higher volume per trade. Finally, Table IV suggests that *over the entire sample period*, the portfolio performance of these two groups do not differ significantly.

The multivariate probit analysis in Table V provides formal results.

[INSERT TABLE V ABOUT HERE]

We perform a probit test, where the dependent variable is set to one if an investor opted to use these index-linked securities at least once. The independent variables are the same as the variables shown in Table IV. However, there is one important difference. In Table V, the independent variables are either static (e.g. our socio-demographic variables) or measured over the first year of the sample, i.e., between August 2005 and August 2006 (see Figure 1). This time period occurred before the first use of an index-linked security in our sample. This approach is necessary because investors do not switch all at once but at different times over a

longer period. Using the static variables and using the values of time series variables from the period before index-linked securities are used by the investors in our sample avoids potential spurious inferences.

Table V confirms most of the results of Table IV. Users of index-linked securities tend to be female and younger. Moreover, users have bigger portfolios, trade more often and bear more idiosyncratic risk. The F-test shows statistical significance, suggesting that the independent variables do distinguish between these two groups.

We now construct a matching sample of non-users of index-linked securities. We match a user to its nearest non-user neighbor in terms of the five variables we found to be significant in explaining the difference between the groups – dummy male, age, average log portfolio value, average number of trades and idiosyncratic variance share.

Table A1 in the Internet Appendix is a test of how good the match is. The difference in this table compared to Table V is that instead of all investors who have a position statement in every month of our sample period, we only include all matched investors in this regression. Table A1 reveals that our match is not bad. The F-test shows no statistical significance, suggesting that these independent variables do not distinguish between these two groups any more.

Also, in the Internet Appendix, we show results for another way to match as well as results when there is no matching, and these we discuss later.

IV. Does the Use of ETFs and Other Index Funds Improve the Portfolio Performance of the Users?

We now address the most important question of our study: do users benefit from index-linked securities?

Table VI reports the results from the matching method. The analysis is in calendar-time to mitigate any problems of cross-correlation as explained in footnote 14.

[INSERT TABLE VI ABOUT HERE]

In Table VI, we note that no matter how we measure the change in portfolio performance – raw return, market-adjusted return (MSCI or CDAX), 1-factor alpha (MSCI or CDAX), or 4 factor alpha (CDAX) – the change is always lower for the user than for the non-user.[17] The differences, however, are significant only for the alphas (the risk-adjusted returns). The changes here are -3.03%, -3.72% and -3.62% for the MSCI 1-factor alpha, CDAX 1-factor alpha and the CDAX 4-factor alpha respectively. We redo Table VI with net returns (unreported results). The changes now are -4.42%, -5.01% and -5.01% for the MSCI 1-factor alpha, CDAX 1-factor alpha and the CDAX 4-factor alpha respectively, and the p-values are stronger. As risk-adjusted returns are the conventional way to measure portfolio performance, we conclude that individual investors worsen their portfolio performance after using index-linked securities compared with non-users.

These results are qualitatively the same for all portfolio performance metrics if we use a match on portfolio size (Table A2 in the Internet Appendix). The results of the multivariate difference-in-difference regressions that do not require matching but uses all users and non-users in event-time are shown in Table A3 in the Internet Appendix. Some results (MSCI 1-factor alpha (Panel D) and Sharpe ratio (Panel G)) are not statistically significant in these event-time regressions. Also, the tests on Sharpe ratio can only be done using event-time.

All these tests, based on different methods, provide evidence that portfolio performance worsens for retail investors after they start to use index-linked securities.

[17] The reader may be wondering why the difference-in-difference point estimates are exactly the same for three variables: the raw return, market-adjusted return MSCI and market-adjusted return CDAX. The reason is that we are subtracting the same constant – market return – to obtain the last two variables from the first.

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

The previous section has shown that the portfolio performance of investors who start using index-linked securities does not improve relative to non-users. This section aims at further assessing the reasons why users of index funds and ETFs do not improve their portfolio performance.

Unwise use of index-linked securities may explain the worsening of the portfolio performance of the users after use. Another reason could be that the returns of the other securities deteriorate. To rule out the latter reason, as discussed in section II.B3, we now compare the passive part (index-linked securities), the active part (non-indexed linked securities) and the performance of the full (active plus passive) portfolio of users. In order to perform a fair comparison, two minor adjustments seem necessary. First, to be included in this comparison, we require each user to have a non-consecutive minimum holding-period of an index-linked security for at least 6 months.[18] Second, all performance measures are calculated only when an investor holds both passive as well as active securities simultaneously, because the periods in which both passive and active securities are held might differ between investors.

[INSERT TABLE VII ABOUT HERE]

Table VII reports the results. Comparing the passive with the active part of the portfolio, columns (1) vs. (2), almost all performance measures show a statistically significant under-performance of the passive part compared with the active one. Raw returns are lower (gross: 3.9% vs. 9.4%), the standard deviation is higher (gross: 29.8% vs. 24.6%), the Sharpe ratio is much lower (gross: 0.098 vs. 0.38) and the alpha is lower (MSCI gross: -3.4% vs. 1.4%, CDAX gross: -0.2% vs. 5.0%). All differences are statistically significant at the 1%-level. The

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

unsystematic variance share in the passive part is higher when using the MSCI as a benchmark (58.8% vs. 55.4%), but lower when using the CDAX (44.2% vs. 50.4%). This difference presumably stems from a preference for index-linked securities with a German index as benchmark (see table II). The difference between gross and net returns is even higher for the passive part of the portfolio, indicating that investors trade more in the passive part. The difference is, of course, partly due to set up costs and the first acquisition of index-linked securities.

We conclude that the performance of index-linked securities in a user's portfolio was worse than the performance of the rest of the portfolio. This means that the unwise use of index-linked securities explains the worsening of the portfolio performance of the users and not the worsening of the returns of the other securities.

It is, however, still possible for investors to combine index-linked securities with their other products in such a way as to end up with an overall more efficient full portfolio. This can be analyzed when comparing the performance of the active part without the index products with the full portfolio including the index funds, i.e., column (2) vs. (3).

We notice in this comparison that the risks in terms of standard deviation and unsystematic variance share are lower in the full portfolio, which implies that these index products seem to have positively affected the diversification of the full portfolio. However, in terms of performance, the inclusion of these index products results in a total portfolio performance that is worse in terms of raw returns (significant only for net raw returns), Sharpe ratio, alpha (significant only for CDAX). It can be concluded that ETFs and index funds definitely do not help investors improve the performance of their portfolio. What is more interesting is that the Sharpe ratio deteriorates, which implies that the overall portfolio becomes less efficient after the use of index-linked securities.

Now that we have established that the cause of performance deterioration experienced by the users after use is their use of index-linked securities, we go on to investigate how they use or rather misuse these products. As described in Section II.B4, we use a measure proposed by Odean (1999) to decompose returns into returns due to market timing and security selection.

[INSERT TABLES VIII and IX ABOUT HERE]

Panel A in Tables VIII and IX give the results using MSCI, whereas Panel B gives the results using CDAX. Table VIII takes all purchases and sales of index fund investors in the passive part into account. In contrast, Table IX first compares purchases and sales at the investor level before computing the average. Thus, Table VIII gives a transaction perspective, whereas Table IX gives an investor perspective. The investor perspective mitigates issues related to cross-correlation (see Section II.B4). For the investor perspective, we require investors to make at least one purchase of an indexed product and one sale of an indexed product.

The results show that investors make poor investment decisions with respect to their index-linked securities. Index securities investors sell outperform index securities they buy. Hence, if they did not trade these index securities, they would be better off. This holds true for both the transaction level as well as the investor level. Using t-tests, the differences are highly statistically significant in all cases except for the 30 day holding period at the investor level, where the difference is negative albeit statistically insignificant.

Is it market timing or is it security selection? As explained in section II.B4, the performance difference of returns between purchases and sales over this holding period is a measure of investment skill. 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 this holding period is solely due to security selection. The

difference of market returns during purchases and sales over this holding period is a measure of market timing.

We notice in Tables VIII and IX that for the investor level as well as for the transaction level the returns to security selection are positive in quite a few cases, some even significantly so. What is more striking though is that the returns to market timing are consistently negative and statistically highly significant. Thereby, it doesn't really matter whether we look at the investor or transaction level. We conclude that the decrease in portfolio performance of the users is primarily due to bad market timing.

It can be argued that our results are biased by issues of cross-correlation that drive our statistical significances (though the analysis at the level of the investor ameliorates this) or that we neglect the rest of an investor's portfolio. To address these valid concerns, the Internet Appendix gives the results of a robustness check. Here we implement a holdings-based test of market timing in the spirit of Jiang, Yao, and Yu (2007) and test of alpha (security selection) in the spirit of Elton, Gruber and Blake (2011). This test is conducted as a difference-in-difference test in calendar-time using matches based on all significant variables (Table A4, Panel A) and size (Table A4, Panel B). The test supports the major findings of this section. The market timing ability becomes worse after the adoption of index linked securities relative to a control group of non-adopters. Security selection ability turns out not to change.

VI. Conclusion

This paper investigates which individual investors use index-linked securities and whether they benefit from using such products.

