The Dark Side of ETFs and Index Funds

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Abstract

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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, namely passive Exchange Traded Funds (ETFs) and index funds.[1] The first retail index mutual fund was launched in 1976 by John Bogle at 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% 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 (the same size as hedge funds), accounting for 16% of NYSE trading volume.[4]

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

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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 individual investors." (ESMA Report and Consultation paper – Guidelines on ETFs and other UCITS issues, 25 July 2012, http://www.esma.europa.eu/system/files/2012-474.pdf, p. 32).

The null hypothesis is that individual 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 have been formalized in seminal papers in finance.[7] Boldin and Cici (2010) reviewed the entire empirical literature on index funds and discussed the benefits of index funds. French (2008) measured the benefits of passive investing 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." Benefits of diversification and passive investing may be even more pronounced for individual investors, given that they significantly under-diversify and over-trade.[8] The benefits may be even higher for ETFs because ETFs offer many advantages over open-end index funds. First, the fees of ETFs are lower compared to the funds. Second, ETFs trade in real time as opposed to 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 individual investors have not benefited by using index-linked securities like ETFs.[9] There is some evidence that investors may not be using these products effectively. Hortaçsu and Syverson (2004) found large fee dispersions although the

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

[9] As this paper is concerned with the performance effect of ETFs on individual investors, we treat all ETFs alike. Particularly, we do not differentiate whether ETFs are synthetic or fully replicating, despite the fact that synthetic ETFs may entail additional risk (Ramaswamy 2011) or be subject to conflicts of interest resulting in increased asset volatility and/or a (small) price discount (Cheng, Massa, and Zhang 2013).

analyzed index funds were financially homogeneous. Similarly, Elton, Gruber and Busse (2004) showed that S&P 500 index funds have become commodities that differ from each other principally in price. They found that investors in these funds irrationally prefer more expensive funds. Choi, Laibson and Madrian (2010) confirmed this behavior in an experiment and found that more financially sophisticated investors pay fewer fees. Second, it is conceivable that although index-linked securities force the individual investor to buy a basket and therefore curb his temptation to pick stocks, these securities, because they are highly correlated with the index and are thus easy to trade, may enhance his temptation to time the underlying index.[10] 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 individual investors to test the null hypothesis.[11]

Our first set of findings is as follows. Investors who begin using these products are more likely to be female and younger than investors who do not use them. In the pre-period in which none of our investors use these products, those who will become users trade more often, have higher portfolio values, and have 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.

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

[11] In essence, we test whether the benefits exceed the costs of trading index-linked securities for individual investors by finding out whether their portfolio performance improves after trading these securities. An ex-ante test like the one proposed by Calvet, Campbell and Sodini (2007) will fail to incorporate the effects of trading.

However, the key question is what occurs after use. Hence, 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 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 debatable, for further robustness, we examine all users and non-users and use a multivariate difference-of-difference specification with investor-specific controls. This test does not require matching, but it can only be performed 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 1- and 4-factor models. 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 users' portfolio performance after use. Another reason could be the deterioration of the returns of the other securities. 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 investors not only have a worse performance in their passive part as compared to their active part, but even the diversification benefit to the full portfolio is virtually non-existent.

Now that we have established that the cause of performance deterioration experienced by 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 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. On the other hand, market-adjusted returns often improve after use. Results are similar if we use CDAX or MSCI. Results do not change if we perform the above analysis at the level of the investor. Results do not change if we take a full-portfolio perspective and implement the holdings-based approach developed by Jiang, Yao and Yu (2007) to measure market timing and that of Elton, Gruber and Blake (2012) to measure security selection. The analysis performed using this holdings-based approach is cross-correlation robust because it is done in calendar-time. The final set of results is reported in the Internet Appendix.

