Portfolio performance across genders and generations : the role of financial innovation

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Abstract

Using a unique dataset on the trading transaction records of private investors from Sweden, we explore the role of gender and age in the use of Exchange Traded Products (ETPs), considered to be innovative investment products, with respect to implications for portfolio performance. We show evidence that investors perform better when trading and investing in mutual funds, but younger investors may be relatively more skillful users of ETPs. We also find that older men and women trade more actively, although they also show a better investment performance, and we emphasize that age and gender are very different demographic determinants of investor behavior and performance.

Keywords: financial innovation, Exchange Traded Product, age, gender

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1 INTRODUCTION

While market participants are becoming more aware of the gender and age-related determinants of investment behavior (e.g. Barber and Odean, 2001), the post-millennium era has been characterized by the development of Exchange Traded Products (ETPs), which facilitate the trading opportunities of both retail and institutional investors. ETPs can be considered as innovative because they are relatively new and crowd pleasing, and they aim to advance the risk-sharing properties of the markets. For instance, the rising popularity of Exchange Traded Funds (ETFs) can be attributed to the ease with which investors can enjoy diversification benefits at relatively low transaction costs (Gastineau, 2001). Additionally, ETPs combine the most recent features of financial engineering, which often makes them more complex.

According to the existing theory on financial innovation, and assuming all things to be equal, trading in innovative instruments should diminish the riskiness of the portfolios of individual investors by providing better diversification features (see e.g. Allen and Gale, 1994). The recent example of the financial crisis of 2007-2010, however, revealed that greater exposure to assets-backed securities and their credit default swaps led to a significant deterioration of performance in investment portfolios. Further, Simsek (2013a,b) argues that innovative instruments actually increase riskiness because of speculative trading. Hence, the empirical implications of financial innovations for portfolio risks may contradict the theory.

The fact that ETPs are very tradable may also encourage investors to trade excessively, which may undermine portfolio performance. Bhattacharya et al. (2014) indeed show that the use of ETFs does not actually improve the performance of individual investors, and that the use of ETFs to time the market erodes the potential benefits from the passive security selection. Therefore, the underlying problem with the use of ETFs is that investors invest in ‘passive’

index-linked investment products, but trade them actively. In this paper we reconcile this matter with the established role of gender and age as determinants of investment performance, and examine whether gender and age affect the performance of investors trading in ETPs, considering plain ETFs, leveraged ETFs, warrants and certificates as these products[1]. To address this research question we use a unique dataset on the trading transaction records of 134 201 individuals from Sweden in 2014. Our sample is unique because it features trading ETPs and other financial securities by retail investors representing a globally large but very distinct group of retail investors. The Swedish common pension plan system facilitates pension savings for all workers in Sweden, allowing participants to allocate part of their pension savings individually, but limiting these investments to certain mutual funds. Therefore, Swedish investors may have less need for self-control, as certain essential pension benefits do not depend on individual pension planning, and the trading activity of older investors may not be as pension-motivated as in Kaplanski et al. (2015), or in Lee and Veld-Merkoulova (2016). In turn, we use data on individual accounts without any restrictions, thus enabling us to address the importance of gender and age in investing when the investors' own self-control becomes a notably vital aspect of trading ETPs.

The previous empirical literature suggests that both gender and age should matter in the use of innovative products such as ETPs since these are recognized factors that have been proven to enforce self-control. Highly relevant to the use of various financial instruments, males and younger individuals are found to be more sensation seeking (e.g. Zuckerman et al., 1978; Ball et al., 1984). According to the findings of Barber and Odean (2001), female investors trade less frequently, allocate less of their portfolios to risky assets and have lower expectations about their

[1] See the Appendix for the distribution of different types of ETPs.

future returns, but appear to earn higher risk-adjusted returns. This gender pattern has been observed not only among non-professional investors but also among professional financial analysts (Olsen and Cox, 2001). Thus, we expect that young male investors trade more ETPs, show a poorer investment performance and take more risk.

This paper contributes to the prior literature by providing a synthesis of two streams of research on financial innovation, and the role of gender and age in investment performance. Thus, in relation to Simsek (2013a,b), we explore the role of gender and age in the use of innovative financial products, and we extend the findings of Bhattacharya et al. (2014), who show that ETF users actually experience a worse performance than ETF non-users by explicitly considering the differences in the investors' gender and age. Moreover, the existing literature does not contrast ETPs with mutual funds as we do in this paper. Considering the role of gender and age in determining the investment behavior and performance documented in many studies (e.g. Barber and Odean, 2001), we contribute to the literature by differentiating between the trading of ETPs and other types of securities by using a large dataset of Swedish investors.

Our results show that investing in mutual funds can be advantageous compared to ETPs and yield a better performance, which may be attributed to the problems of self-control in the use of ETPs. This effect, however, does not persist for younger investors, whose good cognitive abilities may explain this result. In addition, our results confirm previous findings on the superiority of the performance of women's investment portfolios over men's. While the results also indicate that the older generation trades more actively and has higher (risk-adjusted) returns, we observe that younger males make riskier investments than any other group. Overall, our findings are consistent with theoretical predictions on increased riskiness and speculative trading associated with innovations.

The remainder of this paper is organized as follows. Section 2 presents the related literature and our hypotheses. Section 3 describes the data and outlines the methodology used. The empirical findings on the differences in investment habits between men and women and different age groups, as well as the effects of financial innovation, are reported in Section 4. Section 5 concludes the paper.

2 HYPOTHESIS DEVELOPMENT AND THE RELATED LITERATURE

The related literature to this paper can be divided into two areas. The first concentrates on the implications of financial innovation for investment performance, while the second focuses on potential differences in financial decision-making in individuals with respect to gender and age. We briefly discuss each of these areas and present our hypotheses below.