Our findings are as follows. Investors who start to use these products are more likely to be female and younger than investors who do not use them. In the pre-period where none of our investors use these products, those who will become users trade more often, have higher

portfolio values, and more idiosyncratic risk in their portfolios. Their portfolio performance is higher, but not significantly so.

We then go on to find that the portfolio performance of individual users relative to non-users of index-linked securities worsens. Further analysis reveals the reason for this worsening of portfolio performance. Their ability to perform market timing, which becomes easier with these securities, worsens.

Thus, our paper records a dark side of index-linked securities 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
Time line
The figure presents the sequence of relevant events for the analysis of the effects of index-linked securities on private investors' portfolios (dates are always at the end of the respective month)

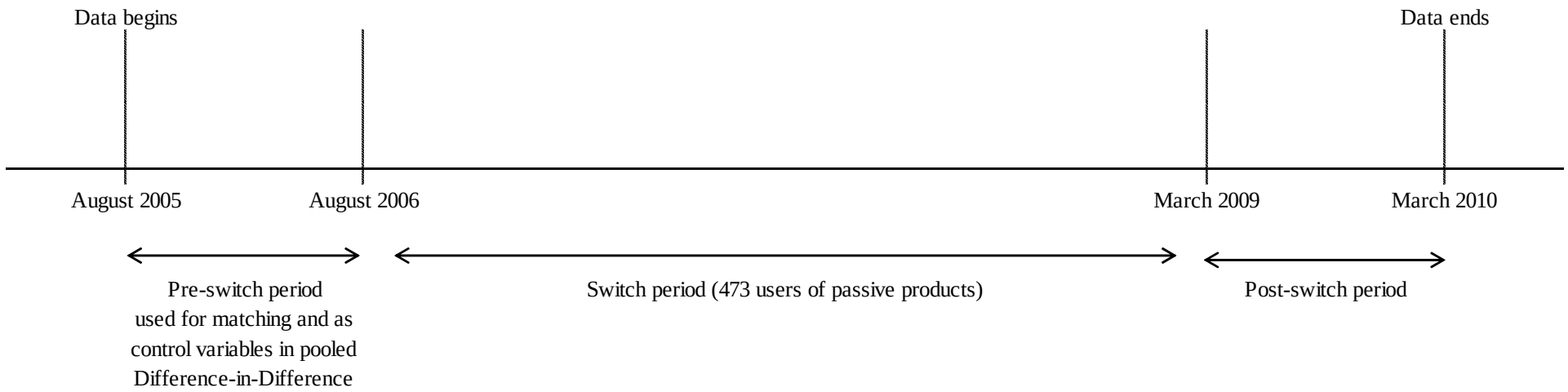

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Figure 2
The use of index-linked securities in our sample
The figure presents the usage of index-linked securities over time. The solid line (left axis) shows the average share of index-linked securities in terms of euros in the portfolios of users (*Passive share in %*). The dashed line (right axis) shows the cumulative number of users at that point in time.

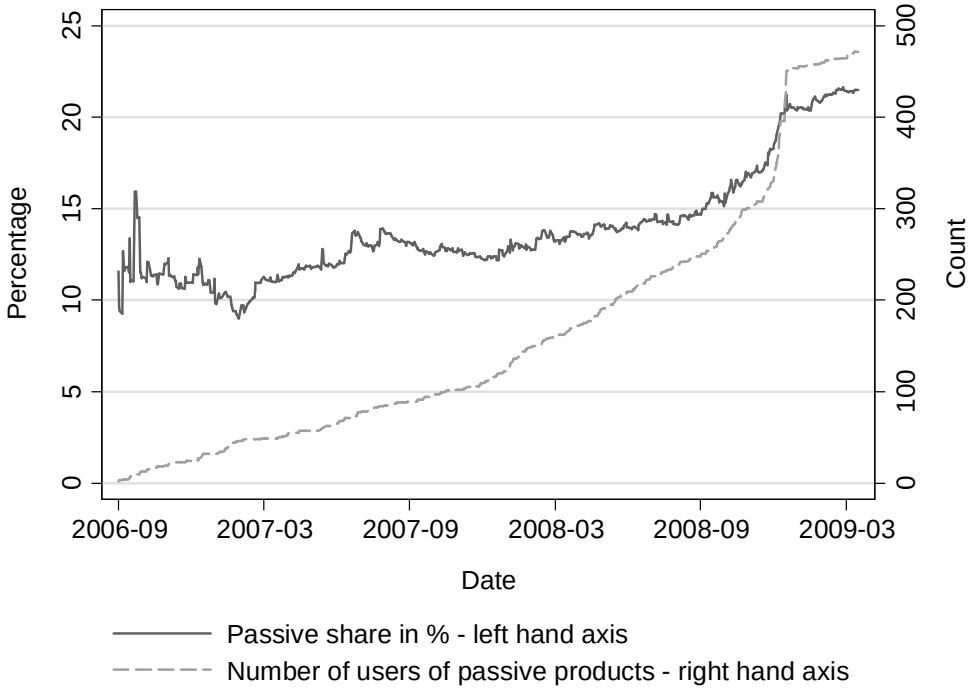

Table I

Usage of index-linked securities – an overview

Table I 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 in absolute and percentage terms. The last two columns compare ETFs and index funds in terms of number of available products and assets under management with active mutual funds.

	Passive investment products				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	294	91%	23	96%		
Index mutual funds	30	9%	1	4%		
Total	324	100%	24	100%	16%	17%

[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

Table II
What kind of index-linked securities do investors buy?

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

Benchmark index	Share in %
DAX	22.8%
STOXX Europe 50	9.5%
MSCI Emerging Markets	7.9%
STOXX Europe 600	4.0%
ShortDAX	3.7%
LevDAX	3.1%
STOXX Europe Select Dividend	2.8%
EONIA	2.4%
STOXX Europe 600 Basic Resources	2.1%
MSCI World	2.0%
MDAX	1.6%
HSCEI	1.5%
NASDAQ 100	1.5%
STOXX Europe Global Select Dividend	1.3%
STOXX Europe 600 Oil & Gas	1.2%
Other (125 indices)	32.6%
Total	100.0%

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

Country / region	Share in %
Germany	38.2%
Europe	29.6%
Emerging markets	11.1%
World	5.8%
USA	4.4%
China	3.2%
Russia	1.9%
Brazil	1.2%
Japan	1.0%
Asia	1.0%
Other	2.7%
Total	100.0%

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

Asset class	Share in %
Equity	87.1%
Bonds	6.8%
Commodities	5.8%
Other	0.3%
Total	100.0%

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 / French Factors (CDAX index)	Daily	Datastream / own calculation
	MSCI World All Country index	Daily	Datastream
	Individual security prices	Daily	Datastream
	Individual security properties	Time-invariant	Bank / Deutsche Börse

Table IV
Summary statistics for "Users" and "All non-users"

Table IV reports summary statistics on client demographics, investor characteristics and portfolio characteristics. The columns "Users" and "All 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 comprise 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, by an external agency (*Wealth*). Portfolio characteristics comprise statistics on the number of years the client has been with the bank (*Length of relationship*), the average risky portfolio value (*Average risky portfolio value*) of the customer during our observation period (*08/2005 – 03/2010*), 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, the average number of trades per month (*Average number of trades*), the average volume per trade in thousand € (*Average volume per trade*) and the average portfolio turnover per month (*Average portfolio turnover*). Portfolio characteristics comprise statistics on market-adjusted returns (*gross and net of transaction costs*) using the CDAX (*Market-adjusted return CDAX*) and the MSCI World All Country index (*Market-adjusted return MSCI*) as a benchmark, Sharpe ratios (*Sharpe ratio gross and net of transaction costs*), the idiosyncratic variance share (*Idiosyncratic variance share*) and 1-factor alphas using CDAX (*CDAX 1-factor alpha*) and MSCI World All Country index returns (*MSCI 1-factor alpha*). The alphas and idiosyncratic variance share stem from applying a 1-factor Jensen model calibrated for Germany and estimated separately for each investor. 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	81.2	100.0	473	84.4	100.0	3,666	.070*
Age	Years	48.9	46.0	473	50.4	49.0	3,666	.006***
Wealth	Microgeoraphic status	6.4	6.5	420	6.3	6.0	3,260	.163
Investor characteristics								
Length of relationship with the bank	Years since account opening	9.1	9.2	473	9.1	9.1	3,666	.609
Average risky portfolio value *(08/2005 - 03/2010)*	€ thousands	69.4	50.6	473	57.7	40.2	3,666	.000***
Risky share *(08/2005)*	%	80.1	86.2	473	84.9	86.7	3,666	.663
Risky share *(03/2010)*	%	83.1	90.4	473	76.5	85.0	3,666	.000***
Average number of trades *(08/2005 - 03/2010)*	Trades per month	2.3	1.5	473	1.7	1.0	3,666	.000***
Average volume per trade *(08/2005 - 03/2010)*	€ thousands	1.8	1.1	473	1.5	0.9	3,666	.013**
Average portfolio turnover *(08/2005 - 03/2010)*	%, monthly	3.8	2.5	473	3.6	2.2	3,666	.252
Portfolio characteristics								
Market-adjusted return CDAX *(08/2005 - 03/2010)*	%, annually	-2.3	-2.1	473	-2.8	-1.9	3,666	.293
Market-adjusted return net CDAX *(08/2005 - 03/2010)*	%, annually	-3.0	-2.6	473	-3.5	-2.4	3,666	.374
Market-adjusted return MSCI *(08/2005 - 03/2010)*	%, annually	0.5	0.7	473	0.0	0.9	3,666	.293
Market-adjusted return net MSCI *(08/2005 - 03/2010)*	%, annually	-0.2	0.2	473	-0.6	0.4	3,666	.373
Sharpe ratio *(08/2005 - 03/2010)*		-0.22	-0.25	473	-0.20	-0.17	3,666	.775
Sharpe ratio net *(08/2005 - 03/2010)*		-0.45	-0.46	473	-0.35	-0.31	3,666	.237
Idiosyncratic variance share CDAX 1-factor *(08/2005 - 03/2010)*	%	49.4	45.7	473	50.1	46.5	3,666	.423
CDAX 1-factor alpha *(08/2005 - 03/2010)*	%, annually	-1.8	-1.7	473	-2.5	-1.6	3,666	.145
MSCI 1-factor alpha *(08/2005 - 03/2010)*	%, annually	0.1	0.3	473	-0.1	0.7	3,666	.591

