Contrarians or Momentum Chasers? Individual Investors' Behaviour when Trading ETFs

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Abstract

We introduce the first study of the impact of momentum on households' ETF trading behaviour. Using 57,491 trades by Finnish households, we compare their trading in the only ETF tracking the benchmark index to their trading in common stocks. Using two methodologies, and robustness tests, we find evidence of contrarian behaviour in ETF trading. However, this contrarian behaviour is significantly weaker than that for common stocks (12.6% higher proportion of contrarian over momentum chaser for ETF purchases, compared with 35.8% higher for common stocks). Moreover, we find (12.9%) higher propensity to chase recent positive momentum when purchasing ETFs, than when purchasing common stocks. As expected, our results are stronger for ETF purchases than sales. Our findings are consistent with hypotheses that households are less overconfident trading index ETFs than common stocks, that contrarian behaviour is more often rational when trading common stocks than when trading index ETFs, and that households include index ETFs in their portfolios for the purpose of holding a well-diversified portfolio for the long run.

Keywords: ETF, Momentum, Contrarian

1 Introduction

Despite the increasing importance of exchange-traded funds (ETFs) as an investment vehicle over the past two decades, the overwhelming majority of the academic literature that analyses trading behaviour of individual investors, or households, focuses nearly exclusively on common stocks. The main contribution of this paper lies in being the first study to focus on how momentum influences households' ETF trading behaviour.

From Euroclear Finland Limited we obtain 57,491 ETF trades made by 12,156 Finnish households between February 2002 and December 2014. The ETF we consider is a low-cost, passively managed ETF traded on the Helsinki Stock Exchange (OMXH) like common stocks, and it is the only ETF listed on the OMXH with meaningful trading volumes during our sample period.[1] It tracks the OMX Helsinki 25 index, the Finnish stock market benchmark, which includes the 25 largest and most liquid common stocks on the OMXH. This index is also the basis for the index futures and options market. We were also able to obtain 988,524 common stock trades made by the households in our sample; the common stocks we select are the securities underlying the OMX Helsinki 25 index and consequently the ETF that we study.

We use this data to answer our two key research questions: 1) how does momentum impact households' behaviour when trading ETFs? And 2) Is households' behaviour the same when trading ETFs and common stocks? We hypothesise that 1) households are contrarian when trading ETFs, and that 2) the contrarian behaviour is weaker when trading ETFs than when trading common stocks. We base our hypotheses on the following four rationales.

Firstly, in our world, individuals perceive fundamentals to be mean reverting. This is because fundamentals (or productivity factors, or moments of distributions of returns) are not increasing to infinitely large values, nor decreasing to infinite negative values, and do not even follow a random walk (which would have implied a sample path variance ever increasing to infinity). Consequently, indeed we observe real-world business cycles. In such a world, trend reversals are more likely than trend persistence.[2] In addition, price impact of

[1] Up until the end of 2012 it was the only ETF listed on the OMXH (two more ETFs were listed by the end of 2014).
[2] See, for example, results on stability of financial prices, fundamentals' properties, and information structures in Feldman (2003)

trades also induces reversal calling for liquidity provisions. This induces rational contrarian trading. This rationale supports our first hypothesis.

Secondly, *both* our first and second hypotheses lie on individuals' *overconfidence* documented in a large number of studies. This overconfidence leads individuals to overestimate their actual ability, the accuracy of one's beliefs, performance, level of control, or chance of success (see discussion in Moore and Healy 2008). It also leads individuals to believe themselves to be better than others, which has been labelled the "better-than-average" effect (Alicke et al. 1995). Overconfidence may lead to contrarian behaviour, in the sense that households purchase (sell) securities after price declines (increases) if they are overconfident in their ability to spot underpriced (overpriced) securities they consider themselves better informed in. We hypothesise that because the price of the ETF in this study is based on a large stock index, households should have no reason to expect to be better informed than the rest of the market on this security. Hence, any informational advantage, whether perceived or actual, households may have on individual stocks, is insufficient to identify ETF mispricing. For this reason, we hypothesise the lack of informational advantage should result in a weaker contrarian behaviour when trading ETFs than when trading common stocks.

Thirdly, considering idiosyncratic shocks to individual common stocks, on the one hand, and diversification effects of index ETFs on the other, contrarian trading behaviour is more appealing when trading individual stocks than when trading index ETFs. Moreover, households may invest in index ETFs to have a well-diversified portfolio as the base, and then take specific bets through direct stock holdings in share they believe they have an information advantage in. This rationale supports our second hypothesis.

Fourthly, intuition suggests that individual investors who choose to invest in index ETFs, do so with longer-term investment horizon in mind than when trading stocks. Hence, momentum impact should be weaker on households' behaviour when trading ETFs than when trading common stocks. This rationale supports our second hypothesis.

Using two methodologies and several robustness tests, we find the following results. For all the past-horizons that we analyse (up to 6 months into the pasts), we find evidence of contrarian behaviour when households trade ETFs; however, the strength of this contrarian behaviour is significantly weaker than for common stocks.

We find that the average proportion of contrarian purchases is 35.8 percent higher than the average proportion of momentum chasers purchases for common stocks, compared with 12.6 percent for ETFs. In addition, we find evidence that positive momentum impacts more strongly the propensity of households to purchase ETFs than to purchase common stocks, with the average proportion of momentum chasers purchases 12.9 percent higher for ETFs than for common stocks. We also find that the timing of ETF trading is not irrational, in that returns for medium-term holding periods following purchases are higher than those following sales by, on average, 19 basis points per month, or about 2.3% annually

We test the robustness of our findings by dividing households into three groups based on the number of trades they make: the "least active", the "most active" and the "mid-active" groups, which are made of the 50 percent of households who trade the least, the 10 percent who trade the most, and the remaining 40 percent, respectively. We find that households in the most active group, who, according to the literature, are the most overconfident,[3] display the strongest contrarian behaviour of the three group. We also document strong contrarian behaviour for households in the mid-active group. Households in the least active group, who, according to the literature, are the least overconfident, are momentum chasers. These findings are consistent with the rationale that overconfidence leads to contrarian behaviour, while the lack of it leads to trading along the same direction of the market. We analyse purchasing behaviour of the three household groups (keeping constant the individuals in each group) with respect to common stocks and we find strong contrarian behaviour also for households in the least active group when they purchase common stocks. Again, this further supports our rationale that overconfidence is specifically lower when trading ETFs than when trading common stocks.

The rest of the paper is organised as follows. In Section 2 we outline the relevant literature review. In Section 3 and 4 we introduce the datasets and the methodologies that we use, respectively. In Section 5 we present and discuss our findings. In Section 6 we finish with a brief summary and some concluding remarks.

[3] Odean 1999, Barber and Odean 2000, 2001, Dorn et al. 2005, Glaser and Weber 2007, Grinblatt and Keloharju 2009.

2 Literature Review

With rare exceptions, as argued by Kaniel, Saar and Titman (2008, p. 300), '[…] there is widespread agreement in the literature that individuals tend to be contrarian […]'. This contrarian behaviour, however, is documented nearly exclusively with respect to common stocks, perhaps also due to the lack of data on individual investors' trades in other types of securities.

Choe, Kho, and Stulz (1999) find that positive (negative) open-to-close return on Korean common stocks is associated with a negative (positive) domestic individuals order imbalance (net buy-sell volume in shares) the next day. Grinblatt and Keloharju (2000, 2001a) provide evidence of Finnish households' contrarian behaviour with respect to both near-term (1 day and 1 week) and intermediate-term (1 month and 6 months) past returns. Jackson (2003), using Australian data, reaches the same conclusion showing that weekly net flows have a strong negative relationship with lagged common stock returns out to a lag of two months.

Analysing trades executed via retail brokers, Griffin, Harris and Topaloglu (2003) also find retail traders tend to be contrarian with respect to the previous 1-day return when submitting orders in NASDAQ common stocks. Richards (2005), using data from six Asian emerging equity markets, shows that individuals' trading pattern can be characterised as contrarian when looking at the previous 1-day return. Barber and Odean (2008) find that individuals are net sellers following days with large positive return movements, despite a relatively larger number of buy trades than sell trades following extreme positive returns; this is due to the mean value of sell trades being higher than the mean value of buy trades.

More recently, Kelley and Tetlock (2013), using a dataset including all retail orders in the majority of common stocks listed on the NYSE, NASDAQ and American Stock Exchange, show that limit orders placed by households are contrarian in nature with respect to the previous 1-week and 1-month returns. Bradrania et al. (2015), using holding data in the Clearing House Electronic Subregister System provided by the Australian Stock Exchange, analyse market adjusted returns over five trading days prior to the portfolio construction day and find that individuals tend to buy (sell) common stocks after price decrease (increase), hence, acting as contrarians. Barrot, Kaniel and Sraer (2016), using a large sample of French retail investors, also find that individuals display contrarian behaviour when considering the past daily, weekly and monthly returns. Finally,

Swan and Westerholm (2016), using Finnish data, analyse trade returns over the previous trading day, week, month and 6-month, and find that domestic individual investors, particularly small and medium households, become more contrarian as the time horizon extends.

A rich literature in psychology documents that individuals are overconfident. This overconfidence leads individuals to overestimate their actual ability, the accuracy of one's beliefs, performance, level of control, or chance of success (see discussion in Moore and Healy 2008). It also leads individuals to believe themselves to be better than others, which has been labelled the "better-than-average" effect (Alicke et al. 1995). When analysed in conjunction with trading behaviour, overconfidence leads to high trading volumes (Odean 1999, Barber and Odean 2000, 2001, Dorn et al. 2005, Glaser and Weber 2007 and Grinblatt and Keloharju 2009). Overconfidence may also lead to contrarian behaviour, as individuals trade against the market by purchasing (selling) securities after price declines (increases) if they are overconfident in their ability to spot mispriced securities they consider themselves better informed in. Vieru, Perttunen and Schadewitz (2006) find supporting evidence of this by showing that households who trade the most, considered the most overconfident, are also the most contrarian.

Another interesting explanation for why individuals may display contrarian behaviour with respect to short-term past-horizons is provided by Goetzmann and Zhu (2005). The authors suggest that contrarian patters may be related to the use of limit orders: sharp increases (decreases) in stock prices, triggers limit orders to sell (buy). A similar view is shared by Linnainmaa (2010) who propose the slowness of individual investors in adjusting limit orders results in short-term contrarian behaviour because "executed limit orders are always contrarian trades" (p. 1476).

An explanation for why investors might disply contrarian behaviour when selling securities is the disposition effect. The disposition effect, firstly introduced by Shefrin and Statman (1985), and widely documented in the literature, suggests a strong preference of investors to sell securities that have increased in value since bought rather than securities whose price is below their cost base. Hence, this preference leads to contrarian selling behaviour.

To the best of our knowledge, the only asset class, other than common stocks, for which individual investors behaviour is documented in the literature is mutual funds. Sirri and Tufano (1998), using data of flows of funds into and out of equity mutual funds from December 1971 through December 1990, find that "Mutual fund consumers chase returns, flocking to funds with the highest recent [1-month] returns, though failing to flee from poor performers" (p. 1590). Rather than proposing momentum chasing behaviour, *per se*, the authors suggest that the behaviour could reflect inferring managerial skill from past returns, hence, investing in those fund managers perceived better skilled. Using a two-year panel of 91,000 individual accounts in an S&P 500 index mutual fund, Goetzmann and Massa (2002) find that in the short-term (1-day) individuals investors are twice more likely to be contrarian than momentum chasers.

More recently, Ivkovic´ and Weisbenner (2009), using trades from 78,000 individual accounts of a large U.S. discount broker, show that individual investors are willing to sell losing mutual funds while are reluctant to sell funds that have appreciated in value. The authors suggest the behaviour is consistent with tax motivations based on minimising tax liabilities. Bailey, Kumar & Ng (2011) find evidence of trend-chasing behaviour. The authors analyse over 600,000 trades by 32,000 individual U.S. investors in 15,000 mutual funds and find that investors tend to buy funds with more positive returns over the previous 1-year and 2-year periods.

We contribute to the wealth of literature on individual investor behaviour, by being the first, to the best of our knowledge, to analyse how momentum impacts households' behaviour when trading ETFs.

3 Data

3.1 Data sources

We merge datasets from two sources: Euroclear Finland Limited and NASDAQ OMXH exchange.