2.1 Investor risk behavior

It is generally agreed in the literature that gender is an important determinant of individuals' risk taking (Croson and Gneezy, 2009; Halek and Eisenhauer, 2001; Eckel and Grossman, 2008). The existing empirical literature shows that women make less risky financial decisions (see e.g. Ardehali et al., 2005; Bajtelsmit et al., 1999; Grable and Roszkowski, 2007; Jianakoplos and Bernasek, 1998; Yao and Hanna, 2005)[2]. This evidence on risk taking is robust regarding professional occupations, as trained female investment managers are found to be more sensitive than males to the uncertainty involved in financial assets (Olsen and Cox, 2001). On a broader level, Huang and Kisgen (2013) show that female executives are less likely to make acquisitions and to issue debt than their male counterparts, implying that male and female executives may

[2] For further evidence please refer to Grable (2008), who provides an excellent literature review on individual factors affecting financial risk taking.

make rather different financial and investment decisions. Several other studies observe clear differences in processing financial information between men and women. They indicate the fact that men are very selective in processing information, whereas women tend to process all the available signals before making a decision (Graham et al., 2002). Furthermore, Vieto et al. (2014) conclude that men and women use different parts of the brain to make investment decisions[3]. Different risk perceptions between men and women have even prompted a debate on whether the financial crisis of 2008 could have been avoided if the "Lehman Brothers" were the "Lehman Sisters" (Adams and Ragunathan, 2015). These findings indicate that gender may be an important factor in determining trading styles and portfolio performance. Hence, our first set of hypotheses is:

H1(a): *Female investors have less risky portfolios.*

H1(b): *Female investors show a better investment performance.*

H1(c): *Female investors trade less actively.*

Age, on the other hand, also seems to be an important factor in investors' risk taking. Although it is usually positively associated with risk aversion (see e.g. Deaves et al., 2007), some studies suggest that this relationship may be nonlinear. Ardehali et al. (2005), for instance, argue that risk tolerance may increase more than once during a lifetime, while Finke et al. (2016) show that confidence in financial decision making does not weaken with age. Other factors, such as household income (e.g. Slimak and Dietz, 2006; Ardehali et al., 2005; Deaves et al., 2007), educational background (e.g. Halek and Eisenhauer, 2001) and marital status (e.g. Ardehali et al., 2005; Yao and Hanna, 2005), may also affect the risk taking of retail investors.

[3] In particular, when investigating exactly what parts of the brain are active when faced with decisions to buy, sell or hold stock, men use the same part of the brain to make all three types of decision, whereas women use different parts of the brain for each type of decision.

One potential reason for excess trading and lower risk aversion is overconfidence, which is a general term for either an overestimation of one's knowledge, or an illusion of self-confidence and control, or both (Deaves et al., 2009). For example, Barber and Odean (2002) report evidence that switching from phone trading to online trading increases trading and reduces performance, which may be attributed to an illusion of knowledge and control, while Grinblatt and Keloharju (2009) show that overconfident investors do indeed trade more frequently. Other studies document that men in general are more overconfident than women (see e.g. Bajtelsmit and Bernasek, 1996; Barber and Odean, 2001; Jianakoplos and Bernasek, 1998). Men also seem to be more active traders than women, but they fail to achieve superior returns due to higher transaction costs and poor security selection (see e.g. Barber and Odean, 2001; Deaves et al., 2009). The existing empirical evidence shows that male investors trade on average 2.5 times more frequently than female investors, which may serve as a proxy for overconfidence (see e.g. Westerholm et al., 2003). With regard to age, Zuckerman et al. (1978) find that males and younger individuals are more sensation seeking. Ball et al. (1984) present evidence that males seek more sensation, and that sensation seeking decreases with age for males and females. Overall, age and gender should be important factors in risk taking because they may affect self-control. It is important to address these differences in gender and age with respect to portfolio performance and the use of innovative instruments. Hence, our second set of hypotheses is:

H2(a): *Younger investors have riskier portfolios.*

H2(b): *Younger investors show a poorer investment performance.*

H2(c): *Younger investors trade more actively.*

2.2 Financial innovation and portfolio performance

Frame and White (2004) describe financial innovation as new tools that are able to reduce trading costs and the riskiness of investors' portfolios. Indeed, products such as ETPs normally provide better options for diversification and significantly reduce the associated trading costs. However, the recent example of the 2008 financial crisis revealed that new financial products do not necessarily make markets safer and may significantly increase the amount of risk that investors undertake. One potential explanation for these contradicting examples is that financial innovation may actually cause higher speculative variance and lead to an increase in portfolio risk (Simsek, 2013a,b). Reduced trading costs and ease of access to new instruments may amplify investors' willingness to speculate on the value of a new asset. This is an important point since ease of access to trading is documented to decrease investors' rates of return. Barber and Odean (2002), for instance, analyze the switch from phone-based to online trading, and find that after going online an average investor trades more, but these trades are much more speculative and less profitable.

Bhattacharya et al. (2014) empirically test whether the use of one of the innovative instruments – ETFs, affects the performance of an individual investor. They show that ETF users experience a slightly worse performance compared to non-users, but this difference is mostly because of the active use of these products rather than the ETFs themselves. Thus, passive investing could be crucial in the use of innovative financial instruments. Other empirical literature confirms these findings and shows that increased trading opportunities may increase investors' portfolio risk (Dieckmann, 2011; Weyl, 2007) and destabilize the markets (Brock et al., 2009). This feature should be crucially relevant to address in the case of trading innovative instruments across investor types with the following hypotheses, based on the above discussion:

H3(a): *Investors who trade more ETPs show a poorer investment performance.*

H3(b): *Investors who trade more ETPs have riskier investment portfolios.*

Unlike the hypotheses on age and gender, our Hypotheses H3(a) and H3(b) are not just applied to a new dataset, they are also new to the literature since they address the issue of the quantity of ETPs traded instead of the choice of using them. For example, Bhattacharya et al. (2014) investigate the differences between ETF "users" and "non-users," while they do not study investments in ETFs along with investments in other types of securities.