Table V
Who uses index-linked securities? A probit test

Table V reports marginal effects of a probit regression. The dependent variable for the probit regression is a dummy (*Dummy user*) that is set to one for clients that held at least one passive product within the sample period. All investors for which we have position statements in every month of our sample period are included in this regression. For the estimation of the probit model, our independent variables are time-invariant or measured either at the beginning (*08/2005*) of our sample period or within the first year (*08/2005 - 08/2006*) before the first use of a passive product by an investor. 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 average risky portfolio value of the customer (*Average log portfolio value*), the proportion of risky assets in the account (*Risky share*), the number of trades per month (*Average number of trades*), the average volume per trade in € (*Average turnover per trade in €*), the average portfolio turnover per month (*Portfolio turnover*), the market-adjusted return measured against the CDAX (*Average market-adjusted return*) and the idiosyncratic variance share (*Idiosyncratic variance share*). The idiosyncratic variance share stems from applying a 1-factor Jensen model calibrated for Germany and estimated separately for each investor. Heteroscedasticity robust p-values are in parentheses. The pseudo R-squared values and number of observations 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				
Dependent variable	(1)	(2)	(3)	(4)	(5)
Demographics					
Dummy male	-0.027*	-0.029**	-0.029**	-0.029**	-0.029**
	(0.065)	(0.049)	(0.044)	(0.044)	(0.044)
Age	-0.001***	-0.002***	-0.002***	-0.002***	-0.001***
	(0.006)	(0.001)	(0.001)	(0.001)	(0.002)
Dummy low wealth	-0.006	-0.005	-0.004	-0.004	-0.005
	(0.793)	(0.822)	(0.840)	(0.849)	(0.803)
Dummy high wealth	0.008	0.008	0.009	0.009	0.010
	(0.419)	(0.426)	(0.355)	(0.356)	(0.335)
Investor characteristics					
Length of relationship		0.002	0.002	0.002	0.002
		(0.425)	(0.412)	(0.393)	(0.370)
Average log portfolio value *(08/2005 - 08/2006)*		0.012**	0.007	0.006	0.009*
		(0.014)	(0.168)	(0.248)	(0.088)
Risky share *(08/2005)*		-0.000	-0.000	-0.000	-0.000
		(0.465)	(0.428)	(0.472)	(0.472)
Average number of trades *(08/2005 - 08/2006)*			0.005***	0.005***	0.005***
			(0.001)	(0.001)	(0.002)
Average turnover per trade in € *(08/2005 - 08/2006)*			0.000	0.000	0.000
			(0.219)	(0.232)	(0.349)
Portfolio turnover *(08/2005 - 08/2006)*			-0.140	-0.134	-0.156
			(0.195)	(0.211)	(0.149)
Portfolio characteristics					
Market-adjusted return *(08/2005 - 08/2006)*				8.204	9.337
				(0.122)	(0.100)
Idiosyncratic variance share *(08/2005 - 08/2006)*					0.001**
					(0.016)
Observations	4,139	4,139	4,139	4,139	4,139
Pseudo-R^2	0.00407	0.00710	0.0105	0.0110	0.0129
F-test		0.0102	0.001***	0.001***	0.000***

Table VI
Does the use of index-linked securities improve portfolio performance? A difference-in-differences test in calendar-time

Table VI reports performance measures for 473 users of index-linked securities and their matched neighbors for the periods before they start to use index-linked securities and after. The differences between the users and their matches are compared before and after. The last column reports the difference-in-differences between before and after. The performance metrics provided in this table are calculated in calendar-time. On each day, we calculate the average return for users who have not yet started to use index-linked securities and for users who have already started to use index-linked securities, thereby constructing two equally weighted portfolio return series that are representative of an average investor within each group. Equivalent average returns are calculated for users' matched neighbors. Metrics provided are measures of overall performance. Raw returns are annualized daily returns. Market-adjusted returns are raw returns minus the return of a benchmark, MSCI or CDAX. We further report 1-factor alphas for the MSCI World All Country index and the CDAX as well as 4-factor alphas for the CDAX. P-values are reported in the line below the respective metric. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

	Before			After			After - before
Metric	User	Matched	Difference (user less match)	User	Matched	Difference (user less match)	Difference
Returns *(%, annual)*							
Raw return	-7.38	-12.42	5.04	-1.08	-1.70	0.62	-4.42
			.139			.817	.310
Market-adjusted return MSCI	-0.92	-5.97	5.04	-1.12	-1.74	0.62	-4.42
	.892	.353	.139	.862	.775	.817	.310
Market-adjusted return CDAX	2.25	-2.79	5.04	0.50	-0.13	0.62	-4.42
	.723	.625	.139	.933	.983	.817	.310
Overall alpha *(%, annual)*							
MSCI 1-factor	-4.78	-8.23	3.45	-3.60	-4.02	0.42	-3.03
	.522	.325	.024**	.644	.599	.749	.032**
CDAX 1-factor	-5.08	-9.04	3.96	-2.48	-2.72	0.24	-3.72
	.328	.143	.008***	.763	.744	.859	.030**
CDAX 4-factor	0.77	-3.28	4.05	-0.36	-0.79	0.43	-3.62
	.747	.166	.067*	.940	.852	.693	.036**

Table VII

How does the passive part of a users' portfolio perform?

Table VII compares the performance of ETFs and index funds ((1) *Passive part*) with all other securities ((2) *Active part*) and the joint portfolio ((3) *Full portfolio*). All measures are calculated only when an investor holds ETFs or index funds as well as other securities. These ETF and index fund 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*), the ratio of excess returns and excess standard deviations (*Sharpe ratio gross and net*), 1- factor alphas (*Alpha gross and net*), unsystematic variance share and beta. Alpha, unsystematic variance share and beta stem from a single factor regression on MSCI All Country World Index excess returns or CDAX excess returns, respectively. The performances of these 4 distinct 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 are attributable to the exclusion of all investors with less than a 6-month ETF or index fund holding period.

	ETFs and index fund holding period			t-test (p-value)			
	(1) Passive part	(2) Active part	(3) Full portfolio	(1) vs. (2)	(1) vs. (3)	(2) vs. (3)	N
Return, gross	3.9	9.4	8.7	.000***	.000***	.156	451
Return, net	2.5	8.8	8.1	.000***	.000***	.094*	451
Standard deviation, gross	29.8	24.6	22.6	.000***	.000***	.003***	451
Standard deviation, net	29.9	24.6	22.6	.000***	.000***	.003***	451
Sharpe ratio, gross	0.098	0.380	0.352	.000***	.000***	.061*	451
Sharpe ratio, net	0.042	0.353	0.317	.000***	.000***	.019**	451
Alpha (MSCI), gross	-3.4	1.4	1.1	.000***	.000***	.416	451
Alpha (MSCI), net	-4.7	0.8	0.4	.000***	.000***	.275	451
Alpha (CDAX), gross	-0.2	5.0	4.4	.000***	.000***	.095*	451
Alpha (CDAX), net	-1.5	4.4	3.8	.000***	.000***	.045**	451
Unsystematic variance share (CDAX)	44.2	50.4	42.9	.000***	.350	.000***	451
Unsystematic variance share (MSCI)	58.8	55.4	50.8	.006***	.000***	.000***	451
Beta (CDAX)	0.7	0.6	0.6	.000***	.000***	.883	451
Beta (MSCI)	0.8	0.7	0.7	.055*	.002***	.312	451