3.1.1 Euroclear Finland Limited

Euroclear Finland Limited (formerly Finnish Central Securities Depository) is responsible for the clearing and settlement of trades in Finland and for maintaining information regarding portfolio holdings of all registered investors. Unlike survey data or data from a single stockbroking firm, due to Euroclear's central clearinghouse role, the data is free from potential representativeness problems. The data reflects the official certificates of ownership and is therefore of extremely high quality.

Every investor trading on the Helsinki Stock Exchange (OMXH) is required to obtain a unique account number by registering with Euroclear; this number must be used for all transactions. The dataset excludes trades by Finnish investors in securities not listed on the OMXH, but include trades on foreign exchanges of Finnish companies, such as Nokia, listed both locally and abroad. However, for the Finnish households in our sample, there are no records of such trades. Along with the account number, each transaction records date, ISIN security code, buy/sell indicator, volume and price, as well as other less relevant information for the purpose of this study.

From Euroclear Finland Limited we obtain trading records of all those Finnish households who traded the OMX Helsinki 25 index (OMXH25) ETF *at least once* during our sample period. In addition to the ETF, we limit the stocks in this study to the constituents of the OMX Helsinki 25 index; this allows us to compare whether households' behaviour differs when trading the ETF and its underlying stocks. Due to delisting, mergers and index rebalancing, the total number of stocks in our sample is 35.

The initial dataset includes more than 74 thousand ETF trades and more than 2.6 million stock trades made by 12,156 Finnish households from February 8, 2002 (the date the OMXH25 ETF was launched) through

December 30, 2014.[4] Following Grinblatt and Keloharju (2001), we net all same-day trades in the same security by the same household. This is done to mitigate the effect of intraday market making and any "double-counting" due to trade splitting that may arise for reasons related to liquidity or execution efficiencies. After completing this netting process, the final dataset consists of 57,491 ETF trades and 988,524 common stock trades.

3.1.2 NASDAQ OMXH exchange

The NASDAQ OMXH exchange provides daily closing prices for all securities traded on the OMXH. The daily stock prices are combined with the trading data from Euroclear Finland Limited to calculate momentum and trading performance. We complement Euroclear data with a look-back period of one year and a look-forward period of two years in order to be able to calculate the momentum of days at the beginning of our sample period, as well as to assess future returns of those trades recorded at the end of our sample period. To compute future returns, we also obtain from the OMXH the history of dividends of the ETF.

Because our sample period begins the day the ETF was launched, we cannot directly compute, for instance, the 6-month momentum for the initial 6-month period, as the closing price of day t – 6 months is not available. For this reason, rather than dropping all the observations in the initial 6 months of the sample period, we estimate the returns the ETF would have had, had it been trading, by using the returns of the OMX Helsinki 25 index as a proxy. In an unreported robustness test, we also drop all the observations in the initial 6-month period and re-perform our analysis; results are virtually identical.

3.2 OMX Helsinki 25 Index ETF

The OMX Helsinki 25 Index ETF (herehence, the ETF) is a low-cost, passively managed ETF traded on the OMXH like stocks. The ETF aims to tracks the OMX Helsinki 25 index which contains the 25 largest and most liquid stocks on the OMXH. Normally, the investors exchange units in the market rather than subscribing/redeeming units directly with the fund management company (Seligson & Co Fund Management

[4] More specifically, only 10,258 of the 12,156 households who trade ETFs also trade common stocks during our sample period. This means that approximately 15.6% of the households in our sample choose not to invest in individual common stocks directly.

Company Plc.). During our sample period, the ETF we study is the only ETF tracking the OMX Helsinki 25 index, it has a correlation of approximately 99.5% and it is the only ETF trading on the OMXH with meaningful trading volumes. Table 1 presents the summary statistics for ETF and common stock trades.

Table 1
Summary Statistics of ETF and Common Stock Trades by Households (HH)

Panel A: Summary Statistics of ETF Trades

Year	Number of Transactions			Mean Trade Value (€)		Total Value (€ million)			# of HH who trade ETFs
	Buys	Sells	Total	Buys	Sells	Buys	Sells	Total	
2002	671	158	829	5,895	7,808	4.0	1.2	5.2	453
2003	395	149	544	7,271	7,874	2.9	1.2	4.0	321
2004	446	325	771	8,026	11,396	3.6	3.7	7.3	434
2005	750	417	1,167	8,007	11,689	6.0	4.9	10.9	686
2006	956	629	1,585	9,781	13,377	9.4	8.4	17.8	809
2007	949	659	1,608	7,298	12,646	6.9	8.3	15.3	785
2008	2,979	525	3,504	3,243	5,494	9.7	2.9	12.5	1,427
2009	7,375	1,923	9,298	4,461	8,105	32.9	15.6	48.5	3,475
2010	5,306	2,257	7,563	5,082	9,574	27.0	21.6	48.6	3,196
2011	7,455	2,954	10,409	4,666	8,636	34.8	25.5	60.3	4,082
2012	5,032	2,391	7,423	4,498	8,353	22.6	20.0	42.6	3,208
2013	3,920	2,434	6,354	4,951	8,739	19.4	21.3	40.7	3,161
2014	3,497	2,939	6,436	18,660	25,097	65.3	73.8	139.0	3,188
Total	39,731	17,760	57,491	6,149	11,730	244.3	208.3	452.6	12,156

Panel B: Summary Statistics of Common Stock (C.S.) Trades

Year	Number of Transactions			Mean Trade Value (€)		Total Value (€ million)			# of HH who trade C.S.*
	Buys	Sells	Total	Buys	Sells	Buys	Sells	Total	
2002	10,058	5,604	15,662	7,221	9,666	72.6	54.2	126.8	1,993
2003	13,527	7,946	21,473	8,401	11,934	113.6	94.8	208.5	2,360
2004	22,754	15,089	37,843	13,159	17,501	299.4	264.1	563.5	3,536
2005	28,139	22,616	50,755	11,022	13,795	310.2	312.0	622.1	3,859
2006	28,986	25,527	54,513	12,960	15,317	375.7	391.0	766.7	3,837
2007	33,769	28,923	62,692	12,120	15,069	409.3	435.8	845.1	4,064
2008	54,138	26,258	80,396	13,814	22,594	747.8	593.3	1,341.1	4,924
2009	75,506	40,898	116,404	5,833	8,860	440.4	362.3	802.7	6,152
2010	76,882	46,487	123,369	7,138	10,581	548.8	491.9	1,040.7	6,764
2011	77,664	49,266	126,930	6,770	10,046	525.8	494.9	1,020.7	7,268
2012	67,814	42,380	110,194	8,081	10,044	548.0	425.7	973.7	6,798
2013	60,143	42,113	102,256	7,444	10,573	447.7	445.3	892.9	7,312
2014	45,375	40,662	86,037	12,803	19,562	580.9	795.4	1,376.4	6,678
Total	594,755	393,769	988,524	9,113	13,106	5,420.2	5,160.7	10,580.9	10,258

* Refers to the number of households who trade *both* common stocks *and* ETFs.

4 Methodology

4.1 Identification of Positive and Negative Momentum

Defining momentum-based behaviour requires, as an initial step, the identification of whether a security, or a group of securities, displays positive or negative momentum. In the literature, this is generally determined as a result of a cross-sectional comparison of securities. For a given horizon, securities are ranked by market-adjusted returns; high-ranked securities (the winners) are said to display positive momentum while low-ranked securities (the losers) are said to exhibit negative momentum. Contrarian (momentum chasing) behaviour is then defined as the tendency to buy (sell) past losers and sell (buy) past winners (see, for example, De Bondt and Thaler 1985, 1987, and Jegadeesh and Titman 1993).

Given this study focuses predominantly on one security, the OMX Helsinki 25 Index ETF (herehence, simply ETF), this "ranking-based" definition of momentum cannot be directly applied to our analysis of households' behaviour. Goetzmann and Massa (2002) had a similar issue in that, by analysing short-term (1-day) momentum-based behaviour of retail investors in an S&P 500 index mutual fund, they required a different methodology in order to classify contrarian and momentum chasing investors. The authors defined momentum chasing investors as those "[…] purchasing when the market rose and selling when the market fell in the previous trading session" (p. 378). They defined contrarian investors in exactly the opposite fashion. By doing so, they implied that a positive (negative) return in the previous trading session was indicative of positive (negative) momentum.

We believe the identification methodology used by Goetzmann and Massa (2002) is reasonable when applied to the 1-day past-horizon considered in their study; however, a question arises of whether such methodology can withstand more general cases. Specifically, would it be appropriate to identify as momentum chasing, a trade placed when the previous, say, 6-month return is positive, regardless of the *magnitude* of such return? For example, while we believe most people would agree that a 15% return over a 6-month period is an indication of *positive* momentum, would they reach the same conclusion if the return over the same period was a meagre 1%?

As the reader might have guessed given the suggestive nature of these questions, we believe the identification of positive and negative momentum must be conditional on the magnitude of realised past-returns. As the literature, to the best of our knowledge, lacks a generally accepted procedure for determining momentum in single security studies, we introduce the following methodology. For each day in our sample, we construct arithmetic return series for five past-horizons:

- -1D, *t* – the previous trading day (herehence, denoted 1D);
- -1W, -D – the previous trading week excluding the previous day (1W-1D);
- -1M, -1W – the previous month excluding the previous week (1M-1W);
- -6M, -1M – the previous 6 months excluding the previous month (6M-1M)
- -6M, *t* – the previous 6 months, which combines all of the other non-overlapping horizons together (6M).

The past-horizons we consider follow Grinblatt and Keloharju (2000). On each day between February 8, 2002 and December 30, 2014, there exist returns for the ETF over the five different horizons. We divide each horizon's return into *terciles*, such that each horizon's bottom (top) tercile consists of the one-third of days with the worst (best) returns; the middle tercile comprises the remaining one-third of days with "middle-of-the-road" returns. We define days in the bottom (top) tercile as having negative (positive) momentum and days in the middle tercile as having neutral momentum.

We study how households' behaviour relates to momentum by adopting two methodologies: the analysis of "buy-ratios" and the analysis of trades conditional on trade direction. We now proceed to introduce these methodologies.

4.2 Buy-Ratio Analysis

To proxy for aggregate household trading activity (*aggregate* in the sense that purchases and sales data is considered *jointly*), for each trading day *t* we calculate the "buy-ratio" as the number of ETF units purchased divided by the sum of the number of units purchased and the number of units sold. That is:

$$Buy\text{ - }Ratio_t = \frac{Number\ of\ Units\ Purchased_t}{Number\ of\ Units\ Purchased_t + Number\ of\ Units\ Sold_t} \quad (1)$$

For example, if 10 households each purchase 200 units on day *t*, while 5 households each sell 100 units on day *t*, and the rest do not trade, then the buy-ratio on day *t* is 0.8 = 10 x 200 / (10 x 200 + 5 x 100). Buy-ratios can range from zero, when all trades on a given day are sales, to one, when all trades on a given day are purchases. Days on which households do no trade are dropped from the sample. A buy-ratio for day *t* greater (smaller) than 0.5 indicates that households on that day have been, in aggregate, net buyers (sellers).

For each of the five past-horizons, we calculate the equally-weighted average buy-ratios of days with negative, neutral and positive momentum. An average buy-ratio greater on days with negative (positive) momentum than on days with positive (negative) and neutral momentum, indicates contrarian (momentum chasing) behaviour. Alternatively, an average buy-ratio greater on days with neutral momentum than on days with negative and positive momentum, indicates households are not significantly influenced by momentum when trading the ETF. Similarly, average buy-ratios that are not statistically different among days with negative, neutral and positive momentum, also indicate households' behaviour is neutral with respect to momentum. Given that buy-ratios are not normally distributed, we compute statistical significance using the Mann–Whitney U test (also known as Wilcoxon rank-sum test), a nonparametric test that does not require the normality assumptions.

We calculate equally-weighted average buy-ratios as opposed to weighting buy-ratios by trading volumes for two main reasons. Firstly, by doing so we avoid results to be skewed by extreme outliers, as each such observation can, at most, skew only one daily buy ratio. Given our sample period spans over 13 years, and that each buy-ratio carries the same weight, a buy-ratio heavily skewed by an extreme outlier would have a negligible overall impact. Secondly, and perhaps more importantly, trading volumes have substantially

increased over time (see Table 1); had we weighted buy-ratios by daily trading volumes, we would have given considerably less weight to buy-ratios of days at the beginning of our sample period than to those ones at the end.