We conclude from the above results that poor market timing and not poor 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 users employ these easy-to-trade index-linked securities that are highly correlated with the market to make bets on market phases, and they bet wrong.[12]

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 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. In terms of costs, ETFs are more cost

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

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.[13]

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

[INSERT TABLE I ABOUT HERE]

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

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

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

Table II examines the index-linked securities that individual 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. It is a very fragmented market. Although the top 6 benchmark indices constitute roughly half of the assets under management, the other 134 benchmark indices make up the other half. This allows us to make two points. First, the popular indices are connected to Germany, Europe and the World, which motivates us to use the local German index, CDAX, and a global index, MSCI, as our two choices of benchmark indices. Second, because so many of these passive securities are linked to narrow indices, it is likely that they offer more choices for timing certain asset classes, sectors or countries, 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

The brokerage that we work with was founded as a direct bank with a focus on offering brokerage services via telephone and the Internet. In 2009, to retain existing customers and attract new ones, the brokerage introduced a financial advisory service, which offered free financial advice to a random sample of 8,000 of its several hundred thousand individual investors. Approximately 95% of these individual investors refused the financial advice and

continued trading as before.[14] 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 the index-linked securities that these investors traded from August 2005 to March 2010. As in Barber and Odean (2002), we require 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]

For our study, we only consider investors who first use index-linked securities in the time period from August 2006 to March 2009 (switch period). This criterion results in a sample of 4,139 customers, of which 473 traded at least one index-linked security in the period from August 2006 to March 2009, and 3,666 non-users who did not trade any index-linked securities in the period from August 2005 to March 2010. The period from August 2005 to August 2006 is a clean period before switches, a period we will later use for matching and generating other control variables. The period from March 2009 to March 2010 is a clean period after switches, a period we need to measure portfolio performance.

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 gray line in Figure 2 shows the growing popularity of index-linked securities in our sample. The solid black line in Figure 2 shows the share of index-linked securities in the

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

portfolio of an average individual investor. It seems that once investors have switched to index-linked securities, their weight in the portfolio hovers between 10% and 20%.

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

In addition, account characteristics were provided by the bank. For all of the customers, we possess monthly position statements, daily transaction data and account transfers for the period August 2005 to March 2010. The account opening date enables us to compute the length of the relationship between a customer and the brokerage. Monthly position statements combined with transactions, transfers and securities' returns enable us to compute daily position statements and the average risky portfolio value over the entire period. In addition, we have information on the cash accounts of each customer at the beginning and the end of our sample period, which enables us to calculate the risky share as the risky portfolio value divided by financial wealth with the brokerage (risky portfolio value plus cash value). We use our transaction records to calculate portfolio turnover, 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 sources of this data are given in Table III.

[INSERT TABLE III ABOUT HERE]

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

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

Finally, we calculate daily portfolio returns before (gross) and after (net) direct transaction costs. The difference between gross and net returns 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.

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 from 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 seem to be slightly younger (48.9 vs. 50.4 years). Moreover, users of index-linked securities have a higher risky portfolio as well as higher share of their portfolio in risky securities. They trade more often and have a higher volume per trade. Finally, Table IV suggests that *over the entire sample period,* the portfolio performance of these two groups does not differ significantly.

The multivariate probit analysis in Table V provides formal results.

[INSERT TABLE V ABOUT HERE]

We perform a probit test in which 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 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.

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

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

In order to address this question, 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 (five variables from Table V). Table A1 in the Internet Appendix is a test of the quality of the match. 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 users and 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 no longer distinguish between these two groups (see Sianesi 2004).

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.

For these time-series, we compute a number of widely used and accepted performance measures: raw returns, market-adjusted returns, Sharpe Ratios[15], 1-factor alphas (Jensen's (1968) 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 investor return series. 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 alpha using daily data. We 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, in addition to 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).

[15] Sharpe Ratios can only be used in an event-time setting, which we discuss later, and whose results are provided in the Internet appendix.

Table VI reports the results from the matching method. The analysis is in calendar-time to mitigate any problems of cross-correlation. [16]

[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 -4.21%, -4.80% and -4.83% for the MSCI 1-factor alpha, CDAX 1-factor alpha and 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 CDAX 4-factor alpha, respectively, and the p-values are stronger. Because 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 follow Barber and Odean (2002) and use a match on portfolio size (Table A2 in the Internet Appendix).