Table VIII

Average returns following purchases and sales of index-linked securities

Table VIII compares the average returns of purchases and sales in ETFs and index funds as well as the difference between purchases and sales for the 20 (1 month), 126 (1/2 year) and 252 (1 year) trading days after the trade occurred. We report the returns for raw return, market adjusted return and the market return for the respective period. Raw returns are simply the return the specific security had over the respective period. To measure returns due to security selection we calculate market adjusted returns by subtracting the market return from the raw return. We also report market returns over the same period as our measure of market timing. Panel A reports results with the MSCI World All Country index and Panel B with the CDAX being the market index. P-values of a t-test against 0 for purchases and sales as well as for the difference of the means between purchase and sales are reported. 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: MSCI

	Purchases			Sales			Difference	
Metric	Mean	P-value	N	Mean	P-value	N	Mean	P-value
Raw return								
20 trading days later	-16.9	.000***	5616	-5.5	.033**	1250	-11.4	.000***
126 trading days later	-5.3	.000***	5616	2.7	.027**	1250	-8.0	.000***
252 trading days later	2.9	.000***	5616	6.0	.000***	1250	-3.1	.005***
Market adjusted returns (i.e. returns due to security selection)								
20 trading days later	-3.0	.001***	5610	0.2	.951	1244	-3.2	.175
126 trading days later	0.1	.778	5610	-2.2	.084*	1244	2.4	.044**
252 trading days later	-1.1	.001***	5610	-6.8	.000***	1244	5.6	.000***
Market return (i.e. returns due to market timing)								
20 trading days later	-13.9	.000***	5610	-5.7	.005***	1244	-8.2	.000***
126 trading days later	-5.4	.000***	5610	5.0	.000***	1244	-10.4	.000***
252 trading days later	4.0	.000***	5610	12.8	.000***	1244	-8.8	.000***

Panel B: CDAX

	Purchases			Sales			Difference	
Metric	Mean	P-value	N	Mean	P-value	N	Mean	P-value
Raw return								
30 trading days later	-16.9	.000***	5616	-5.5	.033**	1250	-11.4	.000***
126 trading days later	-5.3	.000***	5616	2.7	.027**	1250	-8.0	.000***
252 trading days later	2.9	.000***	5616	6.0	.000***	1250	-3.1	.005***
Market adjusted returns (i.e. returns due to security selection)								
30 trading days later	11.0	.000***	5610	5.9	.023**	1244	5.1	.030**
126 trading days later	7.0	.000***	5610	2.5	.062*	1244	4.5	.000***
252 trading days later	4.0	.000***	5610	-2.1	.026**	1244	6.1	.000***
Market return (i.e. returns due to market timing)								
30 trading days later	-27.9	.000***	5610	-11.4	.000***	1244	-16.5	.000***
126 trading days later	-12.3	.000***	5610	0.3	.843	1244	-12.5	.000***
252 trading days later	-1.1	.021**	5610	8.1	.000***	1244	-9.2	.000***

Table IX

Average returns following purchases and sales of index-linked securities grouped by each investor

Table IX compares the average returns of purchases and sales in ETFs and index funds as well as the difference between purchases and sales for the 20 (1 month), 126 (1/2 year) and 252 (1 year) trading days after the trade occurred. The difference in this table compared to Table VIII is that instead of calculating average returns over all transactions we first calculate an average for each investor and then take the average over all investors. Thereby excluding the possibility that only some investors who trade a lot would drive our results. We report the returns for raw return, market adjusted return and the market return for the respective period. Raw returns are simply the return the specific security had over the respective period. To measure returns due to security selection we calculate market adjusted returns by subtracting the market return from the raw return. We also report market returns over the same period as our measure of market timing. Panel A reports results with the MSCI World All Country index and Panel B with the CDAX being the market index. P-values of a t-test against 0 for purchases and sales as well as for the difference of the means between purchase and sales are reported. 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 are attributable to the exclusion of all investors who do not have at least one purchase and sell in ETFs or index funds.

Panel A: MSCI

	Purchases		Sales		Difference		
Metric	Mean	P-value	Mean	P-value	Mean	P-value	N
Raw return							
30 trading days later	-14.6	.001***	-8.5	.085*	-6.2	.303	187
126 trading days later	-4.8	.046**	2.0	.375	-6.9	.015**	187
252 trading days later	-1.5	.409	4.8	.018**	-6.3	.002***	187
Market adjusted returns (i.e. returns due to security selection)							
30 trading days later	2.3	.600	-0.2	.971	2.5	.655	187
126 trading days later	4.4	.040**	0.0	.988	4.5	.067*	187
252 trading days later	0.6	.715	-5.1	.006***	5.7	.001***	187
Market return (i.e. returns due to market timing)							
30 trading days later	-16.9	.000***	-8.1	.035**	-8.8	.033**	187
126 trading days later	-9.3	.000***	2.2	.358	-11.5	.000***	187
252 trading days later	-2.1	.250	10.0	.000***	-12.1	.000***	187

Panel B: CDAX

	Purchases		Sales		Difference		
Metric	Mean	P-value	Mean	P-value	Mean	P-value	N
Raw return							
30 trading days later	-14.6	.001***	-8.5	.085*	-6.2	.303	187
126 trading days later	-4.8	.046**	2.0	.375	-6.9	.015**	187
252 trading days later	-1.5	.409	4.8	.018**	-6.3	.002***	187
Market adjusted returns (i.e. returns due to security selection)							
30 trading days later	11.4	.013**	9.1	.080*	2.3	.682	187
126 trading days later	8.7	.000***	4.6	.074*	4.1	.107	187
252 trading days later	4.3	.009***	-0.8	.666	5.1	.002***	187
Market return (i.e. returns due to market timing)							
30 trading days later	-26.1	.000***	-17.4	.000***	-8.6	.113	187
126 trading days later	-13.5	.000***	-2.5	.343	-11.0	.000***	187
252 trading days later	-5.8	.003***	5.7	.005***	-11.5	.000***	187

INTERNET APPENDIX for

The Dark Side of ETFs and Index Funds

Utpal Bhattacharya, Benjamin Loos, Steffen Meyer, Andreas Hackethal and Simon Kaesler

Table A1
Who uses index-linked securities? A probit test

Table A1 reports marginal effects of a probit regression. The dependent variable for the probit regression is a dummy (*Dummy user*) that is set to one for clients that held at least one index-linked security within the sample period. The difference in this table compared to Table V in the text is that instead of all investors who have a position statement in every month of our sample period, we only include all matched investors in this regression. For the estimation of the probit model, our independent variables are time-invariant or measured either at the beginning (*08/2005*) of our sample period or within the first year (*08/2005 - 08/2006*) before the first use of an index-linked security by an investor. 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 average risky portfolio value of the customer (*Average log portfolio value*), the proportion of risky assets in the account (*Risky share*), the number of trades per month (*Average number of trades*), the average volume per trade in € (*Average turnover per trade in €*), the average portfolio turnover per month (*Portfolio turnover*), the market-adjusted return measured against the CDAX (*Average market-adjusted return*) and the idiosyncratic variance share (*Idiosyncratic variance share*). The idiosyncratic variance share stems from applying a 1-factor Jensen model calibrated for Germany and estimated separately for each investor. Heteroscedasticity robust p-values are in parentheses. The pseudo R-squared values and number of observations 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				
Dependent variable	(1)	(2)	(3)	(4)	(5)
Demographics					
Dummy male	-0.028	-0.029	-0.027	-0.027	-0.025
	(0.513)	(0.497)	(0.534)	(0.534)	(0.558)
Age	-0.002	-0.002*	-0.002	-0.002	-0.002
	(0.136)	(0.096)	(0.115)	(0.116)	(0.108)
Dummy low wealth	0.044	0.043	0.042	0.045	0.050
	(0.539)	(0.552)	(0.562)	(0.537)	(0.497)
Dummy high wealth	0.086**	0.087**	0.086**	0.086**	0.086**
	(0.011)	(0.010)	(0.011)	(0.012)	(0.012)
Investor characteristics					
Length of relationship		0.003	0.002	0.002	0.002
		(0.647)	(0.770)	(0.741)	(0.827)
Average log portfolio value *(08/2005 - 08/2006)*		0.016	0.015	0.012	0.005
		(0.298)	(0.363)	(0.474)	(0.777)
Risky share *(08/2005)*		-0.001	-0.001	-0.001	-0.001
		(0.130)	(0.121)	(0.144)	(0.143)
Average number of trades *(08/2005 - 08/2006)*			0.001	0.001	0.002
			(0.779)	(0.863)	(0.734)
Average turnover per trade in € *(08/2005 - 08/2006)*			0.000	0.000	0.000
			(0.946)	(0.839)	(0.766)
Portfolio turnover *(08/2005 - 08/2006)*			-0.450	-0.440	-0.397
			(0.203)	(0.214)	(0.263)
Portfolio characteristics					
Market-adjusted return *(08/2005 - 08/2006)*				36.666	32.590
				(0.206)	(0.257)
Idiosyncratic variance share *(08/2005 - 08/2006)*					-0.001*
					(0.099)
Observations	946	946	946	946	946
Pseudo-R^2	0.00650	0.00901	0.0110	0.0122	0.0142
F-test		0.138	0.191	0.165	0.106

Table A2

Does the use of index-linked securities improve portfolio performance? A difference-in-differences test in calendar-time matching on portfolio size

Table A2 reports performance measures for 476 users of index-linked securities and their matched neighbors for the periods before they start to use index-linked securities and after. The differences between the users and their matches are compared before and after. The last column reports the difference-in-differences between before and after. The performance metrics provided in this table are calculated in calendar-time. On each day, we calculate the average return for users who have not yet started to use index-linked securities and for users who have already started to use index-linked securities, thereby constructing two equally weighted portfolio return series that are representative of an average investor within each group. Equivalent average returns are calculated for users' matched neighbors. Metrics provided are measures of overall performance. Raw returns are annualized daily returns. Market-adjusted returns are raw returns minus the return of a benchmark, MSCI or CDAX. We further report 1- factor alphas for the MSCI World All Country index and the CDAX as well as 4-factor alphas for the CDAX. P-values are reported in the line below the respective metric. Three stars (***) denote significance at 1% or less; two stars (**) denote significance at 5% or less; one star (*) denotes significance at 10% or less.