3 DATA AND METHODOLOGY

To examine the effects of gender, age, and financial innovation on portfolio performance, we use a unique dataset taken from the transaction history of individual investors in Sweden. These data are obtained from the large Swedish Internet-based bank 'Avanza' and are handled in accordance with the law of bank confidentiality with respect to the non-inclusion of information on single transactions. Therefore, we analyze the mean value of all transactions per individual, and hence we do not reveal private information that may be connected to individual investors, as the customers are distinguished by fictitious identification numbers. We also impose restrictions on the analyzed transactions in order to avoid potential biases in non-active accounts and consider the account to be suitable if it satisfies the following criteria:

- the investor has at least 1 SEK in equity instruments;
- only individual private investors, no companies are considered;
- the investor should be at least 18 years old;
- only private investment accounts, no pension accounts;

• the standard deviation should be less than 1000%;

• the Sharpe ratio should be above -100 and under 1 000.

As a result, the final sample consists of a very large population of 134 201 individuals. It is worth noting that our final sample is significantly larger than the ones used in the extant literature. For example, Bhattacharya et al. (2014) employed a final sample of data on the trading behavior of 5 869 individuals. Barber and Odean (2001) utilized a final sample of 37 664 individuals. We employ information on individual transactions from 2014[4]. The variables included in our analysis are the Sharpe ratio, the annual rate of return, the standard deviation of daily returns, and the mean number of total transactions per month. All risk and return measures are calculated on the whole portfolio held at the bank rather than specific trades reported during the year. The rate of return is calculated based on the beginning and ending portfolio value, excluding any deposits and withdrawals, during the calendar year – from January 1 to December 31, 2014. The Sharpe ratio is calculated using each investor's annual rate of return, while the standard deviation is the annualized standard deviation of daily returns. The risk-free rate is based on the two-year Swedish T-bond of 0.04%.

In general, as can be seen from the Appendix, the average portfolio value of a retail investor in Sweden was over 550 000 SEK (approx. 82 000 USD) in 2014. Swedish investors are also relatively active users of financial innovations, as the total turnover of ETPs in 2014 reached almost 40 bill. SEK (5.8 bill. USD), while the turnover of leveraged ETFs accounted for more than 35% of this sum. However, previous studies on differences in financial decision making between the genders in Sweden (see e.g. Karlsson and Norden, 2007) are primarily focused on pension income and wealth allocation. This focus is due to the characteristics of the Swedish

[4] We also apply data from 2013 in an unreported robustness check. The analysis of data from 2013 does not alter our main findings.

pension system, where participants are allowed to allocate part of their pension savings individually. One of the drawbacks of this analysis is certain restrictions on what kind of assets one can hold when allocating one's pension savings. These restrictions prohibit investing in ETPs and could significantly affect one's financial decisions. However, this paper uses data on individual accounts without these restrictions, providing a unique laboratory to look into the importance of gender and age in investing when there is only an investor's own self-control instead of externally imposed restrictions. This feature makes our dataset unique given that the relative turnover of leveraged ETFs compared to plain ETFs, 35.30% vs. 3.02%, in our sample is very high.

In our data sample, we are able to separately identify and categorize the number of trades in stocks, mutual funds, exchange traded products, and other instruments per month during 2014 per customer. In the category of ETPs we include leveraged and non-leveraged ETFs, warrants and traded certificates, and consider them to be financially innovative. While ETFs and warrants are relatively common across different markets, traded certificates are more specific to the European capital markets, and are also called "constant leverage certificates". These certificates replicate the performance of their underlying assets (which can be a broad index, a specific industry index, or a single stock) and amplify this performance by the corresponding leverage level. The key difference between ETFs and traded certificates is that traded certificates typically offer a leverage multiplier higher than three, unlike ETFs. Moreover, certificates and warrants do not have the same diversification rules as ETFs in Sweden (which must contain at least 16 stocks) as they can be based on only one stock.

The category of other instruments includes bonds, options, futures, and subscription rights, which are not considered to be financially innovative. We choose to aggregate these

instruments under the "other" category as the total turnover of these products accounted for less than 1.5% in 2014, while the combined fraction of actual investments in these products was less than 2.6%, implying that these asset classes account for a very small fraction of transactions by Swedish retail investors. On the other hand, ETPs also accounted for a relatively small invested fraction (1.5%), but had a much higher turnover (13.7%). The distribution of the turnover of the different instruments is presented in the Appendix.

Table 1 presents the descriptive statistics of our sample. Panel A shows that a median investor in the sample did less than one transaction per month and obtained a return of 4.64% with a standard deviation of 10.90%. The low number for the median number of transactions implies the majority of investors in the sample do not trade actively. For *TradeETP*, the zero values for the 75th and 90th percentiles suggest the trading of ETPs is particularly concentrated in a small group of investors.

The significantly higher mean statistics for these variables imply that a large number of transactions, returns, and risk-taking are concentrated in the smaller group of investors in the sample. The variable of investor age has a high maximum value of 103. Our sample includes three observations of age more than 100, which is a very small number considering our sample size. This number may be high due to some investors being old, as well as some accounts being managed on behalf of a deceased person before their inheritance. The descriptive statistics in Panel B show that it is relatively more common to invest in mutual funds than ETPs, as 48% (8%) of the investors invest in mutual funds (ETPs), while about one fifth of the investors trade in other products. As for the gender distribution, our sample of investors consists of 27% women.