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

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

Because methods of matching are controversial, as an additional robustness test, 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 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. This test has two advantages – we do not have to worry about how we match, and we use data from 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. [18]

The results of the multivariate difference-in-difference test 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. Note that tests on the Sharpe ratio (excess returns on individual investor portfolios divided by the standard deviation of excess returns) can only be done using event-time.

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

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

The previous section has shown that the portfolio performance of investors who begin 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.

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[18] 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 (see 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 (see Binder 1998).

Unwise use of index-linked securities may explain the worsening of users' portfolio performance after use. Another reason could be that the returns of other securities deteriorate. To rule out the latter reason, we now compare the passive part (ETFs and index funds), the active part (all other securities) and the performance of the full (active plus passive) portfolio of users. In order to perform a fair comparison, two minor adjustments are made. First, to be included in this comparison, we require each user to have a non-consecutive minimum holding-period of an index-linked security for at least 6 months.[19] Second, all performance measures are calculated only when an investor holds both passive and 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 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 a 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

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

difference is, of course, partly due to set up costs for 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 users' portfolio performance 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 a more efficient full portfolio overall. 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 are lower in the full portfolio in terms of standard deviation and unsystematic variance share, 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), the Sharpe ratio, and alpha (significant only for CDAX). It can be concluded that ETFs and index funds definitely do not help investors improve the performance of their portfolios. 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 the performance deterioration experienced by users after use is their use of index-linked securities, we go on to investigate how they use, or rather misuse, these products. In general, the negative performance contribution of index-linked

securities might stem from choices of which securities to buy or to sell (security selection) or choices of when to buy or to sell a security (market timing).

We use a measure proposed by Odean (1999) to decompose returns into returns due to market timing and security selection. Odean (1999) analyzes the returns to purchases and sales of securities over three defined holding periods. By referring to Benartzi and Thaler (1995), who show that the average holding period in the US is about a year, Odean (1999) chooses holding periods of 84, 252 and 504 trading days. For our sample, the average holding period is 121 days. We hence adapt and set the holding-periods to 30, 126 and 252 trading days for our paper. 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. We follow Odean (1999) but use the MSCI and the CDAX as benchmarks for our study. The performance difference of these market-adjusted returns between purchases and sales over a holding period is due solely to security selection. The difference of market returns during purchases and sales over a holding period is a measure of market timing. In line with Odean (1999), we exclude the day of the transaction to avoid a potential bid-ask spread bias.

Because 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 that require independence. Odean (1999) handles this by creating an empirical distribution. Instead of creating an empirical distribution, as suggested by Odean (1999), we treat all our transactions as independent. However, because results based on this assumption may be biased by more frequent traders, we only treat transactions of one investor as independent. In this second way, we calculate all statistics for a particular investor and then average over investors.

Additionally, the Internet Appendix provides a holding-based test that shows that our results hold even in a full portfolio calendar-time setting that is cross-correlation robust

[INSERT TABLES VIII and IX ABOUT HERE]

Panels A in Tables VIII and IX give the results using MSCI, whereas Panels B in the same tables give the results using CDAX. Table VIII takes all purchases and sales of indexed-linked securities as independent, whereas Table IX compares purchases and sales at the investor level before computing the average. Thus, Table VIII gives the transaction perspective, whereas Table IX gives the investor perspective.

The results show that investors make poor investment decisions with respect to their index-linked securities. The index securities investors sell generally outperform the index securities they buy. Hence, if they did not trade these index securities, they would be better off. This holds true at both the transaction level and the investor level. Using t-tests, the differences are highly statistically significant in all cases except for the 20 day holding period at the investor level (Table IX), where the difference is negative, albeit statistically insignificant.