	Before			After			After - before
Metric	User	Matched	Difference (user less match)	User	Matched	Difference (user less match)	Difference
Returns *(%, annual)*							
Raw return	-7.38	-11.62	4.24	-1.08	-1.34	0.26	-3.98
			.254			.929	.404
Market-adjusted return MSCI	-0.92	-5.17	4.24	-1.12	-1.38	0.26	-3.98
	.892	.343	.254	.862	.816	.929	.404
Market-adjusted return CDAX	2.25	-2.00	4.24	0.50	0.23	0.26	-3.98
	.723	.739	.254	.933	.970	.929	.404
Overall alpha *(%, annual)*							
MSCI 1-factor	-4.78	-7.18	2.40	-3.60	-3.60	0.00	-2.40
	.522	.334	.252	.644	.595	1.000	.006***
CDAX 1-factor	-5.08	-7.58	2.49	-2.48	-2.27	-0.21	-2.70
	.328	.067*	.192	.763	.763	.815	.004***
CDAX 1-factor	0.77	-2.51	3.28	-0.36	-0.80	0.45	-2.83
	.747	.034**	.114	.940	.860	.435	.023**

Table A3

Does the use of index-linked securities improve portfolio performance? A difference-in-differences test in event-time using all non-users

Table A3 reports estimates of a pooled regression on the change of different performance measures in panels A to G. These measures are raw returns (Panel A), market-adjusted returns MSCI (Panel B), market-adjusted returns CDAX (Panel C), 1- factor alphas for the MSCI (Panel D) and the CDAX (Panel E), 4-factor alphas for the CDAX (Panel F) and Sharpe ratios (Panel G). The focus of this table is on the variable Dummy user that is equal to 1 if a client starts using index-linked securities. At each of the 252 switching dates, we construct a full cross-section of all 473 users switching at a specific date and all non-users; subsequently, we pool these cross-sections, which results in 924,305 observations. All investors for which we have position statements in every month of our sample period are included in this regression. Additionally, the model controls for several other independent variables that are measured prior to the first use of an index-linked security by an investor (*08/2005 - 08/2006*) or time-invariant variables (*08/2005*). 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 average risky portfolio value of the customer (*Average log portfolio value*), the proportion of risky assets in the account (*Risky share*), the average portfolio turnover per month (*Portfolio turnover*), the average number of trades per month (*Average number of trades*), the average volume per trade in € (*Average turnover per trade in €*), the idiosyncratic variance share (*Idiosyncratic variance share*), the Sharpe ratio (*Sharpe ratio*) and the share of index-linked securities in the portfolio (*Passive share in %*). The idiosyncratic variance share stems from applying a 1-factor Jensen model calibrated for Germany and estimated separately for each investor. All columns are estimated with month fixed effects. P-values are computed using Driscoll - Kraay standard errors and are presented in parentheses. R-squared values and number of observations 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.

Panel A: Raw return

	Raw return improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-3.453***	-3.460***	-3.657***	-3.710***	-3.048***	-3.470***	-2.589**	-2.680**
	(0.008)	(0.008)	(0.007)	(0.003)	(0.007)	(0.002)	(0.022)	(0.017)
Dummy male		1.401***	1.297***	1.084***	0.848***	0.812***	0.402**	0.812***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	(0.000)
Age		-0.039***	-0.004	-0.002	0.004	0.025***	-0.014***	0.025***
		(0.000)	(0.354)	(0.714)	(0.342)	(0.000)	(0.003)	(0.000)
Dummy low wealth		-0.862***	-0.684***	-0.569***	-0.230*	-0.231*	-0.122	-0.231*
		(0.000)	(0.000)	(0.000)	(0.083)	(0.082)	(0.342)	(0.082)
Dummy high wealth		-0.621***	-0.803***	-0.521***	-0.466***	-0.368***	-0.615***	-0.368***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.353***	0.461***	0.185***	0.187***	0.307***	0.187***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.832***	-2.128***	-0.531***	0.084	-0.675***	0.084
			(0.000)	(0.000)	(0.000)	(0.111)	(0.000)	(0.111)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.001***	-0.001***	-0.002***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				7.902***	-5.050	-9.453***	1.296	-9.453***
				(0.009)	(0.145)	(0.006)	(0.688)	(0.006)
Average number of trades *(08/2005 - 08/2006)*				0.883***	0.177***	0.120***	0.808***	0.120***
				(0.000)	(0.000)	(0.009)	(0.000)	(0.009)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	0.000***	-0.000	-0.000***	-0.000
				(0.000)	(0.000)	(0.565)	(0.000)	(0.565)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.535***	-0.526***		-0.526***
					(0.000)	(0.000)		(0.000)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.112***		0.112***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-1.806***	
							(0.000)	
Passive share in % *(after period)*								-4.375
								(0.207)
Constant	-15.162***	-14.047***	0.384	0.646	-16.263***	-29.290***	-5.942***	-29.289***
	(0.000)	(0.000)	(0.657)	(0.479)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.552	0.552	0.544	0.552	0.663	0.668	0.592	0.668

Panel B: Market-adjusted return MSCI

	Market-adjusted return MSCI improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-4.115***	-4.122***	-4.510***	-4.563***	-3.900***	-4.324***	-3.437***	-3.369***
	(0.007)	(0.007)	(0.004)	(0.002)	(0.004)	(0.001)	(0.008)	(0.010)
Dummy male		1.400***	1.291***	1.079***	0.843***	0.806***	0.394**	0.806***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.024)	(0.000)
Age		-0.040***	-0.005	-0.002	0.004	0.025***	-0.014***	0.025***
		(0.000)	(0.339)	(0.686)	(0.361)	(0.000)	(0.003)	(0.000)
Dummy low wealth		-0.852***	-0.669***	-0.554***	-0.214	-0.215	-0.106	-0.215
		(0.000)	(0.000)	(0.000)	(0.107)	(0.106)	(0.413)	(0.106)
Dummy high wealth		-0.643***	-0.819***	-0.539***	-0.484***	-0.386***	-0.634***	-0.386***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.355***	0.462***	0.185***	0.188***	0.308***	0.188***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.833***	-2.132***	-0.533***	0.086	-0.674***	0.086
			(0.000)	(0.000)	(0.000)	(0.105)	(0.000)	(0.105)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.001***	-0.001***	-0.002***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				7.666**	-5.296	-9.723***	1.039	-9.724***
				(0.011)	(0.126)	(0.005)	(0.747)	(0.005)
Average number of trades *(08/2005 - 08/2006)*				0.878***	0.172***	0.115**	0.803***	0.115**
				(0.000)	(0.000)	(0.012)	(0.000)	(0.012)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	0.000***	-0.000	-0.000***	-0.000
				(0.000)	(0.000)	(0.872)	(0.000)	(0.872)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.535***	-0.526***		-0.526***
					(0.000)	(0.000)		(0.000)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.113***		0.113***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-1.811***	
							(0.000)	
Passive share in % *(after period)*								-5.291
								(0.168)
Constant	2.426***	3.561***	17.984***	18.288***	1.367***	-11.734***	11.679***	-11.733***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.051	0.052	0.061	0.077	0.313	0.323	0.163	0.323