The results we obtain from the buy-ratio analysis allow us to draw meaningful conclusions regarding households trading behaviour. However, despite the contribution to the literature of several studies is built upon similar buy-ratio analyses, a case could be made against the meaningfulness of such results due to how buy-ratio are calculated. Specifically, it could be argued that *sales* play a stronger role in our buy-ratio analysis, and in similar studies, than they perhaps deserve. There are two main reasons to support this argument. The first one is that decisions to sell securities might be influenced by factors that bear no relationship with the seller' view regarding future performance and/or his trading behaviour. For example, an individual might be selling securities because of liquidity reasons (e.g., need to front a large and/or unexpected expense), tax purposes (e.g., sell to lock in capital losses to offset against capital gains), change in personal circumstances and/or risk aversion (e.g., as people age, they tend to move from risky assets such as stocks to safer assets such as bonds), portfolio rebalancing, and so on. The second reason is that individual investors who follow contrarian (momentum chasing) strategies, might not sell securities that have risen (fallen) simply because they do not already own these securities and they do not like to sell short and/or are highly constrained from using this practice. Therefore, in addition to our buy-ratio analysis, we also study trading behaviour conditional on trade direction, by examining separately purchases and sales. This allows to separate any potential "noise" of data on sales from the more meaningful data on purchases. Moreover, unlike for the buy-ratio analysis, studying trades conditional on trade direction allows to determine if momentum impact on households' behaviour is similar when buying and selling securities.

4.3 Analysis of Trades Conditional on Trade Direction

We analyse if momentum influences households' buying behaviour and selling behaviour in a similar fashion. Specifically, the intention of this analysis is to understand if households are contrarian or momentum chasers *both* when they purchase ETFs *and* when they sell them. As mentioned at the end of the previous section, we acknowledge that results obtained from the analysis of sales are possibly not as meaningful as results obtained from the analysis of purchases. Nonetheless, studying behaviour conditional on trade direction, and particularly the purchasing behaviour, complements the results we obtain from our buy-ratio analysis.

Following logic, we define buy trades made on days with negative (positive) momentum as contrarian (momentum chasers) purchases, and buy trades made on days with neutral momentum as momentum neutral purchases. Similarly, we define sell trades made on days with negative (positive) momentum as momentum chasers (contrarian) sales, and sell trades made on days with neutral momentum as momentum neutral sales.

Recall that, because of the methodology we use to identify momentum, for each past-horizon we consider, we have an equal number of days with negative, neutral and positive momentum. The simple and intuitive idea behind our analysis of trades conditional on trade direction is that if households are *not* influenced by momentum when trading ETFs, then the proportion of contrarian purchases (sales) should be approximately equal to the proportion of momentum chasers purchases (sales). We calculate proportions as follows:

First Partition (of the total sample). We split the (total) sample into two mutually exclusive and comprehensive subsets, buy trades, and sell trades.

Second Partition (past-horizon dependent). For each past-horizon, we split each of the First Partition subsets to three mutually exclusive and exhaustive subsets: contrarian trades, designated by *c*, momentum neutral trades, designated by *n*, and momentum chasers trades, designated by *m*. Now, for each past-horizon, we define the proportion of contrarian, momentum neutral and momentum chasers trades conditional on trade direction to be the ratio of the corresponding subset from the Second Partition over the corresponding subset of the First Partition. For example:

$$\text{Proportion of contrarian purchases w.r.t. past-horizon 1D} = \frac{\text{Number of contrarian purchases w.r.t. past-horizon 1D } \textit{(a Second Partition subset w.r.t past-horizon 1D)}}{\text{Total number of purchases } \textit{(a First Partition subset)}}$$

(w.r.t. = with respect to)

More generally, we denote:

$$Proportion_{behaviour_i,\, horizon_h, trade\ direction_j} = \frac{Number\ of\ trades_{behaviour_i,\, horizon_h, trade\ direction_j}}{Total\ number\ of\ trades_{trade\ direction_j}}, \quad \forall\ i, h\ and\ j \tag{2}$$

where *i* equals contrarian, momentum neutral, momentum chasers; past-horizon *h* equals 1D, 1W-1D, 1M-1W, 6M-1M, 6M; and *j* equals purchases, sales. We express proportions in percentage figures. Intuitively, a higher proportion of contrarian (momentum chasers) purchases than momentum chasers purchases is indication of contrarian (momentum chasing) behaviour when purchasing ETFs. Similarly, a higher proportion of contrarian (momentum chasers) sales than momentum chasers sales is indication of contrarian (momentum chasing) behaviour when selling ETFs. We test the null hypothesis that the proportion of contrarian purchases (sales) is equal to the proportion of momentum chasers purchases (sales) using a two-sided Score Z test for equality of proportions (also known as Pearson's $\chi 2$ test).

In this analysis, we calculate the proportions just described using equally-weighted trades, as opposed to weighting trades by *volume* (i.e., number of units traded) or *value* (i.e., number of units traded multiplied by trade price). Such weighting would have led to adverse consequences for the following reasons. Firstly, *not* weighting trades by volume or value prevents results to be skewed by extreme outliers. Secondly, as we do not analyse the behaviour of different households grouped by the *size* of their portfolios (as done, for example, in Grinblatt and Keloharju 2000), we avoid giving a disproportionate weight to wealthy households who are likely to place trades considerably larger than the average. Thirdly, weighting trades by volume place larger relevance on trades executed when the ETF price was, for example, €11 than when the price was €33 (trivially, this is because keeping the value of the trade constant, a trade at €11 purchases three times more units than a trade at €33). Finally, given the length of the period of our sample, weighting trades by *value* would give an unrepresentative equal weight to trades of same value placed years apart, hence, completely ignoring the basic principle of time value of money.

4.4 Behaviour Comparison when Trading ETF and Common Stocks

The key feature of this study is the comparison of households' behaviour when trading ETFs and when trading the common stocks underlying the ETF. As previously mentioned, households are widely regarded to be contrarian when trading common stocks. However, because the households in our sample are specifically limited to those ones who trade the passively managed index ETF centre of this study, there is the possibility that the behaviour displayed by this subset of households is different from the contrarian behaviour documented in the literature. For this reason, we perform the two analyses introduced in section 4.2 and 4.3 on common stock data. The consistency between the methodologies we use to analyse households' behaviour when trading ETFs and common stocks allows for a clearer comparison of behaviour.

4.4.1 Buy-Ratio Analysis: ETF vs. Common Stock Comparison

For each one of the 35 common stocks in the sample, we calculate buy-ratios for each day *t* as the number of common stock *i* shares purchased divided by the sum of the number of common stock *i* shares purchased and sold. That is:

$$Buy\text{ - }Ratio_{t,i} = \frac{Number\ of\ Shares\ Purchased_{t,i}}{Number\ of\ Shares\ Purchased_{t,i} + Number\ of\ Shares\ Sold_{t,i}} \quad (3)$$

To maintain consistency between the buy-ratio analysis on common stocks and the ETF, we identify days with negative, neutral and positive momentum, *for each common stock*, following the methodology introduced in section 4.1.

For each of the five past-horizons, we calculate the equally-weighted average buy-ratios across all stocks on days with negative, neutral and positive momentum. An average buy-ratio greater on days with negative (positive) momentum than on days with positive (negative) and neutral momentum, indicates contrarian (momentum chasing) behaviour. Conversely, an average buy-ratio greater on days with neutral momentum than on days with negative and positive momentum suggests momentum does not significantly influence behaviour when trading common stocks. Similarly, average buy-ratios that are not statistically different among days with negative, neutral and positive momentum, also indicate households' behaviour is unaffected by momentum. Due to the non-normal distribution of buy-ratios, we compute statistical significance using the

Mann–Whitney U test, (also known as Wilcoxon rank-sum test), a nonparametric test that does not require the normality assumptions.

We compare the results from the buy-ratio analysis on the ETF and common stock data to assess whether households' behaviour is the same when trading the two different types of securities. To allow a clearer comparison, we *normalise* the daily buy-ratios of both the ETF and common stocks, by dividing them by the respective sample mean buy-ratios (i.e., we divide ETF buy-ratios by the sample mean ETF buy-ratio and we divide common stock buy-ratios by the sample mean common stock buy-ratio). We test whether the average normalised buy-ratio for the ETF on days with negative momentum is similar to the average normalised buy-ratio for common stocks on days with negative momentum using the Mann–Whitney U test. We repeat the test for average normalised buy-ratios on days with neutral and positive momentum. The reason we normalise buy-ratios is that, on average, buy-ratios are higher for the ETF than for common stocks, regardless of momentum. This arises because households are net-buyers of the ETF during the sample period, while the volume of common stocks purchased is approximately the same as the volume of common stocks sold. By normalising the buy-ratios, we are able to more meaningfully answer the research question at the core of this section. Because, as previously mentioned, analysing buy-ratio does not allow to study trading behaviour conditional on trade direction, and because buy-ratios might be affected by noise in sales data, we overcome these shortcomings by using the methodology we present next.

4.4.2 Analysis of Trades Conditional on Trade Direction: ETF vs. Common Stock Comparison

For each common stock, we identify days with negative, neutral and positive momentum following the methodology introduced in section 4.1. We then repeat our analysis of trades conditional on trade direction introduced in section 4.3, on common stock data. That is, for each past-horizon, we define buy trades made on days with negative (positive) momentum as contrarian (momentum chasers) purchases; we define the remaining buy trades on as momentum neutral.[5] Interpretation of results and statistical tests are as described in section 4.3.

To compare if momentum impacts households' behaviour when purchasing ETFs and common stocks differently, we test the null hypothesis that the proportion of contrarian (momentum chasers) ETF purchases is the same as the proportion of contrarian (momentum chasers) common stock purchases. To compare if momentum impacts the behaviour when selling ETFs and common stocks differently, we test the null hypothesis that the proportion of contrarian (momentum chasers) ETF sales is the same as the proportion of contrarian (momentum chasers) common stock sales. If we reject the null hypothesis, we observe the magnitude of ETF and common stock proportions to establish for which type of security momentum effects households' behaviour the most. For example, if for a given horizon, the proportion of contrarian ETF purchases is 35 percent and the proportion of contrarian common stock purchases is 40 percent, and these proportions are statistically different, we then say that for this past-horizon negative momentum has a stronger influence on households' behaviour to purchase common stocks. In other words, this would suggest that the propensity to purchase common stocks on days with negative momentum is higher than for ETFs. We calculate statistical significance using a two-sided Score Z test for equality of proportions (also known as Pearson's $\chi 2$ test).

[5] For example, if on day *t*, common stocks *x, y* and *z* have negative, neutral and positive 1D momentum, respectively, then we define buy trades of common stocks *x, y* and *z* on day *t* as contrarian, momentum neutral and momentum chasers purchases respectively, with respect to past-horizon 1D.

5 Results

5.1 ETF Buy-Ratio Analysis

Table 2 reports the results we obtain from the buy-ratio analysis. Recall that buy-ratios reflect the degree of aggregate trading volumes by households: a buy-ratio for day *t* greater (smaller) than 0.5 that households have been net buyers (sellers) on that day. In the absence of contrarian or momentum chasing behaviour, the average buy-ratios on days with negative and positive momentum should be approximately equal.