(insert Table 1 about here)

Table 2 presents the correlation statistics of the sample. Contrasting investor activity between mutual funds and ETPs, and the correlation statistics for *TradeETP* and *TradeFunds* reveal the striking result that the trading activities in mutual funds and ETPs have a weak correlation of 0.01. In addition, the correlation between *TradeETP* and *InvestFunds* of -0.01 is also very low. The correlation between *TradeETP* and *TradeStocks* is stronger, 0.11, which implies that investors trading more ETPs are more likely to be active stock traders. These findings emphasize the fact that trading ETPs on the Swedish market is loosely related to the investment behavior of Swedish investors in mutual funds within the common pension plan system.

(insert Table 2 about here)

Regarding the impact of gender and age on the choice of financial instruments, it is notable that both *Age* and *Female* have their lowest correlation coefficients with *InvestETP*, -0.04 and -0.11, respectively. Interestingly, this result suggests that gender and age do not strongly affect the choice of investing in ETPs. However, both *Age* and *Female* are positively associated with *Sharpe* and *Return*, and are negatively associated with *STD*. These statistics are consistent with the evidence of Barber and Odean (2001), who find that females and older investors have higher returns and take less risk.

We analyze the role of ETP trading according to gender and age for investment performance with both univariate and multivariate tests. First, we perform a univariate analysis to compare the trading behavior and performance between young female investors, old female investors, young male investors, and old male investors. These four dimensions of age and gender can be used to assess their relative effects. Second, we run regression estimations with the following specification:

$$Measure_i = \alpha_i + Demographic_i + Invest_i, + Trading_i + \varepsilon_i,$$

where the dependent variable *Measure* is a measure of the Sharpe ratio, a standard deviation of returns, or an average return for an investor *i*; *Demographic* includes the age and gender (dummy: female = 1) variables, which we use to test Hypotheses 1 and 2; *Invest* includes the dummy variables for the choice of investing in a security in Exchange Traded Products (ETPs), Mutual Funds, and Other Products, and *Trading* includes the variables of trading activity in ETPs, Mutual Funds, Other Products, and Stocks. We do not include a dummy variable for stocks in *Invest* in order to avoid the dummy variable trap. With regard to leveraged ETFs, the variable for ETPs in *Invest* has an important role, as it captures the impact of leveraged ETFs and the documented poor performance of holding leveraged ETFs (see e.g. Avallaneda and Zhang, 2009). We investigate the role of gender and age for investment activity in ETPs and investment performance by applying a reduced form model of Equation (1), which excludes *Demographic* in four different samples: (1) only females, (2) only males, (3) aged below 30, and (4) aged over 29. The coefficient value for *TradingETP* is used to test Hypotheses 3 (a,b).

4 RESULTS

Table 3 presents the univariate analysis of our study. Panel A compares the means and medians of investment activity, and performance between men and women. Overall, the results are in line with our first set of hypotheses in that female investors *(a) have less risky portfolios, (b) show better investment performance, and (c) trade less actively.* It is interesting to note that all the compared performances and behavior measures are statistically significant, implying that men and women make very different investment decisions. On average, men make almost twice as many transactions as women; they trade more actively in stocks, ETPs, and other investment

products, but trade somewhat similarly in mutual funds. The slightly different result for mutual funds supports the view that trading behavior between males and females is less different when the instrument is less tradable, and self-control is less important. We observe that the median (mean) rate of return on females' portfolios is 1.68% (1.33%) higher than on the corresponding men's portfolios. At the same time, risk taking by women is significantly lower than by men. The difference in the mean (median) standard deviation is 4.61% (0.84%). This result is in line with previous evidence on risk-taking differences with respect to gender (e.g. Ardehali et al., 2005; Bajtelsmit et al., 1999; Grable and Roszkowski, 2007; Jianakoplos and Bernasek, 1998; Yao and Hanna, 2005). Consequently, the Sharpe ratio is also higher for female investors, 0.66 in contrast to 0.51.

Considering the relative effects of age and gender, the results in Panel B are in line with previous studies on overconfidence and gender (Barber and Odean, 2001), and show that the male gender leads to a poorer performance and significantly higher trading activity in stocks and ETPs. However, the results do not fully support our second set of hypotheses in that younger investors *(a) have riskier portfolios, (b) show poorer investment performance, and (c) trade more actively.* Also, the results are not in line with Barber and Odean (2001), who find that the investors' age is negatively associated with risk taking and portfolio turnover, and positively associated with better performance. More specifically, the results suggest that women aged 18-29 and men aged 18-29 trade less than women aged 55+ and men aged 55+, respectively. Moreover, the statistics suggest that women aged 55+ take more risk than women aged 18-29, which is the opposite of the result for men aged 55+ and men aged 18-29. Notably, the results suggest that female investors increase their risk taking with age, while male investors decrease their risk taking with age. The result that female investors have riskier portfolios when they are older is

evidence against our Hypothesis 2(a). Furthermore, both males and females appear to trade more when they are older, which is not in line with our Hypothesis 2(c), while their performance is also better. These results are in line with the previous findings on the positive effect of experience and knowledge accumulated by older investors on portfolio performance (see e.g. Feng and Seasholes, 2005; Korniotis and Kumar, 2009).