Panel C: Market-adjusted return CDAX

	Market-adjusted return CDAX improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-3.225***	-3.232***	-3.444***	-3.497***	-2.835***	-3.259***	-2.372**	-2.363**
	(0.009)	(0.008)	(0.005)	(0.003)	(0.006)	(0.001)	(0.022)	(0.024)
Dummy male		1.400***	1.291***	1.079***	0.843***	0.807***	0.395**	0.807***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.024)	(0.000)
Age		-0.040***	-0.005	-0.002	0.004	0.025***	-0.014***	0.025***
		(0.000)	(0.340)	(0.687)	(0.360)	(0.000)	(0.003)	(0.000)
Dummy low wealth		-0.853***	-0.670***	-0.555***	-0.215	-0.216	-0.107	-0.216
		(0.000)	(0.000)	(0.000)	(0.106)	(0.104)	(0.410)	(0.104)
Dummy high wealth		-0.644***	-0.820***	-0.540***	-0.485***	-0.386***	-0.634***	-0.386***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.354***	0.462***	0.185***	0.188***	0.308***	0.188***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.833***	-2.131***	-0.533***	0.086	-0.674***	0.086
			(0.000)	(0.000)	(0.000)	(0.104)	(0.000)	(0.104)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.001***	-0.001***	-0.002***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				7.699**	-5.263	-9.691***	1.071	-9.691***
				(0.010)	(0.128)	(0.005)	(0.740)	(0.005)
Average number of trades *(08/2005 - 08/2006)*				0.879***	0.172***	0.115**	0.803***	0.115**
				(0.000)	(0.000)	(0.012)	(0.000)	(0.012)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	0.000***	-0.000	-0.000***	-0.000
				(0.000)	(0.000)	(0.848)	(0.000)	(0.848)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.535***	-0.526***		-0.526***
					(0.000)	(0.000)		(0.000)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.113***		0.113***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-1.811***	
							(0.000)	
Passive share in % *(after period)*								-4.964
								(0.174)
Constant	6.729***	7.863***	22.285***	22.586***	5.664***	-7.437***	15.976***	-7.436***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.013	0.015	0.024	0.041	0.288	0.297	0.131	0.297

Panel D: 1-factor alpha MSCI

	1-factor alpha MSCI improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-0.927	-0.943	-0.858	-0.924	-0.263	-0.712	0.174	-0.587
	(0.219)	(0.214)	(0.390)	(0.344)	(0.752)	(0.364)	(0.856)	(0.576)
Dummy male		1.353***	1.286***	1.055***	0.819***	0.780***	0.387***	0.780***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		-0.045***	-0.017***	-0.013**	-0.008	0.014***	-0.025***	0.014***
		(0.000)	(0.006)	(0.035)	(0.225)	(0.007)	(0.000)	(0.007)
Dummy low wealth		-1.015***	-0.850***	-0.728***	-0.389***	-0.390***	-0.291***	-0.390***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)
Dummy high wealth		-0.691***	-0.869***	-0.553***	-0.499***	-0.394***	-0.645***	-0.394***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.331***	0.450***	0.174***	0.176***	0.299***	0.176***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.629***	-1.962***	-0.366***	0.290***	-0.540***	0.290***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.001***	-0.001***	-0.002***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				7.647***	-5.296***	-9.990***	1.179	-9.990***
				(0.000)	(0.000)	(0.000)	(0.368)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				1.010***	0.305***	0.245***	0.937***	0.245***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	0.000***	-0.000***	-0.000***	-0.000***
				(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.535***	-0.525***		-0.525***
					(0.000)	(0.000)		(0.000)
Equity beta *(08/2005 - 08/2006)*						0.120***		0.120***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-1.768***	
							(0.000)	
Passive share in % *(after period)*								-0.697
								(0.860)
Constant	0.938***	2.429***	15.431***	15.759***	-1.139	-15.027***	9.308***	-15.027***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.210)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.076	0.077	0.077	0.099	0.342	0.352	0.184	0.352

Panel E: 1-factor alpha CDAX

	1-factor alpha CDAX improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-2.496***	-2.458***	-2.285***	-2.339***	-1.673**	-1.871***	-1.254	-1.623*
	(0.000)	(0.000)	(0.005)	(0.005)	(0.013)	(0.004)	(0.129)	(0.050)
Dummy male		1.711***	1.623***	1.324***	1.087***	1.070***	0.664***	1.070***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		-0.017***	0.012*	0.014**	0.020***	0.030***	0.003	0.030***
		(0.003)	(0.058)	(0.029)	(0.003)	(0.000)	(0.687)	(0.000)
Dummy low wealth		-0.938***	-0.684***	-0.524***	-0.183*	-0.183*	-0.092	-0.183*
		(0.000)	(0.000)	(0.000)	(0.051)	(0.050)	(0.316)	(0.050)
Dummy high wealth		-0.662***	-0.889***	-0.525***	-0.470***	-0.425***	-0.617***	-0.425***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.356***	0.508***	0.230***	0.231***	0.359***	0.231***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.603***	-1.904***	-0.298***	-0.009	-0.499***	-0.009
			(0.000)	(0.000)	(0.000)	(0.896)	(0.000)	(0.896)
Risky share *(08/2005)*			-0.001***	-0.002***	-0.001***	-0.001***	-0.001***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				16.957***	3.932***	1.866*	10.569***	1.866*
				(0.000)	(0.005)	(0.082)	(0.000)	(0.082)
Average number of trades *(08/2005 - 08/2006)*				1.054***	0.344***	0.318***	0.982***	0.318***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	0.000	-0.000***	-0.000***	-0.000***
				(0.000)	(0.885)	(0.001)	(0.000)	(0.001)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.538***	-0.534***		-0.534***
					(0.000)	(0.000)		(0.000)
Equity beta *(08/2005 - 08/2006)*						0.053***		0.053***
						(0.003)		(0.003)
Sharpe ratio *(08/2005 - 08/2006)*							-1.746***	
							(0.000)	
Passive share in % *(after period)*								-1.371
								(0.683)
Constant	0.462*	0.212	12.698***	12.127***	-4.878***	-10.990***	5.756***	-10.990***
	(0.099)	(0.616)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.127	0.128	0.124	0.150	0.384	0.386	0.229	0.386

Panel F: 4-factor alpha CDAX

	4-factor alpha CDAX improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-1.849***	-1.779***	-2.075***	-2.162***	-1.502**	-1.480**	-1.097	-2.440***
	(0.005)	(0.007)	(0.007)	(0.009)	(0.026)	(0.027)	(0.193)	(0.002)
Dummy male		1.609***	1.418***	1.212***	0.977***	0.979***	0.565***	0.979***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		0.009*	0.028***	0.033***	0.039***	0.038***	0.022***	0.038***
		(0.057)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy low wealth		-0.787***	-0.457***	-0.365***	-0.027	-0.027	0.059	-0.027
		(0.000)	(0.000)	(0.003)	(0.811)	(0.811)	(0.597)	(0.811)
Dummy high wealth		-0.346***	-0.557***	-0.249***	-0.194***	-0.199***	-0.338***	-0.199***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.518***	0.631***	0.355***	0.355***	0.485***	0.355***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.259***	-1.493***	0.101**	0.069	-0.113***	0.069
			(0.000)	(0.000)	(0.012)	(0.315)	(0.005)	(0.315)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				8.535***	-4.383***	-4.156***	2.264**	-4.156***
				(0.000)	(0.000)	(0.000)	(0.025)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				1.012***	0.308***	0.311***	0.941***	0.311***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.534***	-0.534***		-0.534***
					(0.000)	(0.000)		(0.000)
Equity beta *(08/2005 - 08/2006)*						-0.006		-0.006
						(0.620)		(0.620)
Sharpe ratio *(08/2005 - 08/2006)*							-1.714***	
							(0.000)	
Passive share in % *(after period)*								5.320
								(0.113)
Constant	0.453	-1.159***	6.876***	6.297***	-10.568***	-9.895***	0.044	-9.896***
	(0.155)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)	(0.945)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.058	0.059	0.061	0.083	0.338	0.338	0.167	0.338

Panel G: Sharpe ratio

	Sharpe ratio improvement							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-0.001	-0.001	-0.000	-0.000	0.000	-0.001	0.003	0.003
	(0.830)	(0.800)	(0.956)	(0.953)	(0.908)	(0.754)	(0.542)	(0.450)
Dummy male		0.002***	0.002***	0.001***	0.001***	0.001***	-0.000***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)
Age		-0.000***	-0.000***	-0.000***	-0.000***	0.000**	-0.000***	0.000**
		(0.000)	(0.002)	(0.000)	(0.002)	(0.029)	(0.000)	(0.029)
Dummy low wealth		-0.001**	-0.001**	-0.001**	-0.000	-0.000	0.001**	-0.000
		(0.039)	(0.025)	(0.045)	(0.374)	(0.366)	(0.022)	(0.366)
Dummy high wealth		-0.001***	-0.001***	-0.000***	-0.000***	0.000	-0.001***	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.181)	(0.000)	(0.181)
Length of relationship			0.000	0.000*	-0.000	-0.000	-0.000	-0.000
			(0.176)	(0.055)	(0.790)	(0.856)	(0.212)	(0.856)
Average log portfolio value *(08/2005 - 08/2006)*			-0.004***	-0.004***	-0.002***	0.000	-0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.437)	(0.439)	(0.437)
Risky share *(08/2005)*			-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				0.001	-0.013*	-0.032***	-0.017***	-0.032***
				(0.867)	(0.050)	(0.000)	(0.008)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				0.001***	0.000	-0.000	0.001***	-0.000
				(0.000)	(0.430)	(0.365)	(0.000)	(0.364)
Average turnover per trade in € *(08/2005 - 08/2006)*				0.000***	0.000***	0.000	0.000***	0.000
				(0.004)	(0.000)	(0.569)	(0.006)	(0.569)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.001***	-0.001***		-0.001***
					(0.000)	(0.000)		(0.000)
Equity beta *(08/2005 - 08/2006)*						0.000***		0.000***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-0.005***	
							(0.000)	
Passive share in % *(after period)*								-0.027*
								(0.091)
Constant	-0.057***	-0.052***	-0.018***	-0.015***	-0.034***	-0.089***	-0.033***	-0.089***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.751	0.752	0.748	0.750	0.775	0.789	0.803	0.789