Is it market timing or is it security selection? We notice in Tables VIII and IX that at the investor level as well as at the transaction level, the returns to security selection are positive in all cases but one, most even significantly so. What is more striking, however, is that the returns to market timing are consistently negative in all cases and statistically highly significant. Therefore, it is of little consequence whether we look at the investor or transaction level. We conclude that the decrease in users' portfolio performance 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 (although the analysis at the level of the investor ameliorates this) or that we neglect the remainder 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 (2012). 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. Market timing ability becomes worse after the adoption of index linked securities relative to a control group of non-adopters. Security selection ability remains stable. Table A5 repeats the analysis in a pooled multivariate difference-in-difference regression, where we compare every user with all of the non-users as an additional robustness test. Results remain qualitatively unaltered.

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 begin using these products are more likely to be female and younger than investors who do not use them. In the pre-period in which none of our investors use these products, those who will become users trade more often, have higher portfolio values, and have 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: 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 individual investors' portfolios (dates are always at the end of the respective month)

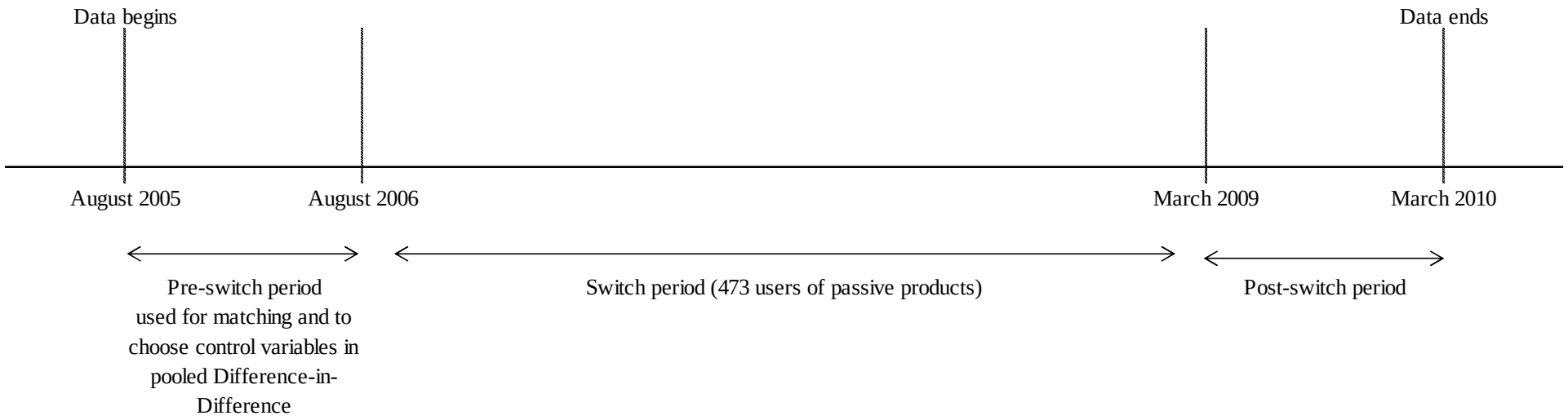

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Figure 2
The use of index-linked securities in our sample
The figure presents the usage of index-linked securities over time. The solid line (left axis) shows the average share of index-linked securities in terms of euros in the portfolios of users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