(insert Table 3 about here)

Table 4 presents the multivariate analysis of investment performance using the whole sample. Confirming our findings from the univariate analysis and supporting our first set of hypotheses, the estimation results in Table 4 suggest that females earn higher returns and have higher Sharpe ratios, while taking less risk. The results show that age is positively associated with the Sharpe ratio, but older investors seem to have a higher standard deviation of returns on their portfolios, which is not consistent with Hypothesis 2(a). Accordingly, the relation between *Age* and *STD* is opposite to the findings of Barber and Odean (2001), implying that age and gender are very different demographic determinants of investor behavior and performance. Moreover, taking into account the previously observed nonlinearity of the relationship between investment performance and age across genders, we obtain a statistically significant coefficient for the squared term of Age in the STD regressions. These results suggest that the positive impact of age on risk taking becomes weaker at higher levels of investor age.

Comparing investors' trading in different instruments, the evidence in Table 4 is mixed, and depends on the instrument in question with regard to our third set of hypotheses in that investors who trade more ETPs *(a) show a poorer investment performance and (b) have a riskier investment portfolio*. The estimated coefficients for *TradeFunds* and *TradeETP* show an interesting contradiction, as the former obtains positive coefficients for *Return* and *Sharpe*, while

the latter obtains negative coefficients implying that trading mutual funds (ETPs) is associated with a better (poorer) performance. Looking at the implications of investing in mutual funds for performance and risk, we find that investors who choose to invest in mutual funds earn a 0.738 higher Sharpe ratio, a -1.675 percentage point (pp) lower standard deviation, and a 8.791 pp higher return. These effects are the opposite for ETPs, as investors who invest in ETPs earn a 0.283 lower Sharpe ratio, a -12.531 pp higher standard deviation, and a 5.421 pp lower return. Moreover, it can be seen by looking at the coefficient for *TradeETP* in the *Return* analysis that 10 ETP transactions per month would decrease *Return* by 5.330 pp and nearly double the negative effect on portfolio riskiness. Thus, the results support Hypotheses 3 (a,b) in the case of ETPs, but not in the case of mutual funds. Also, the statistically insignificant coefficients for *TradeStocks* and *TradeOther* do not warrant support for Hypotheses 3 (a,b) in the case of stocks and other financial instruments. As a negative relation between trading activity and performance is not seen for *TradeStocks*, a possible explanation for this result could be that ETPs reduce certain risks such as idiosyncratic risk and adverse selection risk, which feeds the illusion of self-control, thus making the use of ETPs so detrimental to investor wealth.

(insert Table 4 about here)

Our findings are in line with Bhattacharya et al. (2014), who show that the use of ETPs does not actually improve the performance of individual investors, and that the use of ETPs to time the market erodes potential benefits from passive security selection. As an addition to the evidence of Bhattacharya et al. (2014), our results show that investing in mutual funds can be advantageous compared to ETPs and yield a better performance, which may be attributed to the problems of self-control with the use of ETPs. Thus, the trading of ETPs together may be detrimental to the investment performance of retail investors.

Table 5 presents the multivariate analysis of investment performance using samples according to gender. Overall, the estimated coefficients across the male and female samples are very similar, although the regressions in the female sample yield higher adjusted R-squares. The results provide similar evidence for Hypotheses 3 (a,b) to the results in Table 4, but there are still a few distinct differences between the genders. One of these differences can be seen in the analysis of *Return,* where the coefficient for *TradeFunds* is statistically significant and positive only for males, but the impact on *Sharpe* is indifferent with respect to gender. While we previously noted that the trading of ETPs together with the illusion of self-confidence and self-control of investors may negatively impact investment performance, the results reported in Table 5 imply that both females and males may suffer from the same problem.

(insert Table 5 about here)

Table 6 presents the multivariate analysis of investment performance using samples according to age categories. We split our sample into three primary categories, namely "young" (Panel A), "middle-aged" (Panel B), and "old" (Panel C) investors[5]. We nominally define younger investors as those who are between 18 and 29 years old. Investors between 30 and 54 years old are classified as middle-aged, while those who are older than 54 are categorized as old. In contrast to the results for gender reported in Table 5, age seems to play a significant role in explaining the investment performance, and the results are interesting with respect to Hypotheses H3(a) and H3(b). The coefficient estimates for *TradeETP* are insignificant when explaining the Sharpe ratio for younger investors (Panel A), which is not in line with Hypothesis 3 (a), but they are highly statistically significant and negative for middle-aged and older investors (Panels B and C), which is in line with Hypothesis 3 (a). These results suggest that age may be an important

[5] In an unreported robustness test we also split our sample based on the median age and re-ran the analysis on the two sub-samples: Age<45 and Age>44. The results remained virtually unchanged.

determinant in the impact of trading ETPs on investment performance, but not in the case of younger investors. As for the investors' returns, we document a negative and significant relation between returns and trading ETPs across all the age categories. However, as can be noted from Panel A in Table 6, *TradeETP* seems to fail to explain the portfolio risk of younger investors, but it is highly statistically significant and positive in the samples of older investors reported in Panels B and C. Interestingly, these findings imply that younger investors may be relatively better active users of financial innovations, as their trading of ETPs neither increases their risk nor diminishes their performance. In addition, when we only consider the older investors in Panel C, we observe that *TradeStocks* has a negative impact on Sharpe ratio and Return, while *TradeFunds* does not have a positive or statistically significant impact on Return. These results are in fact consistent with a study by Korniotis and Kumar (2009), where investment performance declines with age, which may be associated with the decline of cognitive abilities with age. Although more overconfidence in younger investors may negatively affect their investment performance, this effect may be canceled out by their better cognitive abilities, especially in the case of innovative instruments. This finding may also be attributed to the distinctive sample employed in our study, which consists of retail investor accounts that are more exposed to excessive trading. To ensure that the obtained results are not driven by older investors who may intend to sell off more of their holdings or rebalance toward safer assets the closer they get to retirement, we re-estimate our models on the sample that excludes investors over the age of 60, given that the retirement age in Sweden is 65. The results remain virtually unchanged[6].