Market Timing and Stock Picking

Following Jiang, Yao, and Yu (2007), who argue that a holdings-based measure of market timing is more accurate[19] and has higher statistical power than the traditional return-based tests proposed by Treynor and Mazuy (1966) and Henriksson and Merton (1981), we implement a holdings based approach. This approach has become standard in the literature.[20]

Our implementation is as follows. Instead of calculating the individual beta for every security on every trading day as Jiang, Yao and Yu (2007) do, we construct a daily "synthetic" return series of the return the investor would have earned had she held her portfolio of day t over the previous year. We then regress these daily synthetic portfolio returns of the previous year on the market returns to determine the investor's market exposure. Whereas this approach is broadly equivalent to the aggregation of weighted single security betas to portfolio betas as suggested by Jiang, Yao and Yu (2007), it deviates from their approach as we treat investment products like mutual funds as one single security. We choose this approach because the full portfolio holdings of the mutual funds in our sample are not available. Our approach has the disadvantage that the exposures to the market are not necessary solely driven by the decisions of private investors, but instead could also be partly traced back to trading of the fund managers. On the other hand our approach has the advantage that it allows us to obtain market exposures as well as market timing and security selection returns for each investor between August 2005 and March 2010 on a daily basis.

We implement a single-index market timing model as in Jiang, Yao and Yu (2007). As in the main text, we run all tests for the CDAX as well as the MSCI. The timing contribution is calculated as

$$Market\ Timing = \frac{1}{T}\sum_{t=1}^{T}(w_{j,i,t}-\overline{w}_{j,i,t})\times R_{i,t+1} \qquad (1)$$

where w is the weight for investor j on market i on day t, $\overline{w}$ is the average weight for investor j on market i over a period t=1 to T. $R_{i,t+1}$ is the benchmark return on the market factor i on day t+1. This measure is similar in spirit to the characteristic timing measure used by Daniel et al. (1997).

[19] Jiang, Yao and Yu (2007) point out that the traditional return based approaches suffer from inaccuracy due to a "dynamic trading effect" and a "passive timing" effect.

[20] See for example, Jiang, Yao and Yu (2007) or Kaplan and Sensoy (2005), Elton, Gruber and Blake (2011 and 2012).

The security selection computation is done following Elton, Gruber and Blake (2011). The computation of alpha as selection measure is computed as the difference between the investor return and the sum of the riskless rate and the return earned by the market benchmark times their market exposure.

$$Security\ Selection = \frac{1}{T}\sum_{t=1}^{T}[R_{j,t}-[R_{f,t}+(w_{j,i,t}\times R_{i,t})]] \quad (2)$$

where $w_{j,i,t}$ is the weight for investor j on market i on day t,. $R_{i,t}$ is the benchmark return on market i on day t, and $R_{f,t}$ is the three-month money market rate.

For each user, we compute market timing and security selection before the first use of an index-linked security and after the first use. We do the same for the matched non-user.

Table A.4 presents the results from our difference-in-difference test in calendar-time of changes in market timing and security selection ability due to the first usage of ETFs and index funds.

Panel A presents the match by significant variables. In the 1-factor CDAX model, we note that the users become worse in their timing ability compared with their matched non-users. The difference-in-differences is -2.27% and it is marginally statistically insignificant at the 10%-level (p-value of 10.5%). Using the 1-factor MSCI model we also find that market timing abilities worsen. The difference-in-difference estimate is -1.77% and it is statistically significant at the 5%-level. In both cases (1-factor CDAX and 1-factor MSCI) the security selection ability does not change in a significant manner.

Panel B presents the match by portfolio size. In the 1-factor CDAX model, we note that the users become worse in their timing ability compared with their matched non-users. The difference-in-differences is -2.15% and it is statistically significant at the 5% level. Using the 1-factor MSCI model we also find that market timing abilities worsen. The difference-in-difference estimate is -2.00% and it is statistically significant at the 5%-level. In both cases (1-factor CDAX and 1-factor MSCI) the security selection ability does not change in a significant manner.

For further robustness, we group all users and non-users together, and use a multivariate difference-of-difference specification with investor-specific controls. This test does not require matching, but this test can only be done in event time. Specifically, at each of the 252 switching dates, we construct a full cross-section of all users switching at a specific date and of all non-users.

Subsequently, we pool these cross-sections, which results in 924,305 observations. All investors for which we have position statements in every month of our sample period are included in this regression.

The results of this are given in Tables A5 (MSCI) and A6 (CDAX). Table A5 shows that the timing ability mostly decreases significantly after an investor first uses an index-linked security, though security selection ability has no significant change. Table A6 shows that the timing ability always decreases significantly after an investor first uses an index-linked security, though security selection ability has no significant change.

In conclusion, the results in Tables A4, A5 and A6 confirm the results in the main text: after the first use of an index-linked security, it is particularly the market timing ability that worsens.

Table A4

A difference-in-differences test on changes in market timing and security selection abilities between users and matched non-users of index-linked securities in calendar time.

Table A4 reports measures on the change of returns due to timing and security selection in the case of a 1-factor model and security selection. We run these tests for 473 users of index-linked securities and their matched neighbors for the period before the switch to passive securities and after the switch in calendar-time. The difference between the users and their matches are compared before and after. The last column provides the difference-in-differences between before and after. Returns are computed using a 1-factor model based on the MSCI (Panel A) or CDAX (Panel B) to compute daily weights and factor (market) returns. P-values are reported in the line below the respective metric. 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: Match based on all significant variables from Table V

	Before			After			After - before
Metric	User	Matched	Difference (user less match)	User	Matched	Difference (user less match)	Difference
CDAX 1-factor model:							
Timing	-0.51	-2.04	1.53	-1.18	-0.43	-0.74	-2.27
	.553	.084*	.240	.060*	.483	.138	.105
Alpha from selection	-3.71	-7.13	3.41	-1.14	-1.97	0.83	-2.58
	.415	.160	.249	.773	.689	.706	.486
MSCI 1-factor model:							
Timing	0.80	-0.08	0.88	0.20	1.09	-0.90	-1.77
	.300	.893	.238	.631	.023**	.012**	.032**
Alpha from selection	-1.36	-3.59	2.23	-1.39	-1.73	0.34	-1.89
	.807	.502	.475	.785	.775	.886	.630

Panel B: Match based on portfolio size

	Before			After			After - before
Metric	User	Matched	Difference (user less match)	User	Matched	Difference (user less match)	Difference
CDAX 1-factor model:							
Timing	-0.51	-1.64	1.13	-1.18	-0.15	-1.03	-2.15
	.553	.100*	.189	.060*	.778	.033**	.029**
Alpha from selection	-3.71	-5.85	2.13	-1.14	-2.24	1.10	-1.04
	.415	.207	.477	.773	.651	.638	.785
MSCI 1-factor model:							
Timing	0.80	-0.18	0.97	0.20	1.23	-1.03	-2.00
	.300	.765	.228	.631	.017**	.006***	.025**
Alpha from selection	-1.36	-3.18	1.83	-1.39	-0.77	-0.63	-2.45
	.807	.588	.583	.785	.922	.796	.552

Table A5

Does the use of index-linked securities improve returns on timing and selection? A difference-in-differences test in event-time against all non-users using a MSCI model

Table A5 reports estimates of a pooled regression on the change of returns on timing (Panel A) and security selection (Panel B). Returns are computed using a MSCI model to compute daily weights and factor (market) returns. The focus of the table is on the variable Dummy user that is equal to 1 if a client starts using index-linked securities. At each of the 252 switching dates, we construct a full cross-section of all users switching at a specific date and of all non-users; subsequently, we pool these cross-sections, which results in 924,305 observations. All investors for which we have position statements in every month of our sample period are included in this regression. Additionally, the model controls for several other independent variables which are measured prior to the first use of index-linked securities by an investor (08/2005 - 08/2006) or time-invariant variables (08/2005). 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 average risky portfolio value of the customer (*Average log portfolio value*), the proportion of risky assets in the account (*Risky share*), the average portfolio turnover per month (*Portfolio turnover*), the average number of trades per month (*Average number of trades*), the average volume per trade in € (*Average turnover per trade in €*), the idiosyncratic variance share (*Idiosyncratic variance share*), the Sharpe ratio (*Sharpe ratio*) and the share of index-linked securities in the portfolio (*Passive share in %*). P-values are computed using Driscoll - Kraay standard errors and are presented in parentheses. R-squared values and number of observations 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.