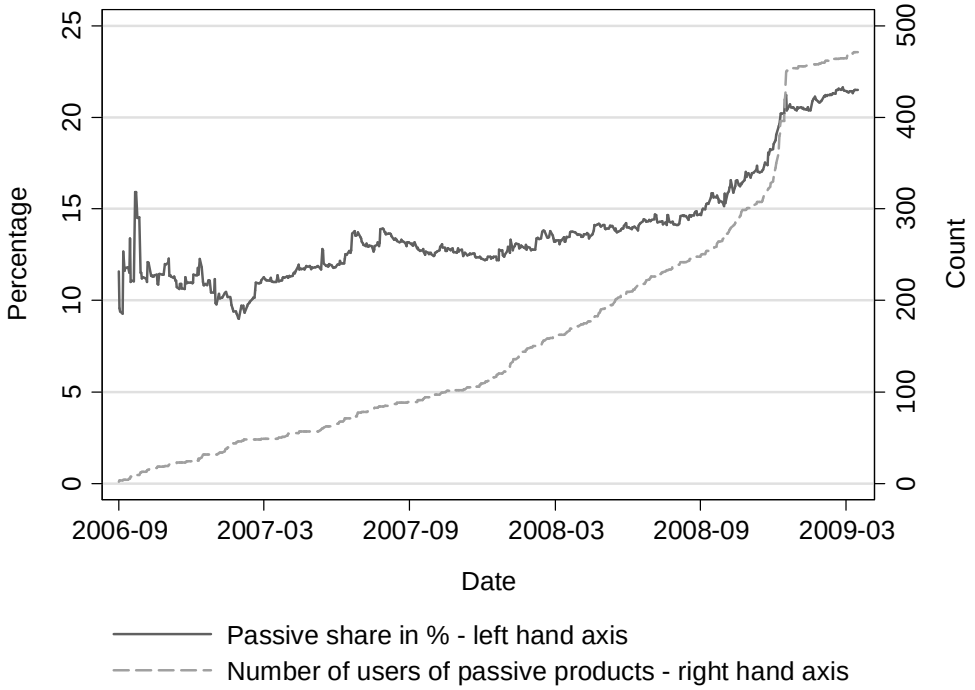

Table I

Usage of index-linked securities – an overview

Table I provides an overview of the markets for ETFs and index funds in Germany (Panel A), the U.S. (Panel B) and within our sample (Panel C). For all panels, the latest available year-end data have been used. We report number of products as well as assets under management (AUM) in absolute and percentage terms. The last two columns compare ETFs and index funds 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 and French (1993) & Carhart (1997) 4 - factors	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 are comprised of statistics on the share of male clients (*Gender*), the age of clients (*Age*) and the wealth of a client measured by the micro-geographic status rating, one through nine, assessed by an external agency (*Wealth*). Portfolio characteristics are comprised of 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 are comprised of 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 the marginal effects of a probit regression. The dependent variable for the probit regression is a dummy (*Dummy user*) that is set to one for 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 and after they begin using index-linked securities. 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. For 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	-7.46	-13.01	5.54	-1.14	-1.16	0.02	-5.52
			.120			.992	.207
Market-adjusted return MSCI	-1.01	-6.55	5.54	-1.18	-1.20	0.02	-5.52
	.884	.297	.120	.852	.842	.992	.207
Market-adjusted return CDAX	2.16	-3.38	5.54	0.44	0.41	0.02	-5.52
	.739	.555	.120	.941	.947	.992	.207
Overall alpha *(%, annual)*							
MSCI 1-factor	-4.79	-8.84	4.06	-3.64	-3.49	-0.15	-4.21
	.527	.312	.062*	.645	.644	.903	.043**
CDAX 1-factor	-5.09	-9.58	4.49	-2.49	-2.18	-0.31	-4.80
	.342	.124	.028**	.763	.791	.823	.039**
CDAX 4-factor	0.85	-3.95	4.80	-0.32	-0.29	-0.03	-4.83
	.748	.125	.128	.947	.944	.977	.059*