(insert Table 6 about here)

[6] And hence are not reported for the sake of brevity but are available from the authors upon request.

5 CONCLUSIONS

Our study focuses on the use of ETPs, which are considered to be innovative financial instruments, and other types of instruments according to different gender and age groups. Our results on the effects of trading activity and performance confirm the previous evidence on the abuse of ETPs by Bhattacharya et al. (2014), and show that investors can be better off by investing and trading mutual funds instead of ETPs, which enforce fewer trading restrictions and increase the role of self-control. Our findings that more active ETP trading by younger investors neither deteriorates investment performance nor increases risk, which it does for older investors, imply that younger investors may be relatively better active users of financial innovations. Thus, our findings together are in line with the existing evidence on younger investors, who may possess better skills for trading new innovative financial instruments (Korniotis and Kumar, 2009), even though they may be more overconfident than older investors.

Our results also confirm previous findings on the superiority of the performance of women's investment portfolios over men's, and that men trade more than women. We document that women's portfolios yield on average one percentage point extra return, are 4.5% less volatile, and have a higher Sharpe ratio. Nevertheless, we record that the relationship between the age and the riskiness of a portfolio may be nonlinear. Moreover, we observe that younger males make riskier investments, but older investors trade more actively. The main lesson from our study for retail investors is that ETPs not only enable less restricted trading, but also expose investors to a lack of self-control, which can be hazardous for investment performance. For future studies, our paper encourages looking into the trading behavior of different investment groups according to the type of financial instrument.

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Table 1. Descriptive statistics

This table reports the descriptive statistics of the sample. No. of transactions is the mean number of total transactions per month. Return, Sharpe, and STD are an average rate of return, Sharpe ratio, and standard deviation of returns for investor *i*, correspondingly. The returns are presented in percentages. TradeStocks, TradeETP, TradeFunds, and TradeOther are the mean number of transactions per month in stocks, ETPs, Mutual Funds, and other products, correspondingly. Age is the number of years since the investor's birth. InvestETP, InvestFunds, and InvestOther are dummy variables for the choice of investing in an instrument in Exchange Traded Products, Mutual Funds, and other products by investor *i*. Female is a dummy variable taking the value of one if the investor is a woman.

Panel A.

	No. of transactions	Return	Sharpe	STD	Trade Stocks	Trade ETP	Trade Funds	Trade Other	Age
Mean	2.63	5.82	0.55	15.65	1.32	0.23	0.97	0.11	46.82
Median	0.67	4.64	0.47	10.90	0.08	0.00	0.00	0.00	45.00
75^{th} percentile	2.25	13.81	1.22	15.77	0.75	0.00	0.92	0.00	59.00
90^{th} percentile	5.83	19.83	1.67	32.02	2.67	0.00	2.58	0.08	69.00
95^{th} percentile	9.83	27.15	1.98	50.49	5.17	0.33	4.50	0.17	73.00
Maximum	799.2	2250.4	15.45	998.2	799.2	357.0	519.2	233.2	103.0
Minimum	0.00	-100.0	-19.78	0.00	0.00	0.00	0.00	0.00	18.00
Std. Dev.	10.61	33.87	0.93	32.40	8.26	3.01	3.92	1.91	15.57
Skewness	28.28	16.89	0.32	12.70	40.39	54.15	46.25	65.87	0.30
Kurtosis	1329.9	647.8	7.80	255.3	2561.1	4763.4	4476.5	5916.1	2.20

Panel B. Dummy variables

	InvestETP	InvestFunds	InvestOther	Female
Yes	8%	48%	20%	27%
No	92%	52%	80%	73%

Table 2. Correlation statistics

This table presents the correlation coefficients across the sample variables. All the variables are defined as in Table 1.

	Trade Stocks	Return	Sharpe	STD	Trade ETP	Trade Funds	Trade Other	Invest Stocks	Invest ETP	Invest Funds	Invest Other	Female
Return	0.02*											
Sharpe	0.01*	0.50*										
STD	0.07*	0.31*	-0.09*									
TradeETP	0.11*	-0.05*	-0.06*	0.11*								
TradeFunds	0.04*	0.04*	0.15*	-0.02*	0.01*							
TradeOther	0.22*	0.01*	0.00	0.06*	0.11*	0.00						
InvestStocks	0.13*	-0.01*	-0.07*	0.17*	0.04*	0.00	0.04*					
InvestETP	0.12*	-0.04*	-0.07*	0.15*	0.26*	0.06*	0.06*	0.15*				
InvestFunds	0.00	0.13*	0.41*	-0.02*	-0.01	0.26*	-0.01	-0.01*	0.06*			
InvestOther	0.13*	0.07*	0.07*	0.11*	0.05*	0.03*	0.11*	0.25*	0.13*	0.03*		
Female	-0.05*	0.02*	0.07*	-0.09*	-0.03*	0.00	-0.02*	-0.19*	-0.11*	0.03*	-0.07*	
Age	0.06*	0.02*	0.04*	-0.01*	0.01	0.02*	0.02*	0.06*	-0.04*	-0.02*	0.09*	0.08*

Note: * refers to statistical significance at $p < 0.01$.

Table 3. Univariate tests

This table presents univariate tests on differences in means across genders and ages. All the variables are defined as in Table 1.