Table 2
Average ETF Buy-Ratio for Days with Negative, Neutral and Positive Momentum

For each of the five past-horizons we calculate **average buy-ratio** as the equally-weighted average of daily buy-ratios [(buy volume)/(buy volume + sell volume)] of days with negative, neutral and positive momentum. We define momentum as follows. For each day from February 8, 2002 to December 30, 2014, we construct arithmetic return series for five past-horizons: previous 1 day (**1D**); previous 1 week excluding previous 1 day (**1W-1D**); previous 1 month excluding previous 1 week (**1M-1W**); previous 6 months excluding previous 1 month (**6M-1M**) and previous 6 months which combines all of the other non-overlapping horizons together (**6M**). We divide each horizon's return into **terciles**, such that each horizon's bottom (top) tercile consists of the one-third of days with the worst (best) returns; the middle tercile comprises the remaining one-third of days with the lowest absolute returns. We define days in the bottom (top) tercile as having **negative** (**positive**) momentum and days in the middle tercile as having **neutral** momentum. Days on which households do no trade are dropped from the sample. This is the reason why the number of daily buy-ratios is not exactly equal among days with negative, neutral and positive momentum. The sample consists of 3,080 daily buy-ratios. Using the Mann–Whitney *U* test (also known as Wilcoxon rank-sum test), for each past-horizon, we test the null hypothesis that buy-ratios of days with negative momentum are approximately equal to buy-ratios of days with positive momentum. If we do not reject the null hypothesis, we define **trading behaviour** as **indifferent**. If we reject the null hypothesis, we define trading behaviour as **contrarian** (**momentum chaser**) if the average buy-ratio is higher on days with negative (positive) momentum. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Momentum	Terciles (Return Range)	N (days)	Average Buy-Ratio	Trading Behaviour	*p*-value
Panel A: *1D* Momentum					
Negative	$r < -0.41\%$	1,040	0.631		
Neutral	$-0.41\% \leq r \leq 0.52\%$	1,003	0.575	Contrarian***	0.0065
Positive	$r > 0.52\%$	1,037	0.599		
Panel B: *1W-1D* Momentum					
Negative	$r < -0.77\%$	1,027	0.619		
Neutral	$-0.77\% \leq r \leq 1.21\%$	1,015	0.587	Contrarian*	0.0922
Positive	$r > 1.21\%$	1,038	0.599		
Panel C: *1M-1W* Momentum					
Negative	$r < -0.92\%$	1,028	0.624		
Neutral	$-0.92\% \leq r \leq 2.92\%$	1,017	0.558	Indifferent	0.5414
Positive	$r > 2.92\%$	1,035	0.622		
Panel D: *6M-1M* Momentum					
Negative	$r < -0.67\%$	1,012	0.642		
Neutral	$-0.67\% \leq r \leq 12.08\%$	1,027	0.586	Contrarian***	0.0000
Positive	$r > 12.08\%$	1,041	0.579		
Panel E: *6M* Momentum					
Negative	$r < 0.24\%$	1,018	0.653		
Neutral	$0.24\% \leq r \leq 13.41\%$	1,022	0.570	Contrarian***	0.0000
Positive	$r > 13.41\%$	1,040	0.584		

Table 2 shows that average buy-ratios are greater on days with negative momentum than on days with positive and neutral momentum for all past-horizons except for the 1M-1W past-horizon, whereby the average buy-ratios on days with positive and negative momentum are not statistically different. This indicates that households net buying behaviour is generally stronger on days characterised by relatively poor past-performance. Moreover, the buy-ratio difference between days with positive momentum and days with negative momentum is greater for longer past-horizons (6M-1M and 6M) than for the shorter past-horizons. Hence, as hypothesised, households tend to be contrarian when trading ETFs, and this behaviour appears to be stronger with respect to longer past-horizons.

With the exception of the 6M-1M past-horizon, we also find that the average buy-ratio is lowest on days with neutral momentum. This is consistent with Barber and Odean (2008), who argue that this behaviour is due to an "attention-grabbing" effect, whereby those investors that follow contrarian (momentum chasing) strategies are prompted to purchase securities following extreme negative (positive) returns.

While not strictly related to this study, it is interesting to notice that average buy-ratios are greater than 0.5 regardless of past-momentum (the average buy-ratio for the entire sample is 0.602). This indicates the households have been net buyers of ETFs during our sample period and confirms the increasing popularity and relevance of ETF investing.

The findings that momentum does not significantly influence behaviour at the 1M-1W horizon, while we document contrarian behaviour for the other horizons, is quite puzzling. Our buy-ratio analysis does not allow us to determine whether these results are driven by relatively lower (higher) buying (selling) volumes on days with negative 1M-1W, relatively higher (lower) buying (selling) volumes on days with positive (negative) 1M-1W momentum, or a combination of both. Next, we present the results from our analysis of ETF trades conditional on trade direction which allow us to clarify the momentum neutral behaviour for the 1M-1W past-horizon we identify with our buy-ratio analysis.

5.2 Analysis of ETF Trades Conditional on Trade Direction

Table 3 reports the result of our analysis of ETF trades conditional on trade direction. Recall that the underlying idea of this analysis is that if households are *not* influenced by negative and positive momentum differently, then the proportion of buy (sell) ETF trades made on days with negative momentum should be approximately equal to the proportion of buy (sell) ETF trades made positive momentum. Due to reasons affecting selling decisions that are not related to past-momentum (refer to the last paragraph of section 4.2 for a brief discussion on this topic), we avoid drawing definite conclusions from the analysis of sell trades. Nonetheless, we report the results for completeness.

Table 3

Proportion of Contrarian, Momentum Neutral and Momentum Chaser ETF Purchases and Sales

This table reports, for each of the five past-horizons, the proportions of contrarian, momentum neutral and momentum chaser purchases and sales. We classify purchases (sales) made on days with negative, neutral and positive momentum as **contrarian** (**momentum chaser**), **momentum neutral** and **momentum chaser** (**contrarian**), respectively. We define momentum as follows. For each day from February 8, 2002 to December 30, 2014, we construct arithmetic return series for five past-horizons: previous 1 day (**1D**); previous 1 week excluding previous 1 day (**1W-1D**); previous 1 month excluding previous 1 week (**1M-1W**); previous 6 months excluding previous 1 month (**6M-1M**) and previous 6 months which combines all of the other non-overlapping horizons together (**6M**). We divide each horizon's return into terciles, such that each horizon's bottom (top) tercile consists of the one-third of days with the worst (best) returns; the middle tercile comprises the remaining one-third of days with "middle-of-the-road" returns. We define days in the bottom (top) tercile as having **negative** (**positive**) momentum and days in the middle tercile as having **neutral** momentum. Days on which households do no trade are dropped from the sample. The sample consists of 57,491 trades. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon, we test the null hypothesis that the proportion of purchases (sales) made on days with negative momentum is equal to the proportion of purchases (sales) made on days with positive momentum. If we do not reject the null hypothesis, we define **trading behaviour** as **indifferent**. If we reject the null hypothesis, we define trading behaviour for purchases as **contrarian** (**momentum chaser**) if the proportion of contrarian purchases is higher (lower) than the proportion of momentum chasers purchases. For sales, we define trading behaviour as **contrarian** (**momentum chaser**) if the proportion of contrarian sales is higher (lower) than the proportion of momentum chasers sales. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Panel A: ETF Purchases

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	39.5%	26.6%	33.9%	Contrarian***	0.0000
1W-1D	37.9%	28.5%	33.6%	Contrarian***	0.0000
1M-1W	37.8%	27.8%	34.4%	Contrarian***	0.0000
6M-1M	37.2%	28.4%	34.4%	Contrarian***	0.0000
6M	38.4%	28.4%	33.2%	Contrarian***	0.0000

Panel B: ETF Sales

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	34.1%	30.4%	35.4%	Indifferent	0.1236
1W-1D	35.3%	30.7%	34.0%	Indifferent	0.1443
1M-1W	33.0%	32.1%	34.9%	Mom. Chaser**	0.0278
6M-1M	35.3%	32.1%	32.7%	Contrarian***	0.0024
6M	34.2%	33.7%	32.1%	Contrarian**	0.0178

Consistently with our first hypothesis, Panel A of Table 3 shows that, for each past-horizon, households' behaviour is contrarian when purchasing ETFs, with the average proportion of contrarian purchases across past-horizons 12.6 percent greater than the proportion of momentum chaser purchases.[6] Moreover, while the contrarian purchasing behaviour appears to be stronger with respect to the previous 1D horizon, the proportions of contrarian, momentum neutral and momentum chasers trades remain relatively unchanged across the different past-horizons. This would seem to suggest that the strength of household contrarian behaviour with respect to purchases is indifferent to the length of past-horizon considered. Days with neutral momentum have the lowest proportion of purchases; this is consistent with the results from our buy-ratio analysis, as well as with the "attention-grabbing" effect Barber and Odean (2008) suggest, that we mentioned in the previous section.

The analysis of sales also produces some interesting results. Keeping in mind the possible shortcomings affecting any analysis based on sales data, our results suggest that households' behaviour is indifferent to momentum with respect to short-term past-horizons (1D and 1W-1D), momentum chasing at the 1M-1W past-horizon and contrarian for the two remaining longer-term horizons. The findings that selling behaviour is indifferent to short-term momentum is consistent with the rationale that, because individuals who invest in index ETFs do so with long-term investment horizons in mind, selling behaviour is less affected by momentum, especially for short-term past-horizons.

The selling behaviour for our two longest past-horizons is consistent both with the contrarian behaviour observed in our results thus far, as well as with the disposition effect. The disposition effect firstly introduced by Shefrin and Statman (1985), and widely documented in the literature, suggests a strong investor preference to sell securities that have increased in value since bought rather than securities whose price is below their cost base. It is beyond the scope of this paper to determine whether households behave as contrarian when they sell with respect to the longer past-horizons because they expect prices to fall after periods of strong performance, or whether the behaviour we observe is instead the result of the disposition effect. Nonetheless, both

[6] 12.6% = [(39.5/33.9 + 37.9/33.6 + 37.8/34.4 + 37.2/34.4 + 38.4/33.2)/5] - 1

hypotheses are consistent with our findings that individual investors tend to sell ETFs after periods of relatively strong momentum.

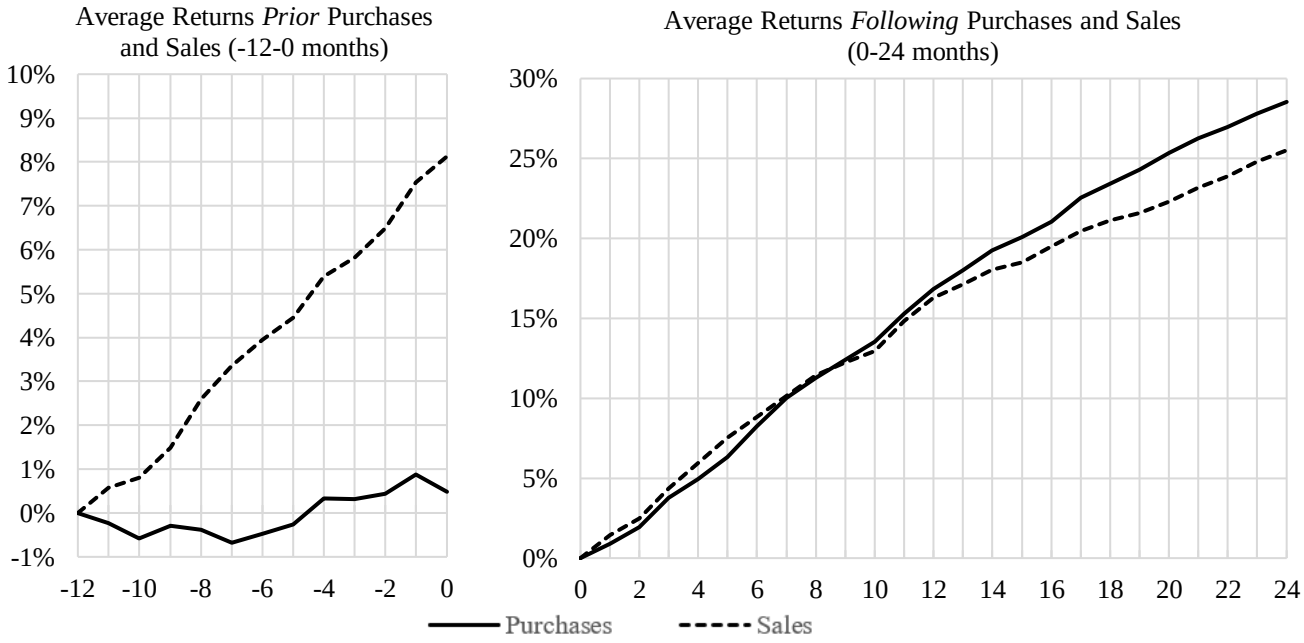
Finally, while we find quite puzzling the momentum chasing selling behaviour we document for the 1M-1W past-horizon, we attempt to explain it as follows. Let us assume again that households are not influenced in their selling decisions by momentum with respect to short-term past-horizons due to their medium- to long-term average holding periods. While this assumption might be reasonable for the average individual, there might be a group of investors who are sensitive even to short-term price declines. This group could be made of those investors who trade on margin, by borrowing funds from the broker to invest in the stock market. While short-term price declines a few-day long might not be sufficient to drain their margin accounts, longer declines could trigger margin calls, prompting investors to sell securities if they are not prepared, or are unable, to top-up their margin accounts. In this scenario, it is then possible for results to be skewed by those investors for which even the price performance over the prior 1M-1W does matter, despite the majority of investors being indifferent to this past-horizon momentum.