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 market return for the respective period. Raw returns are simply the specific security's return 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	-20.0	.000***	5616	-5.8	.104	1250	-14.2	.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	-4.1	.001***	5610	-2.5	.440	1244	-1.7	.572
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	-15.8	.000***	5610	-3.3	.157	1244	-12.6	.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								
20 trading days later	-20.0	.000***	5616	-5.8	.104	1250	-14.2	.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	15.7	.000***	5610	1.0	.750	1244	14.7	.000***
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)								
20 trading days later	-35.7	.000***	5610	-6.8	.019**	1244	-28.9	.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. We report the returns for raw return, market adjusted return and the market return for the respective period. Raw returns are simply the specific security's return 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							
20 trading days later	-16.9	.004***	-7.6	.222	-9.4	.257	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)							
20 trading days later	2.0	.725	-3.9	.492	5.9	.455	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)							
20 trading days later	-18.9	.000***	-3.7	.362	-15.2	.003***	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							
20 trading days later	-16.9	.004***	-7.6	.222	-9.4	.257	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)							
20 trading days later	15.4	.007***	4.5	.444	10.9	.171	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)							
20 trading days later	-32.3	.000***	-12.2	.026**	-20.1	.004***	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 the marginal effects of a probit regression. The dependent variable for the probit regression is a dummy (*Dummy user*) that is set to 1 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 including 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 investor's first use of an index-linked security. 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 473 users of index-linked securities and their matched neighbors for the periods before and after they begin using index-linked securities. 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	-7.46	-11.84	4.37	-1.14	-1.04	-0.09	-4.46
			.286			.974	.370
Market-adjusted return MSCI	-1.01	-5.38	4.37	-1.18	-1.09	-0.09	-4.46
	.884	.317	.286	.852	.853	.974	.370
Market-adjusted return CDAX	2.16	-2.21	4.37	0.44	0.53	-0.09	-4.46
	.739	.712	.286	.941	.931	.974	.370
Overall alpha *(%, annual)*							
MSCI 1-factor	-4.79	-7.29	2.50	-3.64	-3.31	-0.33	-2.83
	.527	.310	.342	.645	.627	.796	.061*
CDAX 1-factor	-5.09	-7.69	2.60	-2.49	-1.97	-0.52	-3.12
	.342	.042**	.297	.763	.799	.659	.050*
CDAX 4-factor	0.85	-2.88	3.74	-0.32	-0.64	0.32	-3.42
	.748	.007***	.164	.947	.895	.492	.106

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, plus 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 Security Selection

Following Jiang, Yao, and Yu (2007), who argue that a holdings-based measure of market timing is more accurate[21] 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.[22]

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. Although 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 in that 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 necessarily solely driven by the decisions of individual investors, but instead could also be partly traced back to fund managers' trading. 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

[21] 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.

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

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

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).

The security selection computation is performed following Elton, Gruber and Blake (2012). The computation of alpha as the 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 and after the first use of an index-linked security. 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 users become worse in their timing ability compared with their matched non-users. The difference-in-differences is -2.27%, which 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%, which 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 users become worse in their timing ability compared with their matched non-users. The difference-in-differences is -2.15%, which 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%, which 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 pool 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 it 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. We subsequently 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 Panel A shows that timing ability generally decreases significantly after an investor first uses an index-linked security, although security selection (Panel B) ability shows no significant change. Table A6 Panel A shows that the timing ability always decreases significantly after an investor first uses an index-linked security, although security selection (Panel B) ability shows 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, market timing ability particularly 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 and after the switch to passive securities in calendar-time. The difference between 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	-0.82	-1.99	1.17	-1.01	-0.24	-0.77	-1.93
	.484	.132	.500	.163	.740	.169	.290
Alpha from selection	-3.69	-7.62	3.94	-1.19	-1.64	0.44	-3.50
	.442	.123	.206	.765	.737	.834	.353
MSCI 1-factor model:							
Timing	0.59	-0.09	0.67	0.58	1.07	-0.49	-1.17
	.516	.907	.460	.270	.072*	.382	.277
Alpha from selection	-1.40	-4.54	3.14	-0.89	-1.09	0.20	-2.94
	.802	.402	.309	.862	.855	.923	.430

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	-0.82	-1.68	0.86	-1.01	-0.16	-0.85	-1.72
	.484	.171	.464	.163	.807	.108	.186
Alpha from selection	-3.69	-5.87	2.18	-1.19	-2.00	0.81	-1.37
	.442	.203	.524	.765	.681	.719	.738
MSCI 1-factor model:							
Timing	0.59	-0.35	0.94	0.58	1.16	-0.58	-1.51
	.516	.622	.342	.270	.056*	.267	.175
Alpha from selection	-1.40	-3.26	1.85	-0.89	-1.08	0.19	-1.67
	.802	.579	.603	.862	.855	.932	.692

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 begins 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 also 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: 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 that 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 also 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: 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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