Panel A. Difference in means across genders

	Women	Men		Women	Men	
	Mean		Diff.	Median		Diff.
Return	6.79	5.46	1.33***	5.88	4.20	1.68***
Sharpe	0.66	0.51	0.15***	0.66	0.41	0.25***
STD	11.08	15.69	-4.61***	9.62	10.46	-0.84***
No. of trans.	1.73	2.97	-1.24***	0.42	0.75	-0.33***
TradeStocks	0.65	1.57	-0.92***	0.00	0.17	-0.17***
TradeETP	0.09	0.29	-0.20***	0.00	0.00	0.00***
TradeFunds	0.94	0.98	-0.04*	0.00	0.00	0.00***
TradeOther	0.05	0.13	-0.08***	0.00	0.00	0.00***
Age	48.80	46.07	2.73***	48.00	44.00	4.00***

Panel B. Difference in means across genders and ages

Means	No. of transactions	Return	Sharpe	STD	Trade Stocks	Trade ETP	Trade Funds	Trade Other
Women 18-29	0.87	5.92	0.55	9.92	0.25	0.04	0.57	0.02
Men 18-29	1.74	3.13	0.38	15.74	0.88	0.19	0.60	0.06
diff.	-0.87***	2.79***	0.17***	-5.82***	-0.63***	-0.15***	-0.03	-0.04***
Women 55+	2.08	6.83	0.68	11.24	0.97	0.10	0.95	0.06
Men 55+	3.85	6.46	0.56	14.96	2.32	0.29	1.07	0.17
diff.	-1.77***	0.37	0.12***	-3.72***	-1.35***	-0.19***	0.12**	-0.11***
Difference across generations (W)	1.21***	0.91**	0.13***	1.32***	0.72***	0.06	0.38***	0.04***
Difference across generations (M)	2.06***	3.33***	0.18***	-0.78**	1.44***	0.10***	0.47***	0.11***

*** refers to statistical significance at the 1% level.

Table 4. Analysis of investment performance

This table presents the Ordinary Least Squares (OLS) analysis of investor trading activity and its effect on investment performance, risk, and return. The regression model is as follows: $Measure_i = \alpha_i + Demographic_i + Invest_i + Trading_i + \varepsilon_i$, where the dependent variable *Measure* is a measure of the Sharpe ratio, standard deviation of returns, or the average rate of return for an investor *i*; *Demographic* includes the age and gender (dummy: female=1) variables; *Invest* includes the dummy variables for the choice of investing in an instrument in Exchange Traded Products (ETPs), Mutual Funds, and other products, and *Trading* includes the variables of the mean number of transactions per month in ETPs, Mutual Funds, other products, and stocks. The standard errors are corrected for heteroscedasticity using the White (1980) method.

	Sharpe		STD		Return	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.040*	*1.93*	10.950***	*14.62*	-1.130	*-1.47*
Age	0.003***	*2.91*	0.211***	*6.69*	0.050	*1.54*
Age^2	0.000	*-0.59*	-0.002***	*-7.63*	0.000	*-0.77*
Female	0.114***	*23.40*	-4.580***	*-29.25*	1.003***	*6.08*
TradeETP	-0.012***	*-5.43*	0.805***	*4.46*	-0.533***	*-6.03*
InvestETP	-0.283***	*-23.36*	12.531***	*19.41*	-5.421***	*-10.16*
TradeFunds	0.011***	*5.21*	-0.201***	*-5.46*	0.077***	*3.29*
InvestFunds	0.738***	*117.0*	-1.675***	*-8.93*	8.791***	*46.62*
TradeOther	0.003	*1.15*	0.513***	*3.54*	0.147	*1.07*
InvestOther	0.168***	*23.83*	6.961***	*26.65*	5.597***	*17.71*
TradeStocks	0.001	*0.79*	0.115***	*4.20*	0.089**	*2.06*
Adj. R-squared	0.19		0.04		0.03	
F-stat.	*3072.9*		*630.4*		*374.8*	
No. of obs.	134 201		134 201		134 201	

*, **, and *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5. Analysis of investment performance by gender

This table presents the Ordinary Least Squares (OLS) analysis of investor trading activity and its effect on investment performance, risk, and return between the genders. The regression model is as follows: $Measure_i = \alpha_i + Invest_i + Trading_i + \varepsilon_i$, where the dependent variable *Measure* is a measure of the Sharpe ratio, standard deviation of returns, or the average rate of return for an investor *i*; *Invest* includes the dummy variables for the choice of investing in an instrument in Exchange Traded Products (ETPs), Mutual Funds, and other products, and *Trading* includes the variables of the mean number of transactions per month in ETPs, Mutual Funds, other products, and stocks. The standard errors are corrected for heteroscedasticity using the White (1980) method.

Panel A.

	Sharpe (for females)		STD (for females)		Return (for females)	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.209***	*41.63*	8.400***	*52.56*	1.925***	*13.78*
TradeETP	-0.015***	*-4.12*	0.457	*1.33*	-0.445***	*-2.66*
InvestETP	-0.249***	*-8.24*	13.580***	*10.81*	-4.925***	*-4.58*
TradeFunds	0.010***	*2.75*	-0.144**	*-2.47*	0.025	*1.27*
InvestFunds	0.845***	*84.54*	2.213***	*8.79*	8.796***	*36.23*
TradeOther	-0.001	*-0.31*	1.122***	*4.96*	-0.328**	*-2.47*
InvestOther	0.224***	*16.69*	6.210***	*17.28*	4.557***	*11.57*
TradeStocks	-0.005*	*-1.74*	0.283***	*4.12*	-0.011	*-0.28*
Adj. R-squared	0.27		0.05		0.05	
F-stat.	*1894.74*		*261.98*		*248.49*	
No. of obs.	36 688		36 688		36 688	

*, **, and *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel B.