Interestingly, we notice that the momentum chasing selling behaviour we observe for the 1M-1W past-horizon explains why the results from our buy-ratio analysis show no evidence of aggregate contrarian trading behaviour for this past-horizon. While the average value of buy-ratios on days with negative momentum is increased by contrarian buying behaviour, momentum chasing selling behaviour has the opposite effect, exercising downward pressure on buy-ratios. These opposite effects counterbalance each other, resulting in household aggregate trading behaviour being indifferent to momentum for this horizon when we analyse it using our buy-ratio analysis.

Having examined households' behaviour with trading ETF, both at the aggregate level with our buy-ratio analysis, and conditional on trade direction, we analyse if the timing of trading decisions is "optimal", in that returns following purchases are, on average, higher than returns following sales. We now present the findings to this question. Moreover, to complement our previous results and to provide a more comprehensive picture, we also calculate the average return patterns before purchases and sales in our sample. It should be noted that all the evidence we discuss next focuses on pre-tax returns as does not take into account transaction costs.

Figure 1 graphs equally-weighted average returns for the 12-month period and 24-month period prior to and following trades, respectively. While our study focuses on horizons up to 6 months into the past, we consider a look-back period of 1 year to observe if average returns significantly change once we extend the past-horizons. This does not appear to be the case. The chart on the left-hand side of Figure 1 is consistent with our general findings that households are contrarian when they trade ETFs: they purchase (sell) them after periods of relatively poor (good) performance. The chart on the right-hand side of Figure 1 shows that average returns following sales are higher than following purchases for the initial 6-month period post-trades. As we extend the holding period over the tenth month, the opposite holds, with returns following purchases outperforming returns following sales, on average, by 19 basis points per month, or about 2.3% annually. These findings are highly statistically significant.[7] In the period between 6 months and 10 months following trades, these returns are approximately equal.

Figure 1



The findings that returns following purchases underperform returns following sales in the initial 6-month period post-trades is further strong evidence of household contrarian behaviour. By acting as contrarian,

[7] Refer to Appendix 1 for details on statistical significance of these results.

households experience lower short-term returns following purchases than following sales. This can be attributed to the *momentum effect* firstly documented by Jegadeesh and Titman (1993) which suggests that securities with relatively strong (poor) recent performance will continue to outperform (underperform). Having tested and confirmed our first research hypothesis that that households are contrarian when trading ETFs, we now proceed to present the results of the comparison in households' behaviour when trading ETFs and common stocks.

5.3 Comparison of Households' Behaviour when Trading ETF vs. Common Stocks

5.3.1 Buy-Ratio Analysis Comparison

To allow the comparison of households' behaviour when trading ETFs and when trading the common stocks underlying the ETF we study (our second research question), we begin this section by reporting in Table 4 the results of our buy-ratio analysis on the common stocks in our sample.

Table 4

Average Common Stock Buy-Ratio for Days with Negative, Neutral and Positive Momentum

For each of the five past-horizons we calculate **average buy-ratio** as the equally-weighted average of daily buy-ratios of days with negative, neutral and positive momentum. Buy-ratios are calculated for each day *t* as the number of common stock *i* shares purchased divided by the sum of the number of common stock *i* shares purchased and sold. We define momentum as follows. For each day in our sample and for each common stock that on that day is part of the OMX 25 Helsinki Index, we construct arithmetic return series for five past-horizons: previous 1 day (**1D**); previous 1 week excluding previous 1 day (**1W-1D**); previous 1 month excluding previous 1 week (**1M-1W**); previous 6 months excluding previous 1 month (**6M-1M**) and previous 6 months which combines all of the other non-overlapping horizons together (**6M**). For each common stock, we divide each horizon's return into terciles, such that each horizon's bottom (top) tercile consists of the one-third of days with the worst (best) returns; the middle tercile comprises the remaining one-third of days with the lowest absolute returns. We define days in the bottom (top) tercile as having negative (positive) momentum and days in the middle tercile as having neutral momentum. Days on which households do no trade are dropped from the sample. This is the reason why the number of daily buy-ratios is not exactly equal among days with negative, neutral and positive momentum. The sample consists of 85,644 daily buy-ratios. Using the Mann–Whitney *U* test (also known as Wilcoxon rank-sum test), for each past-horizon, we test the null hypothesis that buy-ratios of days with negative momentum are approximately equal to buy-ratios of days with positive momentum. If we do not reject the null hypothesis, we define **trading behaviour** as **indifferent**. If we reject the null hypothesis, we define trading behaviour as **contrarian** (**momentum chaser**) if the average buy-ratio is higher on days with negative (positive) momentum. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Momentum	N (stock-days)	Average Buy-Ratio	Trading Behaviour	*p*-value
Panel A: *1D* Momentum				
Negative	28,772	0.529		
Neutral	28,093	0.496	Contrarian***	0.0000
Positive	28,766	0.491		
Panel B: *1W-1D* Momentum				
Negative	28,773	0.536		
Neutral	28,166	0.495	Contrarian***	0.0000
Positive	28,664	0.485		
Panel C: *1M-1W* Momentum				
Negative	28,624	0.532		
Neutral	28,180	0.502	Contrarian***	0.0000
Positive	28,690	0.482		
Panel D: *6M-1M* Momentum				
Negative	28,498	0.526		
Neutral	27,883	0.499	Contrarian***	0.0000
Positive	28,389	0.492		
Panel E: *6M* Momentum				
Negative	28,503	0.544		
Neutral	27,813	0.494	Contrarian***	0.0000
Positive	28,454	0.478		

Results on Table 4 allow to draw four major observations. Firstly, we observe that days with negative momentum have the highest average buy-ratios. This is consistent with the results we obtain from our ETF buy-ratio analysis and confirms contrarian behaviour also for common stocks. We find this result particularly important for the significance of this study because the households in our sample are specifically limited to those ones who trade the passively managed index ETF centre of this study. Therefore, there was the possibility that the behaviour displayed by this subset of households was different from the contrarian behaviour widely documented in the literature.

Secondly, it stands out a difference in the "magnitude" of the average buy-ratios of common stocks when compared to the average buy-ratios of the ETF. While the average ETF buy-ratio of about 0.60 indicates that households have been net-buyers of this security during our sample period, the average buy-ratio of approximately 0.51 for common stocks indicates the number of shares purchased during the sample period is approximately the same of the number of shares sold. This is consistent with the increasing popularity of ETF investing compared to the mature stage of the broader stock market.

Thirdly, unlike for the ETF, households' aggregate trading behaviour is strongly contrarian also at the 1M-1W past-horizon. Lastly, while ETF buy-ratios are generally lower for days with neutral momentum, for common stocks this is true for days with positive momentum, which suggests that households respond to positive momentum differently when trading the ETF and common stocks. This is consistent with our hypothesis that households are less overconfident when trading ETFs than common stocks, which lead them to trading in the same direction of the market, by purchasing ETFs relatively more than common stocks following periods of stronger market performance.

To allow a clearer analysis, in Table 5 we present the results of the comparison between the *normalised* daily buy-ratios of the ETF and common stocks, following the methodology introduced in section 4.4. The main reason we normalise buy-ratios is that, as previously mentioned, buy-ratios are higher for the ETF than for common stocks, regardless of momentum; therefore, a direct comparison prevents us from testing statistical significance of results.

Table 5

Comparison Between Normalised Average Buy-Ratio of ETF and Common Stocks (C.S.)

This table reports, for each of the five past-horizons, the normalised average buy-ratio of days with negative, neutral and positive momentum, for the ETF and common stocks. We calculate **normalised average C.S. buy-ratios** using the following methodology. Firstly, we calculate common stock buy-ratios for each day *t* as the number of common stock *i* shares purchased divided by the sum of the number of common stock *i* shares purchased and sold. Secondly, we normalise each common stock buy-ratio by dividing them by the average daily buy-ratio among all common stock in our sample. Finally, the normalised average C.S. buy-ratio for a given past-horizon and for a given momentum is the equally-weighted average of all normalised buy-ratios for that past-horizon and for that momentum. We compute **normalised average ETF buy-ratios** following the same methodology. Refer to section 4.1 for the methodology we use to define momentum. Using the Mann–Whitney U test (also known as Wilcoxon rank-sum test), for each past-horizon, we test the null hypothesis that normalised average ETF buy-ratios are approximately equal to normalised average common stock buy-ratios for days with the same momentum. If we reject the null hypothesis, we determine how momentum affects trading of common stocks and ETFs differently, by comparing the magnitude of the two normalised average buy ratios. Statistically higher normalised buy-ratio for a given type of security and for a given past-horizon, indicates momentum influence household trading behaviour for that type of security and for that past-horizon more strongly. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Momentum	**Normalised Average ETF Buy-Ratio**	**Normalised Average C.S. Buy-Ratio**	***p*-value**
Panel A: *1D* Momentum			
Negative	1.048	1.048	0.1766
Neutral	0.955	0.981	0.1756
Positive	0.995	0.971	0.3759
Panel B: *1W-1D* Momentum			
Negative	1.029	1.060	0.0034***
Neutral	0.976	0.980	0.5884
Positive	0.996	0.959	0.1031
Panel C: *1M-1W* Momentum			
Negative	1.037	1.053	0.0309**
Neutral	0.928	0.993	0.0026***
Positive	1.034	0.954	0.0007***
Panel D: *6M-1M* Momentum			
Negative	1.066	1.040	0.7983
Neutral	0.973	0.987	0.3348
Positive	0.962	0.973	0.5900
Panel E: *6M* Momentum			
Negative	1.084	1.077	0.1277
Neutral	0.947	0.977	0.1487
Positive	0.970	0.947	0.1837

We find that, normalised average buy-ratios appear to be higher for ETFs than for common stocks on days with positive momentum. However, with some exceptions, normalised average buy-ratios are not significantly different between the two types of securities. At the 1W-1D and 1M-1W past-horizons, contrarian behaviour is stronger for common stocks than for ETFs. Moreover, at the 1M-1W past-horizon the normalised average buy-ratio is higher (lower) for the ETF than for common stocks in days with positive (neutral) momentum

indicating that both neutral and positive momentum at this past-horizon also influence households' behaviour when trading ETFs and common stocks differently.

The major shortcoming of this comparison arises from the fact that the analysis of buy-ratios does not allow to condition for trade direction. For example, we are unable to determine if relatively higher buy-ratios are the consequence of relatively higher buying volumes, relatively lower selling volumes, or a combination of both. Furthermore, as previously mentioned, it is possible that buy-ratios are affected by "noise" arising from the use of sell trades which can be influenced by factors that bear no relationship with the seller' view regarding future performance and/or his trading behaviour (e.g., liquidity reasons, tax purposes, change in personal circumstances, portfolio rebalancing, etc.). For these reasons, we believe the findings we obtain analysing trades conditional on trade direction for each type of security, will provide more meaningful results. We present these findings next.

5.3.2 Analysis of Trades Conditional on Trade Direction Comparison

In this section we limit the discussion to the comparison of *buying* behaviour, given the potential distortion of sales data we previously discussed. For completeness, we report the comparison of *selling* behaviour in Appendix 2. We begin by reporting in Table 6 the relevant results we obtain from our analysis of trades conditional on trade direction on common stock data. As expected, we find that, for each past-horizon, households' behaviour is strongly contrarian when buying common stocks.