Panel A: Timing (MSCI)

	Timing (1-factor MSCI)							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-0.762***	-0.768***	-0.732**	-0.726**	-0.728**	-0.762**	-0.693*	-0.566
	(0.004)	(0.004)	(0.036)	(0.049)	(0.049)	(0.039)	(0.057)	(0.174)
Dummy male		0.102***	0.043	0.114***	0.115***	0.112***	0.094**	0.112***
		(0.006)	(0.213)	(0.001)	(0.001)	(0.001)	(0.010)	(0.001)
Age		-0.004***	0.007***	0.007***	0.007***	0.008***	0.006***	0.008***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy low wealth		-0.053	0.030	-0.010	-0.010	-0.010	0.003	-0.010
		(0.266)	(0.440)	(0.797)	(0.778)	(0.777)	(0.929)	(0.777)
Dummy high wealth		0.187***	0.178***	0.100***	0.100***	0.108***	0.097***	0.108***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.049***	0.014***	0.015***	0.015***	0.010***	0.015***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-0.398***	-0.335***	-0.338***	-0.287***	-0.292***	-0.287***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Risky share *(08/2005)*			0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				-4.677***	-4.654***	-5.017***	-4.871***	-5.017***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				-0.208***	-0.206***	-0.211***	-0.210***	-0.211***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				0.000***	0.000***	0.000***	0.000***	0.000***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average market-adjusted return *(08/2005 - 08/2006)*					0.001	0.002		0.002
					(0.697)	(0.485)		(0.485)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.009***		0.009***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-0.053***	
							(0.000)	
Passive share in % *(after period)*								-1.088
								(0.368)
Constant	1.256***	1.297***	4.447***	4.607***	4.637***	3.562***	4.414***	3.562***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.013	0.013	0.020	0.041	0.041	0.042	0.042	0.042

Panel B: Alpha from selection (MSCI)

	Alpha from selection (1-factor MSCI)							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-1.493**	-1.463**	-1.191	-1.236	-0.585	-0.863	-0.191	-1.019
	(0.024)	(0.025)	(0.177)	(0.199)	(0.499)	(0.305)	(0.855)	(0.370)
Dummy male		1.615***	1.549***	1.199***	0.967***	0.943***	0.563***	0.943***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		-0.022***	-0.003	-0.001	0.004	0.018***	-0.012**	0.018***
		(0.000)	(0.685)	(0.873)	(0.496)	(0.001)	(0.041)	(0.001)
Dummy low wealth		-0.903***	-0.757***	-0.567***	-0.234**	-0.234**	-0.151*	-0.234**
		(0.000)	(0.000)	(0.000)	(0.012)	(0.012)	(0.091)	(0.012)
Dummy high wealth		-0.785***	-0.991***	-0.588***	-0.534***	-0.469***	-0.676***	-0.469***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.329***	0.506***	0.234***	0.235***	0.362***	0.235***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.222***	-1.522***	0.049	0.456***	-0.168***	0.456***
			(0.000)	(0.000)	(0.451)	(0.000)	(0.006)	(0.000)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				22.836***	10.100***	7.191***	16.683***	7.191***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				1.108***	0.414***	0.377***	1.038***	0.377***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	-0.000*	-0.000***	-0.000***	-0.000***
				(0.000)	(0.081)	(0.000)	(0.000)	(0.000)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.526***	-0.520***		-0.520***
					(0.000)	(0.000)		(0.000)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.074***		0.074***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-1.682***	
							(0.000)	
Passive share in % *(after period)*								0.861
								(0.837)
Constant	1.001***	1.110***	10.443***	9.404***	-7.223***	-15.830***	3.268***	-15.830***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.050	0.051	0.050	0.085	0.328	0.333	0.165	0.333

Table A6

Does the use of index-linked securities improve returns on timing and selection? A difference-in-differences test in event-time against all non-users using a CDAX model

Table 5 reports estimates of a pooled regression on the change of returns on timing (Panel A) and security selection (Panel B). Returns are computed using a CDAX model to compute daily weights and factor (market) returns. The focus of the table is on the variable Dummy user that is equal to 1 if a client starts using index-linked securities. At each of the 252 switching dates, we construct a full cross-section of all users switching at a specific date and of all non-users; subsequently, we pool these cross-sections, which results in 924,305 observations. All investors for which we have position statements in every month of our sample period are included in this regression. Additionally, the model controls for several other independent variables which are measured prior to the first use of index-linked securities by an investor (08/2005 - 08/2006) or time-invariant variables (08/2005). 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 average risky portfolio value of the customer (*Average log portfolio value*), the proportion of risky assets in the account (*Risky share*), the average portfolio turnover per month (*Portfolio turnover*), the average number of trades per month (*Average number of trades*), the average volume per trade in € (*Average turnover per trade in €*), the idiosyncratic variance share (*Idiosyncratic variance share*), the Sharpe ratio (*Sharpe ratio*) and the share of index-linked securities in the portfolio (*Passive share in %*). P-values are computed using Driscoll - Kraay standard errors and are presented in parentheses. R-squared values and number of observations 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.

Panel A: Timing (CDAX)

	Timing (1-factor CDAX)							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-0.770***	-0.784***	-0.770***	-0.767***	-0.762***	-0.809***	-0.738***	-0.595*
	(0.000)	(0.000)	(0.003)	(0.007)	(0.007)	(0.004)	(0.008)	(0.076)
Dummy male		0.087**	0.036	0.117***	0.115***	0.111***	0.100***	0.111***
		(0.012)	(0.252)	(0.000)	(0.000)	(0.001)	(0.004)	(0.001)
Age		-0.009***	0.000	0.000	0.000	0.003***	0.000	0.003***
		(0.000)	(0.677)	(0.488)	(0.448)	(0.000)	(0.821)	(0.000)
Dummy low wealth		0.094***	0.157***	0.110***	0.112***	0.112***	0.121***	0.112***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy high wealth		0.177***	0.181***	0.095***	0.096***	0.107***	0.093***	0.107***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.044***	0.005	0.003	0.004	0.001	0.004
			(0.000)	(0.175)	(0.304)	(0.260)	(0.729)	(0.261)
Average log portfolio value *(08/2005 - 08/2006)*			-0.364***	-0.290***	-0.278***	-0.209***	-0.253***	-0.209***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Risky share *(08/2005)*			0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				-5.310***	-5.405***	-5.899***	-5.478***	-5.899***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				-0.220***	-0.226***	-0.232***	-0.222***	-0.232***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				0.000***	0.000***	0.000***	0.000***	0.000***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.004	-0.003		-0.003
					(0.107)	(0.263)		(0.263)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.013***		0.013***
						(0.000)		(0.000)
Sharpe ratio *(08/2005 - 08/2006)*							-0.046***	
							(0.000)	
Passive share in % *(after period)*								-1.188
								(0.319)
Constant	-0.997***	-0.708***	2.242***	2.366***	2.242***	0.780***	2.199***	0.780***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.039	0.039	0.047	0.074	0.075	0.077	0.075	0.077

Panel B: Alpha from selection (CDAX)

	Alpha from selection (1-factor CDAX)							
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy user	-1.814***	-1.764***	-1.672**	-1.716**	-1.068	-1.203*	-0.663	-1.091
	(0.006)	(0.007)	(0.038)	(0.041)	(0.130)	(0.079)	(0.447)	(0.213)
Dummy male		1.658***	1.585***	1.234***	1.003***	0.991***	0.593***	0.991***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age		-0.010*	0.014**	0.015**	0.020***	0.027***	0.004	0.027***
		(0.081)	(0.030)	(0.020)	(0.002)	(0.000)	(0.565)	(0.000)
Dummy low wealth		-0.974***	-0.795***	-0.604***	-0.272***	-0.272***	-0.184**	-0.272***
		(0.000)	(0.000)	(0.000)	(0.003)	(0.003)	(0.038)	(0.003)
Dummy high wealth		-0.816***	-1.019***	-0.616***	-0.562***	-0.531***	-0.704***	-0.531***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Length of relationship			0.318***	0.495***	0.224***	0.225***	0.350***	0.225***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average log portfolio value *(08/2005 - 08/2006)*			-1.361***	-1.668***	-0.103*	0.093	-0.303***	0.093
			(0.000)	(0.000)	(0.052)	(0.111)	(0.000)	(0.111)
Risky share *(08/2005)*			-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio turnover *(08/2005 - 08/2006)*				22.700***	10.016***	8.612***	16.495***	8.612***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average number of trades *(08/2005 - 08/2006)*				1.110***	0.419***	0.401***	1.040***	0.401***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average turnover per trade in € *(08/2005 - 08/2006)*				-0.000***	-0.000	-0.000***	-0.000***	-0.000***
				(0.000)	(0.236)	(0.000)	(0.000)	(0.000)
Average market-adjusted return *(08/2005 - 08/2006)*					-0.524***	-0.521***		-0.521***
					(0.000)	(0.000)		(0.000)
Idiosyncratic variance share *(08/2005 - 08/2006)*						0.036**		0.036**
						(0.028)		(0.028)
Sharpe ratio *(08/2005 - 08/2006)*							-1.696***	
							(0.000)	
Passive share in % *(after period)*								-0.617
								(0.867)
Constant	0.590**	0.102	10.699***	9.722***	-6.836***	-10.992***	3.534***	-10.992***
	(0.029)	(0.803)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	924,305	924,305	814,027	814,027	814,027	814,027	814,027	814,027
R-squared	0.102	0.103	0.099	0.134	0.371	0.372	0.213	0.372

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