	Sharpe (for males)		STD (for males)		Return (for males)	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.166***	*43.32*	15.739***	*100.55*	0.481***	*3.03*
TradeETP	-0.012***	*-4.81*	0.842***	*4.28*	-0.536***	*-5.60*
InvestETP	-0.291***	*-22.37*	12.578***	*17.61*	-5.602***	*-9.50*
TradeFunds	0.012***	*4.53*	-0.215***	*-4.99*	0.099***	*3.11*
InvestFunds	0.695***	*87.85*	-3.059***	*-12.83*	8.758***	*36.03*
TradeOther	0.003	*1.20*	0.433***	*2.82*	0.214	*1.41*
InvestOther	0.165***	*20.31*	7.074***	*22.19*	6.059***	*15.53*
TradeStocks	0.002	*1.12*	0.103***	*3.73*	0.095**	*2.09*
Adj. R-squared	0.16		0.04		0.02	
F-stat.	2599.71		546.99		347.48	
No. of obs.	97 513		97 513		97 513	

*, **, and *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6. Analysis of investment performance by age

This table presents the Ordinary Least Squares (OLS) analysis of investor trading activity and its effect on investment performance, risk, and return by age category. The regression model is as follows: *Measurei = αi + Investi, + Tradingi + εi,* where the dependent variable *Measure* is a measure of the Sharpe ratio, standard deviation of returns, or the average rate of return for an investor *i*; *Invest* includes the dummy variables for the choice of investing in an instrument in Exchange Traded Products (ETPs), Mutual Funds, and other products, and *Trading* includes the variables of the mean number of transactions per month in ETPs, Mutual Funds, other products, and stocks. The standard errors are corrected for heteroscedasticity using the White (1980) method.

Panel A:	Sharpe (when AGE<30)		STD (when AGE<30)		Return (when AGE<30)	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.105***	*13.96*	13.359***	*39.74*	0.139	*0.36*
TradeETP	-0.007	*-1.27*	0.798	*1.18*	-0.760***	*-3.02*
InvestETP	-0.321***	*-10.17*	16.954***	*10.23*	-8.040***	*-7.45*
TradeFunds	0.009*	*1.83*	-0.185	*-1.42*	0.086	*1.49*
InvestFunds	0.722***	*48.15*	-0.981*	*-1.82*	7.759***	*15.72*
TradeOther	0.013	*0.39*	-0.858	*-0.68*	2.184**	*2.18*
InvestOther	0.139***	*6.62*	8.219***	*8.96*	3.757***	*4.35*
TradeStocks	0.014*	*1.80*	0.206	*1.42*	0.611***	*4.04*
Adj. R-squared	0.17		0.04		0.03	
F-stat.	*540.92*		*102.93*		*96.77*	
No. of obs.	18 543		18 543		18 543	

Panel B:	Sharpe (when 29<AGE<55)		STD (when 29<AGE<55)		Return (when 29<AGE<55)	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.164***	*38.04*	14.099***	*80.35*	0.457***	*2.79*
TradeETP	-0.017***	*-6.43*	1.203***	*4.75*	-0.781***	*-7.03*
InvestETP	-0.295***	*-19.01*	13.276***	*15.23*	-4.620***	*-6.10*
TradeFunds	0.017***	*3.95*	-0.246***	*-3.48*	0.136***	*2.85*
InvestFunds	0.756***	*70.02*	-1.910***	*-6.89*	9.393***	*34.45*
TradeOther	0.001	*0.49*	0.454***	*2.58*	-0.055	*-0.66*
InvestOther	0.144***	*14.37*	7.595***	*20.95*	6.038***	*13.54*
TradeStocks	0.003	*1.48*	0.104**	*2.46*	0.119***	*3.78*
Adj. R-squared	0.19		0.05		0.03	
F-stat.	*2439.91*		*518.29*		*315.09*	
No. of obs.	71 685		71 685		71 685	

Panel C:	Sharpe (when AGE≥55)		STD (when AGE≥55)		Return (when AGE≥55)	
Variable	Coef.	*t-stat.*	Coef.	*t-stat.*	Coef.	*t-stat.*
C	0.243***	*44.84*	13.189***	*67.60*	1.978***	*10.64*
TradeETP	-0.011***	*-5.42*	0.492***	*3.19*	-0.352***	*-5.36*
InvestETP	-0.299***	*-14.45*	9.731***	*11.06*	-5.754***	*-7.93*
TradeFunds	0.008***	*3.21*	-0.146***	*-3.87*	0.035	*1.29*
InvestFunds	0.706***	*75.19*	-1.709***	*-5.79*	8.061***	*26.48*
TradeOther	-0.003	*-0.76*	0.736***	*4.26*	0.272	*0.97*
InvestOther	0.194***	*18.07*	6.617***	*16.31*	5.389***	*11.35*
TradeStocks	-0.004***	*-2.58*	0.150***	*3.69*	-0.046*	*-1.68*
Adj. R-squared	0.17		0.03		0.03	
F-stat.	*1327.06*		*215.68*		*166.95*	
No. of obs.	43 973		43 973		43 973	

*, **, and *** refer to statistical significance at the 10%, 5%, and 1% levels, respectively.

APPENDIX. Average portfolio characteristics and turnover of different types of products.

Panel A: Mean portfolio characteristics	Mean	Median
Portfolio value as of 31.12.2014	567 324 SEK (~82 000 USD)	115 613 SEK (~17 000 USD)
	Invested as of 31.12.2014	Turnover during 2014
Cash holdings	9.7%	-
Stocks	64.0%	74.7%
Funds	22.2%	10.2%
ETPs	1.5%	13.7%
Other	2.6%	1.4%

Panel B: Turnover of different types of exchange-traded products	SEK in 2014	%
Total turnover	39 652 972 600	100%
Turnover non-leveraged ETF	1 197 015 580	3.02%
Turnover leveraged ETF	13 997 548 940	35.30%
Turnover Warrants	4 180 401 165	10.54%
Turnover Certificates	20 278 006 915	51.14%