Table 6

Proportion of Contrarian, Momentum Neutral and Momentum Chaser Common Stock Purchases

This table reports, for each of the five past-horizons, the proportions of contrarian, momentum neutral and momentum chaser common stocks purchases. We classify purchases made on days with negative, neutral and positive momentum as **contrarian**, **momentum neutral** and **momentum chaser**, respectively. We define momentum and past-horizons following the methodology introduced in section 4.1. We calculate the proportions of contrarian, momentum neutral and momentum chasers purchases, following the methodology introduced in section 4.3. The sample consists of 988,524 common stock trades. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon, we test the null hypothesis that the proportion of contrarian purchases is approximately equal to the proportion of momentum chasers purchases. If we do not reject the null hypothesis, we define **trading behaviour** as indifferent. If we reject the null hypothesis, we define trading behaviour as **contrarian** (**momentum chaser**) if the proportion of contrarian purchases is higher (lower) than the proportion of momentum chaser purchases. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	40.0%	27.8%	32.1%	Contrarian***	0.0000
1W-1D	41.0%	28.3%	30.8%	Contrarian***	0.0000
1M-1W	39.5%	30.3%	30.1%	Contrarian***	0.0000
6M-1M	40.0%	30.2%	29.8%	Contrarian***	0.0000
6M	43.0%	29.4%	27.6%	Contrarian***	0.0000

Results in Table 6 shows that, for each past-horizon, households' behaviour is strongly contrarian when purchasing ETFs, with the average proportion of contrarian purchases across past-horizons 35.8 percent greater than the proportion of momentum chaser purchases.[8] We use results in Table 6 and in Table 3, Panel A, to determine if households' behaviour when *purchasing* ETFs and common stocks is impacted by momentum similarly. Specifically, we are interested in understanding if momentum influences the *propensity* of households to purchase ETFs and common stocks in a similar way. We present these findings in Table 7.

[8] 35.8% = [(40.0/32.1 + 41.0/30.8 + 39.5/30.1 + 40.0/29.8 + 43.0/27.6)/5] - 1

Table 7

Influence of Momentum on the Propensity to Purchase ETFs vs. Common Stocks (C.S.)

This table reports, for each of the five past-horizons, the comparison of proportions of ETF and common stock purchases that are contrarian, momentum neutral and momentum chaser. We classify purchases made on days with negative, neutral and positive momentum as **contrarian**, **momentum neutral** and **momentum chaser**, respectively. We define momentum and past-horizons following the methodology introduced in section 4.1. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon, we test the null hypothesis that the proportion of contrarian, momentum neutral and momentum chaser ETF purchases is the same as the proportion of contrarian, momentum neutral and momentum chaser common stock purchases, respectively. If we do not reject the null hypothesis, we define momentum **influence** as **similar**. If we reject the null hypothesis, we define momentum **influence** as **lower** (**higher**) if the proportion of ETF purchases is lower (higher) than the proportion of common stock purchases. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Panel A: Influence of negative momentum on the propensity to purchase ETFs vs. common stocks.

Past Horizon	ETF Contrarian Purchases	C.S. Contrarian Purchases	Influence	*p*-value
1D	39.5%	40.0%	Similar	0.1667
1W-1D	37.9%	41.0%	Lower***	0.0000
1M-1W	37.8%	39.5%	Lower***	0.0000
6M-1M	37.2%	40.0%	Lower***	0.0000
6M	38.4%	43.0%	Lower***	0.0000

Panel B: Influence of positive momentum on the propensity to purchase ETFs vs. common stocks.

Past Horizon	ETF Mom. Chaser Purchases	C.S. Mom. Chaser Purchases	Influence	*p*-value
1D	33.9%	32.1%	Higher***	0.0000
1W-1D	33.6%	30.8%	Higher***	0.0000
1M-1W	34.4%	30.1%	Higher***	0.0000
6M-1M	34.4%	29.8%	Higher***	0.0000
6M	33.2%	27.6%	Higher***	0.0000

Panel C: Influence of neutral momentum on the propensity to purchase ETFs vs. common stocks.

Past Horizon	ETF Mom. Neutral Purchases	C.S. Mom. Neutral Purchases	Influence	*p*-value
1D	26.6%	27.8%	Lower***	0.0022
1W-1D	28.5%	28.3%	Similar	0.2853
1M-1W	27.8%	30.3%	Lower***	0.0000
6M-1M	28.4%	30.2%	Lower***	0.0000
6M	28.4%	29.4%	Lower**	0.0130

Table 7 shows that households' behaviour when purchasing ETF and common stock is influenced by momentum differently. We find that, across past-horizons, the propensity of households to purchase ETFs is lower than that for common stocks when momentum is negative or neutral. Households appear much more likely to purchase ETFs than common stocks when momentum is positive, with the average proportion across past-horizons of momentum chaser purchases 12.9 percent greater for ETFs than for common stocks.[9] These findings are strongly consistent with our hypothesis that households are less overconfident when trading ETFs

[9] 12.9% = [33.9/32.1 + 33.6/30.8 + 34.4/30.1 + 34.4/29.8 + 33.2/27.6)/5] – 1

than when trading common stocks, which results in households trading ETFs less (more) against (along) the market than when trading common stocks. This is shown by the lower (higher) impact of negative (positive) momentum on the propensity to purchase ETFs than that of common stocks.

To test the robustness of the assumption that overconfidence leads to stronger contrarian behaviour, we should then find that households who trade the most and who are considered to be the most overconfident (see Barber and Odean 2000, 2001, Dorn et al. 2005, Grinblatt and Keloharju 2009 among others), should have a stronger contrarian behaviour than households who trade the least. In section 5.4.2 we will show that this is indeed the case, as we find that the 50 percent of households to trade the most are significantly more contrarian than the 50 percent of households who trade the least.

In the next section we present some of the most meaningful robustness tests we conduct. The findings from these robustness tests complement what presented thus far and provide further insight into our results.

5.4 Robustness Tests

5.4.1 Dependency of short-term behaviour on longer past-horizon momentum

Despite our findings, we have suggested that household ETF trading behaviour might not be influenced by momentum over very short-term past-horizons given their propensity to hold ETF investments for the medium- to long-term. Hence, a question arises of whether our results with respect to 1D past-horizon are actually driven by momentum over longer past-horizons (as we have already shown that neutral momentum has the least effect on households' behaviour, we limit this analysis to positive and negative momentum). We analyse this possibility by testing the following hypotheses.

If contrary to our findings, households trade ETFs irrespectively of previous 1D momentum, then the following two hypotheses should hold: 1) Average buy-ratios on days with opposite 1D momentum, but similar momentum over a longer past-horizon, should be similar; 2) Average buy-ratios on days with similar 1D momentum, but opposite momentum over a longer past-horizon, should be different. We test these hypotheses and report our findings in Table 8.

Table 8

ETF Trading Behaviour w.r.t. 1D Momentum, Conditional on 1W-1D and 1M-1W Momentum

We calculate **average buy-ratio** as the equally-weighted average of daily buy-ratios [(buy volume)/(buy volume + sell volume)] conditional on previous 1D momentum and previous 1W-1D or 1M-1W momentum. For example, in Panel A, 0.636 is the equally-weighted average of all daily buy-ratios on days with negative 1D momentum *and* positive 1W-1D momentum. ***We test the following two null hypotheses***: 1) average buy-ratios on days with opposite 1D momentum, but similar 1W-1D or 1M-1W momentum, are approximately equal; 2) Average buy-ratios on days with similar 1D momentum, but opposite 1W-1D or 1M-1W momentum, are approximately equal. ***To strengthen our findings that household ETF trading behaviour is influenced by 1D momentum, the first (second) hypothesis should (not) be rejected.*** We test the null hypothesis using the Mann–Whitney U test (also known as Wilcoxon rank-sum test). Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Panel A *(Hypothesis #1)*

1W-1D	1D	Average Buy-Ratio	N (days)	*p*-value
Positive	Negative	0.636	333	0.0519*
	Positive	0.597	338	
Negative	Negative	0.649	405	0.0576*
	Positive	0.612	365	

Panel C *(Hypothesis #2)*

1W-1D	1D	Average Buy-Ratio	N (days)	*p*-value
Negative	Positive	0.612	365	0.3785
Positive		0.597	338	
Negative	Negative	0.649	405	0.4679
Positive		0.636	333	

Panel B *(Hypothesis #1)*

1M-1W	1D	Average Buy-Ratio	N (days)	*p*-value
Positive	Negative	0.630	329	0.6954
	Positive	0.627	341	
Negative	Negative	0.668	380	0.0077***
	Positive	0.612	377	

Panel D *(Hypothesis #2)*

1M-1W	1D	Average Buy-Ratio	N (days)	*p*-value
Negative	Positive	0.612	377	0.793
Positive		0.627	341	
Negative	Negative	0.668	380	0.0647*
Positive		0.630	329	

Consistently with our first hypothesis discussed in this section, results in Table 8 shows that average buy-ratios are generally higher on days with negative 1D momentum than on days with positive 1D momentum, despite holding constant 1W-1D (Panel A) and 1M-1W (Panel B) momentum. Consistently with our second hypothesis discussed in this section, holding constant 1D momentum, average buy-ratios are generally not affected by opposite 1W-1D momentum (Panel C) and 1M-1W momentum (Panel D), as indicated by the statistical *insignificance* of the hypothesis test. Given the results of this robustness test, it appears that our findings that households' ETF trading behaviour is contrarian to previous 1D momentum are not driven by trading behaviour with respect to longer past-horizons momentum.

5.4.2 Does overconfidence actually lead to contrarian behaviour?

To test the robustness of the assumption that overconfidence leads to stronger contrarian behaviour, we should find that households who trade the most and who are the most overconfident (Odean 1999, Barber and Odean 2000, 2001, Dorn et al. 2005, Glaser and Weber 2007 and Grinblatt and Keloharju 2009), should have stronger contrarian behaviour than households who trade the least. Similarly, households who trade the least, who are also the least overconfident, should have stronger propensity to be momentum chasers, as they trade in the same direction of the market. The importance of this robustness test lies on the fact that we hypothesise that households are less overconfident when trading ETFs than when trading common stocks. This leads to our expectation (confirmed thus far by our findings) of weaker household contrarian behaviour when trading ETFs than when trading common stocks. To test this hypothesis, we divide households into three groups as follows:

- The *least active group* is made of the 50% of households in our sample who trade the least (two trades or less). This group is responsible for 17.0% of all ETF trades.
- The *most active group* is made of the 10% of households who trade the most (ten trades or more). This group is responsible for 42.6% of all ETF trades.
- The *mid-active group* is made of the remaining 40% of households and is responsible for 40.4% of all ETF trades.

We repeat our analysis of trades conditional on trade direction for each of the three household groups, focusing the attention on purchases only, to specifically test our findings reported in section 5.3.2.[10] Results in Table 9 show that purchasing behaviour significantly differs among households in the least active group and households in the two other groups. Specifically, for all the past-horizon, while the two groups of households who trade the most are strongly contrarian, households who trade the least display strong momentum chasing behaviour. This is strongly consistent with the assumption that households' own belief that they are "better-than-average" result in contrarian behaviour, as they purchase securities after price declines because they are

[10] Moreover, note that because most households in the least active group never sell ETFs (these households only make one or two *purchases*), there is an insufficient number of observations for this group to analyse their ETF selling behaviour.

overconfident in their ability to spot underpriced securities. Importantly, it also confirms our findings that the weaker contrarian households' behaviour when trading ETFs than when trading common stocks is due to lower overconfidence in their ability to determine the "true" value of ETFs better than the market.

Table 9
Proportion of Contrarian, Momentum Neutral and Momentum Chaser ETF Purchases, by Household Group

For each of the five past-horizons and for each household group, this table reports the proportions of contrarian, momentum neutral and momentum chaser purchases. We classify purchases made on days with negative, neutral and positive momentum as **contrarian**, **momentum neutral** and **momentum chaser**, respectively. We define momentum and past-horizons following the methodology introduced in section 4.1. We calculate the proportions of contrarian, momentum neutral and momentum chasers purchases, following the methodology introduced in section 4.3. The **least active group** is made of the 50% of households in our sample who trade the least. The **most active group** is made of the 10% of households who trade the most. The **mid-active group** is made of the remaining 40% of households. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon and for each household group, we test the null hypothesis that the proportion of contrarian purchases is approximately equal to the proportion of momentum chasers purchases. If we reject the null hypothesis, we define **trading behaviour** as **contrarian** (**momentum chaser**) if the proportion of contrarian purchases is higher (lower) than the proportion of momentum chaser purchases. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Panel A: Most Active Group

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	42.3%	26.4%	31.3%	Contrarian***	0.0000
1W-1D	40.4%	28.1%	31.5%	Contrarian***	0.0000
1M-1W	38.7%	27.6%	33.7%	Contrarian***	0.0000
6M-1M	37.9%	27.9%	34.2%	Contrarian***	0.0000
6M	39.4%	28.3%	32.2%	Contrarian***	0.0000

Panel B: Mid-Active Group

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	38.9%	25.5%	35.6%	Contrarian***	0.0002
1W-1D	37.6%	27.6%	34.8%	Contrarian***	0.0018
1M-1W	38.8%	27.1%	34.1%	Contrarian***	0.0000
6M-1M	38.8%	27.5%	33.6%	Contrarian***	0.0000
6M	40.4%	27.4%	32.3%	Contrarian***	0.0000

Panel C: Least Active Group

Past-Horizon	Contrarian	Neutral	Momentum Chaser	Behaviour	*p*-value
1D	33.8%	29.6%	36.6%	Mom. Chaser**	0.0384
1W-1D	32.5%	31.8%	35.6%	Mom. Chaser**	0.0257
1M-1W	33.5%	29.8%	36.7%	Mom. Chaser**	0.0185
6M-1M	31.6%	31.6%	36.9%	Mom. Chaser***	0.0001
6M	31.4%	30.9%	37.7%	Mom. Chaser***	0.0000

To further test the robustness of our findings that households are less overconfident when they purchase ETFs, and that the weaker overconfidence results in weaker contrarian behaviour when trading ETFs, we repeat our analysis on purchasing behaviour for each of the three household groups, on common stock data. If our

hypothesis holds, we should observe that even households in the least active group, contrary to what we observe when purchasing ETFs, should display contrarian behaviour when purchasing common stocks. Results in Table 10 confirm our hypotheses, as we find highly statistically significant evidence of contrarian behaviour across all groups, indicating that even the least active households are strongly contrarian when they purchase common stocks. Again, this confirms the weaker, or lack of, overconfidence when trading ETFs.

Table 10
Proportion of Contrarian, Momentum Neutral and Momentum Chaser Common Stock Purchases, by Household Group

This table reports, for each of the five past-horizons and for each household group, the proportions of contrarian, momentum neutral and momentum chaser purchases. We classify purchases made on days with negative, neutral and positive momentum as **contrarian**, **momentum neutral** and **momentum chaser**, respectively. We define momentum and past-horizons following the methodology introduced in section 4.1. To compare the consistency of behaviour, we maintain individuals in the three household groups consistent to the individuals in Table 9. Specifically, the **least active group** (**most active group**) is made of the 50% (10%) of households in our sample who trade ETF the least (most). The **mid-active group** is made of the remaining 40% of households. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon and for each household group, we test the null hypothesis that the proportion of purchases made on days with negative momentum is equal to the proportion of purchases made on days with positive momentum. If we reject the null hypothesis, we define **trading behaviour** as **contrarian** (**momentum chaser**) if the proportion of contrarian purchases is higher (lower) than the proportion of momentum chaser purchases. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Panel A: Most Active Group

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	40.5%	28.3%	31.2%	Contrarian***	0.0000
1W-1D	39.2%	29.0%	31.8%	Contrarian***	0.0000
1M-1W	37.6%	30.8%	31.5%	Contrarian***	0.0000
6M-1M	38.6%	30.5%	30.9%	Contrarian***	0.0000
6M	41.1%	29.6%	29.3%	Contrarian***	0.0000

Panel B: Mid-Active Group

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	39.4%	27.8%	32.8%	Contrarian***	0.0000
1W-1D	41.2%	28.1%	30.6%	Contrarian***	0.0000
1M-1W	40.3%	30.3%	29.4%	Contrarian***	0.0000
6M-1M	40.4%	30.4%	29.2%	Contrarian***	0.0000
6M	43.6%	29.6%	26.9%	Contrarian***	0.0000

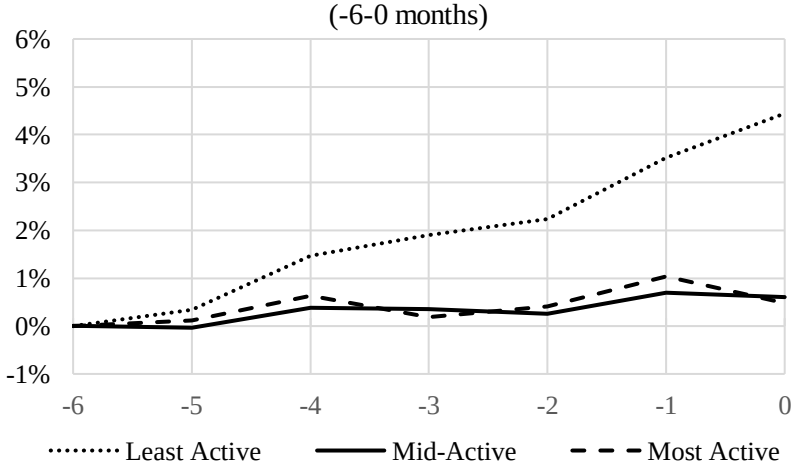
Panel C: Least Active Group

Past-Horizon	Contrarian	Momentum Neutral	Momentum Chaser	Trading Behaviour	*p*-value
1D	40.5%	27.5%	32.0%	Contrarian***	0.0000
1W-1D	42.0%	27.9%	30.1%	Contrarian***	0.0000
1M-1W	39.9%	30.0%	30.1%	Contrarian***	0.0000
6M-1M	40.7%	29.7%	29.6%	Contrarian***	0.0000
6M	43.8%	28.9%	27.3%	Contrarian***	0.0000

Before we conclude this section, we feel compelled to draw some further observations from the results in Table 9.[11] Table 9 shows that households who trade the most show the strongest contrarian behaviour with respect to the 1D past-horizon, with any given trade being 35% more likely to be contrarian than momentum chaser. We believe this finding may have significant implications for asset pricing given that ETF trading can transmit non-fundamental shocks to the underlying assets. Specifically, price pressure resulting from demand shocks for ETFs can propagate to the underlying securities through the arbitrage channel (see Da and Shive 2016 and Ben-David, Franzoni and Moussawi 2017, among others).[12] Hence, the short-term contrarian buying behaviour of households who trade the most may provide the liquidity to absorb, or at least partially mitigate, these shocks. This may contribute to provide price support and stabilise prices, especially during market crises. We strongly believe this should be tested in future studies.

To complement the findings in Table 9, we analyse the average returns before purchases for each household group. Figure 2 graphs equally-weighted average returns for the 6-month period prior to purchases, for each household group.

Figure 2
Average Returns Prior Purchases, by Household Group
(-6-0 months)



[11] We apologise to the reader for jumping back to previous results. However, the natural flow of our discussion required us to provide the robustness test in Table 10 before we could make further comments on the results in Table 9.
[12] Demand shocks that create a discrepancy between the ETF price and the net asset value of the basket of underlying securities may lead arbitrageurs to sell the expensive asset and buy the cheap one to profit the spread. Thus, shocks that occur in the ETF market can propagate to the underlying securities.

Consistently with the results in Table 9, Figure 2 shows that average market return is considerably stronger prior to purchases of least active households than before purchases of households in the other two groups. Extending the look-back period to 12 months prior to purchases, we observe that average returns between *t*-12 and *t*-6 are approximately the same among household groups (refer to Appendix 3 for further details).

To conclude this section, we test whether households' overconfidence is "justified". That is, we test whether households in the most active group, who are the most overconfident, are able to achieve higher returns than households in the least active group, who are the least overconfident. Specifically, if overconfidence is justified we expect households in the most active group to outperform the other two groups in the initial few months following purchases. This is because, as a result of their higher trading frequency, it is likely that they focus more on short-term performance, and care less about returns over longer horizons. Moreover, we expect that the households in the least active group achieve lower returns following purchases than those achieved by households in the other two groups. Figure 3 graphs equally-weighted average returns for the 24-month period following ETF purchases for each household group.

Figure 3
Average Returns Following ETF Purchases, by Household Group
(Left chart: 0-24 months, right chart: 0-6 months)

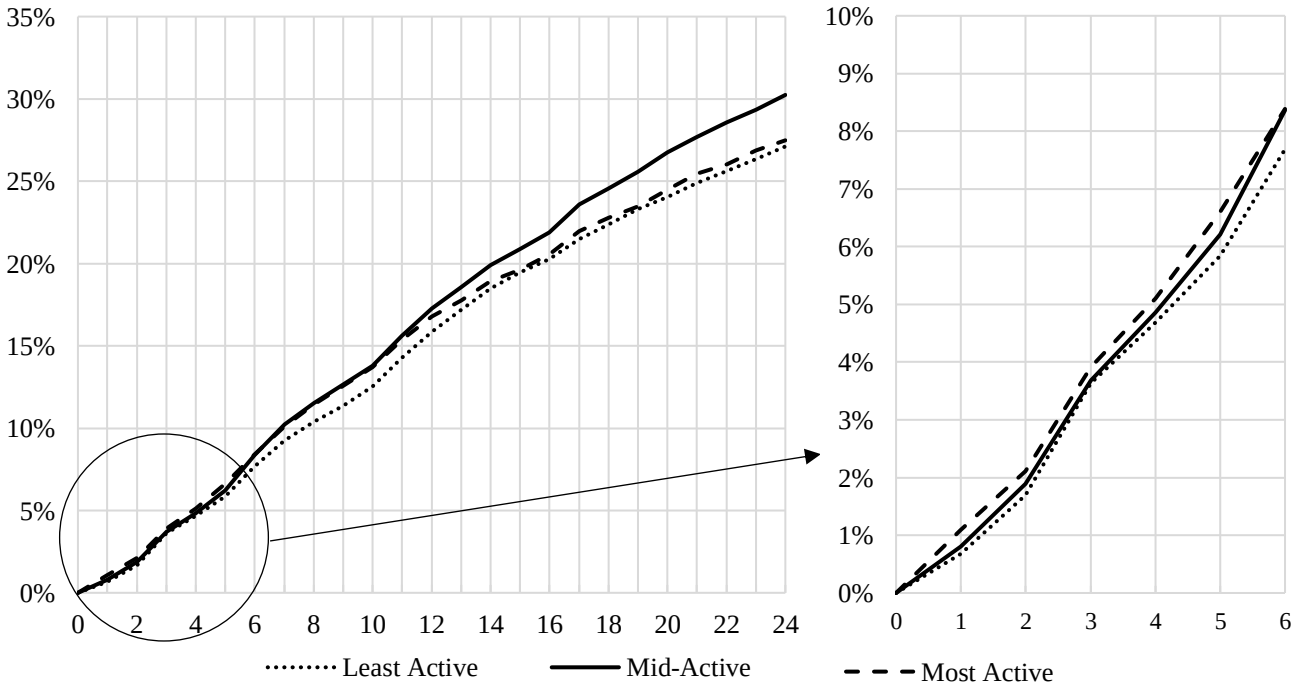


Figure 3 (and further details we report in Appendix 4) appears to confirm that overconfidence is justified, as households in the most active group experience statistically higher average returns than households in the mid-active (least active) group, for the initial 5 (12) months following purchases. For all the future horizons we analyse, average returns following purchases of households in the least active group are lower than those of households in the two other groups. However, as our analysis is based on gross returns, it is not clear whether the superior performance can persist once transaction costs are taken into account.

6 Summary and Conclusion

While the extent to which momentum influences households' behaviour when trading common stocks is widely documented in the literature, to the best of our knowledge, no published study analyses how momentum affects trading behaviour with respect to exchange-traded funds (ETFs). Ours is the first paper that begins filling this gap. We do this by employing two methodologies. Firstly, we examine whether the average daily buy-ratio [(buy volume)/(buy volume + sell volume)] of days with negative momentum exceeds the average daily buy-ratio of days with positive momentum. Secondly, we analyse behaviour conditional to trade direction which allows observing if momentum affects purchasing behaviour and selling behaviour differently. Specifically, we examine whether the proportion of buy (sell) trades made on days with negative momentum is higher than the proportion of buy (sell) trades made on days with positive momentum.

Using 57,491 ETF trades made by 12,156 Finnish households between February 2002 and December 2014, we show that individual investors are contrarian for a range of past-horizons up to 6 months into the past. Contrarian behaviour is particularly stronger when households purchase ETFs than when they sell them. Decisions to sell are less influenced by past-momentum, especially with respect to the shorter past-horizon we consider (prior 1D and prior 1W-1D) for which households behave neither as momentum chasers nor as contrarians. This is consistent with our hypothesis that short-term momentum has little impact on selling behaviour due to the medium- to long-term investment horizons households have in mind when investing in index ETFs. As we extend the look-back period to our longer past-horizons (6M-1M and 6M) we document evidence of contrarian behaviour also with respect to ETF sales.

We analyse if the contrarian behaviour we observe for the households in our sample when trading ETFs, also persists when trading common stocks. We use 988,524 trades from February 2002 to December 2014 to perform the buy-ratio analysis and the trade analysis conditional on trade direction for common stocks. The common stocks we select are the securities underlying the OMX Helsinki 25 index, the same index tracked by the ETF centre of this study. Consistently with what documented in the literature, we find that households in our sample display contrarian behaviour also when they trade common stocks. However, the strength of contrarian purchasing behaviour is significantly stronger for common stocks than for ETFs, with the average

proportion of contrarian purchases 35.8 percent higher than momentum chaser purchases for common stocks, compared with 12.6 percent higher for ETFs. Moreover, we find that the average proportion of momentum chasers purchases is 12.9 percent higher for ETFs than for common stocks, indicating that positive momentum has a stronger effect on the propensity of households to purchase ETFs than to purchase common stocks. These findings are consistent with our hypothesis that households are less overconfident in their ability to identify mispricing when trading ETFs than when trading common stocks.

Future research should focus on households' behaviour when trading ETFs that are not tracking major common stock indices. A natural hypothesis would be that the smaller the basket of securities underlying the ETFs, the closer the trading behaviour to common stock will be. Researchers could also focus on how momentum affects households' behaviour when trading bond ETFs and more "exotic" ETFs, such as those offering exposure to particular trading strategies not directly applicable by individual investors. For these types of ETFs, it would be interesting to understand whether household chase recent strong performance, as when they invest in mutual funds,[13] or whether they maintain the contrarian behaviour that we identify in this paper with respect to index ETFs, and that is widely documented in the literature for common stocks. We believe that it is important to understand how households behave when trading ETFs not only because of their exponential relevance as investment vehicles, but also because of the potential for ETF trading to transmit non-fundamental shocks to the underlying securities. In this case, household contrarian behaviour may provide the liquidity to absorb, or at least partially mitigate, these shocks, and hence, stabilise asset prices.

[13] As we mentioned in our literature review, refer to Sirri and Tufano 1998, Bailey, Kumar and Ng 2011, among others studies, for evidence that individual investors tend to chase strong recent performance when they invest in mutual funds.

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Appendices

Appendix 1 – Average Return Following Purchases and Sales of ETFs

The table in this appendix shows the comparison of equally-weighted average returns following ETF purchases and ETF sales (each trade has equal weight, irrespective of trading size). A two-tailed Welch's *t*-test (unpaired two-sample *t*-test with unequal variance) is used to test the null hypothesis that the returns following purchases are equal to return following sales. Average returns include dividends but ignore transaction costs and taxes. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Time (month)	**Purchases (P)**	**Sales (S)**	**(P) - (S)**	***t*-stat**
1	0.90%	1.43%	-0.53%***	(-9.46)
2	1.95%	2.47%	-0.52%***	(-6.47)
3	3.77%	4.35%	-0.58%***	(-6.11)
4	4.93%	5.95%	-1.02%***	(-9.46)
5	6.31%	7.51%	-1.20%***	(-9.70)
6	8.26%	8.81%	-0.56%***	(-4.21)
7	10.01%	10.17%	-0.15%	(-1.11)
8	11.30%	11.46%	-0.15%	(-1.06)
9	12.39%	12.24%	0.16%	(1.02)
10	13.53%	12.95%	0.58%***	(3.54)
11	15.28%	14.82%	0.46%***	(2.67)
12	16.82%	16.31%	0.51%***	(2.77)
13	17.98%	17.11%	0.87%***	(4.54)
14	19.25%	18.03%	1.22%***	(6.10)
15	20.09%	18.52%	1.57%***	(7.52)
16	21.06%	19.48%	1.58%***	(7.23)
17	22.55%	20.48%	2.07%***	(8.96)
18	23.43%	21.11%	2.32%***	(9.88)
19	24.30%	21.59%	2.71%***	(11.06)
20	25.33%	22.30%	3.03%***	(12.00)
21	26.27%	23.19%	3.08%***	(11.93)
22	26.99%	23.90%	3.09%***	(11.73)
23	27.78%	24.78%	3.00%***	(11.19)
24	28.54%	25.51%	3.03%***	(11.14)

Appendix 2: Influence of Momentum on the Propensity to Sell ETFs vs. Common Stocks

As argued on several occasions in the main body of our paper, data on sell trades is inherently affected by noise because individual investors might choose to sell securities for reasons totally unrelated to their view regarding future performance and/or their trading behaviour (e.g., liquidity reasons, tax purposes, change in personal circumstances, portfolio rebalancing, etc.). Hence, we do not discuss the comparison of the influence of momentum on the propensity to sell ETFs and common stocks in our main "Results" section. Nonetheless, we report the comparison in this appendix for completeness.

Influence of Momentum on the Propensity to Sell ETFs vs. Common Stocks (C.S.)

This table reports, for each of the five past-horizons, the comparison of proportions of ETF and common stock sales that are contrarian, momentum neutral and momentum chaser. We classify sales made on days with negative, neutral and positive momentum as **momentum chaser**, **momentum neutral** and **contrarian**, respectively. We define momentum and past-horizons following the methodology introduced in section 4.1. Using a two-sided Score *Z* test for equality of proportions (also known as Pearson's $\chi 2$ test), for each past-horizon, we test the null hypothesis that the proportion of contrarian, momentum neutral and momentum chaser ETF sales is the same as the proportion of contrarian, momentum neutral and momentum chaser common stock sales, respectively. If we do not reject the null hypothesis, we define momentum **influence** as **similar**. If we reject the null hypothesis, we define momentum **influence** as **lower** (**higher**) if the proportion of ETF sales is lower (higher) than the proportion of common stock sales. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

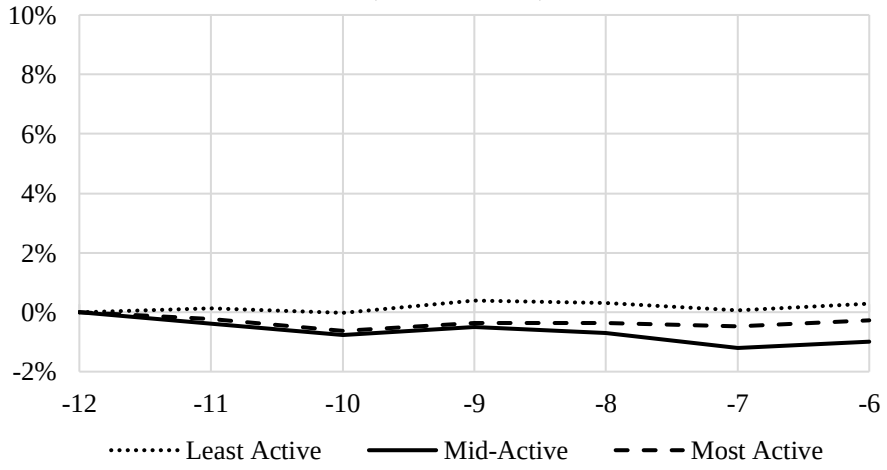
Influence of negative momentum on the propensity to sell ETFs vs. common stocks				
Past Horizon	**ETF Contrarian Sales**	**C.S. Contrarian Sales**	**Influence**	***p*-value**
1D	34.1%	36.4%	Lower***	0.0003
1W-1D	35.3%	35.4%	Similar	0.8242
1M-1W	33.0%	34.9%	Lower***	0.0039
6M-1M	35.3%	33.2%	Higher***	0.0007
6M	34.2%	33.7%	Similar	0.4325
Influence of positive momentum on the propensity to sell ETFs vs. common stocks.				
Past Horizon	**ETF Mom. Chaser Sales**	**C.S. Mom. Chaser Sales**	**Influence**	***p*-value**
1D	35.4%	33.1%	Higher***	0.0001
1W-1D	34.0%	33.3%	Similar	0.2152
1M-1W	34.9%	33.0%	Higher***	0.0013
6M-1M	32.7%	35.0%	Lower***	0.0003
6M	32.1%	34.1%	Lower**	0.0021
Influence of neutral momentum on the propensity to sell ETFs vs. common stocks.				
Past Horizon	**ETF Mom. Neutral Sales**	**C.S. Mom. Neutral Sales**	**Influence**	***p*-value**
1D	30.4%	30.5%	Similar	0.9768
1W-1D	30.7%	31.3%	Similar	0.3255
1M-1W	32.1%	32.2%	Similar	0.8416
6M-1M	32.1%	31.8%	Similar	0.6807
6M	33.7%	32.2%	Lower**	0.0165

We avoid drawing any conclusion as we doubt the meaningfulness of any analysis based entirely on sales data for the previously mentioned reason. The only comment we make is that results confirm that sale data is affected by noise as we can see the influence of momentum appears to be totally random on selling behaviour. Of course, a possible alternative explanation is that momentum, in fact, plays no role in determining the decision to sell securities. We leave to the reader to decide which explanation to choose from.

Appendix 3 – Average Returns Prior Purchases, by Household Group

Figure 4 graphs equally-weighted average returns for the 6-month period from -12 months to -6 months prior to purchases, for each household group. The purpose of Figure 4 is to complement the finding we present in Figure 3, on page 40, where we show that average market return over the 6 months prior to purchases is significantly stronger for the least active households than for households in the other two groups. Figure 4 shows average returns are the essentially similar among household groups once we extend the look-back period over 6-month into the past.

Figure 4
Average Returns *Prior* Purchases, by Household Group
(-12-6 months)



Appendix 4 – Average Returns Following Purchases, by Household Group

This table shows the comparison of equally-weighted average returns following purchases of ETFs for three household groups (each trade has equal weight, irrespective of trading size). The *least active group* is made of the 50% of households in our sample who trade ETFs the least. The most active group is made of the 10% of households who trade the most; it is responsible for 42.6% of all ETF trades. The mid-active group is made of the remaining 40% of households and is responsible for 40.4% of all ETF trades. A two-tailed Welch's t-test (unpaired two-sample t-test with unequal variance) is used to test the null hypothesis that the returns following purchases by different pairs of household groups are equal. Average HPC returns include dividends but ignore transaction costs. Statistical significance is indicated at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Time (month)	Least Active (1)	Mid-Active (2)	Most Active (3)	Average Return Difference		
				(2) - (1)	(3) - (1)	(3) - (2)
1	0.67%	0.80%	1.09%	0.13%	0.41%***	0.29%***
2	1.70%	1.89%	2.11%	0.19%	0.41***	0.22%*
3	3.63%	3.68%	3.91%	0.05%	0.28%*	0.23%*
4	4.69%	4.85%	5.10%	0.17%	0.41%**	0.25%
5	5.84%	6.21%	6.60%	0.37%*	0.76%***	0.39%**
6	7.69%	8.36%	8.39%	0.68%***	0.70%***	0.02%
7	9.27%	10.22%	10.12%	0.95%***	0.85%***	-0.10%
8	10.39%	11.52%	11.46%	1.13%***	1.07%***	-0.06%
9	11.37%	12.66%	12.56%	1.29%***	1.19%***	-0.10%
10	12.52%	13.77%	13.71%	1.25%***	1.19%***	-0.06%
11	14.28%	15.62%	15.36%	1.33%***	1.08%***	-0.25%
12	15.85%	17.27%	16.78%	1.43%***	0.93%***	-0.50%**
13	17.20%	18.56%	17.75%	1.36%***	0.55%*	-0.81%***
14	18.48%	19.91%	18.93%	1.43%***	0.45%	-0.99%***
15	19.44%	20.87%	19.60%	1.43%***	0.16%	-1.27%***
16	20.28%	21.91%	20.56%	1.63%***	0.29%	-1.34%***
17	21.49%	23.61%	21.96%	2.12%***	0.47%	-1.65%***
18	22.37%	24.55%	22.78%	2.18%***	0.41%	-1.77%***
19	23.29%	25.58%	23.48%	2.29%***	0.19%	-2.10%***
20	24.03%	26.75%	24.50%	2.72%***	0.47%	-2.25%***
21	24.88%	27.69%	25.47%	2.81%***	0.59%	-2.22%***
22	25.62%	28.56%	26.04%	2.94%***	0.42%	-2.52%***
23	26.35%	29.35%	26.86%	3.00%***	0.51%	-2.48%***
24	27.11%	30.24%	27.48%	3.13%***	0.37%	-2.76%***