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Back to Basics! The Educational Gap of Online Investors and the Conundrum of Virtual Communities



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Abstract

This paper presents a survey on a sample of online investors in a virtual community in Italy. The survey aims to understand what this new type of investor is like – subjects studied range from occasional to independent and semi-professional investors – and it examines the implications emanating from their online exposure. By looking at motivation, risk propensity, education and online experience, we found that knowledge sharing and learning in virtual communities cannot compensate for the financial education-gap of these investors. Secondly, results showed that online exposure tends to increase investors' propensity for risk, which in turn does not guarantee better portfolio performance. Only a robust education level and more trading experience were found to promote good portfolio performance, and help investors to keep risk under control. Our results cast serious doubts about the mantra of online knowledge generation, and calls for urgent initiatives to improve the financial literacy of online investors.

Keywords: Online Investors; Sociology of Finance; Virtual Communities; Learning, Risk Propensity; Educational Gap.

JEL Codes: Z13; G02; D03.

1 Introduction

The growing prominence of the Internet and social media has radically changed the way in which investors seek and share information (e.g., Sassen, 2005; Preda, 2009a; Knorr Cetina, 2005). Apart from prices, official statistics, and reports, investors increasingly use e-communication platforms for investment ideas (e.g., Tetlock, 2007). Millions of non-professional investors have recently started to invest thanks to the user-friendliness of new online trading platforms and the abundance of financial information available on

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the Internet. Recent estimates indicate that in 2011, there were about 21 million online investors in Europe and 30 million in the United States.

It is worth noting that most of these investors can be categorised as non-professional investors, i.e., individuals who invest their own money in financial markets without being employed within a financial organisation (Mayall, 2006; Roscoe and Howorth, 2009). While studies on the sociology of finance have mainly focused on large institutions and professionals (e.g., Beunza and Stark, 2003; Beunza *et al.*, 2006; Zaloom, 2006), little is known about online investors, except for a few reports conducted by banks or foundations that offer aggregate data.

This paper aims to fill this gap by presenting a survey of a sample of 229 online investors of the Italian web community *finanzaonline.com*, the leading Italian financial online community, which includes more than 150,000 active users. Established at the end of 1999 by Brown Editore, an independent and influential publishing company specialised in economic and financial information, *finanzaonline.com* is now a main information and communication online platform for Italian investors. The website provides real time data and financial analysts' reports, and hosts the most popular peer-to-peer communication platform for investors in Italy, i.e., the *finanzaonline.com* forum.

Our aim was first, to understand the characteristics of this new type of investor, especially in terms of education and trading experience. Secondly, we wanted to understand if online information and knowledge sharing can aid investors to keep risk under control and achieve good portfolio performance. The role of risk is especially important after the recent financial crisis, which increased market complexity and volatility, and amplified the chance that unsophisticated investors would be the first to suffer losses (e.g., Jappelli, 2010). Finally, we wanted to verify whether online experience could compensate for the lack of financial education, which is a crucial problem not only for the wider population, but also for online investors (e.g. Volpe *et al.*, 2002).

Recent studies have emphasised certain differences between professional and non-professional investors, including online investors. For instance, Roscoe and Howorth (2009) showed that non-professionals are less influenced by the organisational environment and from hierarchical control found in many financial institutions (Knorr-Cetina and Bruegger, 2002; Beunza and Stark, 2003). Although there is no evidence that non-professionals use different technologies compared to professionals (Roscoe and Howorth, 2009), some studies have shown that non-professionals fail to assess the quality of financial information, believing more in pro-forma disclosures of companies (Allee *et al.*, 2007; Frederickson and Miller, 2004) and buying stocks that have a higher profile in the news (Barber and Odean, 2004).

Non-professionals are also more inclined to trade more often and aggressively (Barber and Odean, 2001). This would testify to the fact that they have less information about markets than professionals, are relatively more subject to over-confidence bias (Lichtenstein *et al.*, 1982; Griffin and Tversky, 1992), and take more frequent sub-optimal decisions, such as «buying high and selling low» (Bloomfield *et al.*, 1999). Furthermore, while professionals and analysts base their investments on well-defined valuation models that help to estimate the real value of financial statements correctly (Maines and McDaniel, 2000; Jacoby *et al.*, 2001), non-professional traders follow ill-defined valuation models

(Hodege and Pronk, 2006) that are based on relatively unstructured information (Maines and McDaniel, 2000).

For these reasons, non-professionals are more likely to seek help in interpreting financial information rather than doing so by themselves (Elliot *et al.*, 2005), and are more attracted to new online financial communication services. Furthermore, the increasing popularity of online communities among non-professionals is due to their tendency to seek information primarily from independent sources. Indeed, public opinion and social media have recently viewed traditional financial institutions as being too involved in conflicts of interest concerning information and of being heavily responsible for the recent financial crisis. In addition, the importance of virtual financial communities is also due to the growing socio-technological complexity of financial markets. For example, the high uncertainty and unpredictability of financial market environments, due to real time, global scale decisions of millions of dispersed investors, induces investors to rely on Web peer-to-peer communication platforms (e.g., Preda, 2009b; Knorr-Cetina, 2009).

On the one hand, the increasing financialisation of the economy, i.e., the growing importance of financial markets as a means to allocate savings and investments of a large population of investors worldwide (e.g., Epstein, 2005), and the availability of large-scale, online information and communication platforms from which investors are expected to benefit from peer-to-peer knowledge sharing, suggest that online investors could compensate for their lack of expertise through these collective platforms. A key concept is that the more information they have, the better it is for their investment strategy prospects, and that this is instrumental to ensure that financial markets work more efficiently (e.g., Tapscott and Williams, 2006; Landini, 2013).

On the other hand, despite their importance these online communities have been poorly investigated at a micro-level. There is little understanding of the characteristics of online investors, in terms of demographic information, education and qualifications, the level of financial literacy and investment strategies, as well as to why they participate in knowledge generation processes in these communities. This information is needed to understand if online communities are beneficial for investors and if they can be considered as collective learning scaffolds that might compensate for the possible educational gaps of individuals.

The structure of the paper is as follows: in the next section, we present our data, with particular attention paid toward descriptive statistics that allow us to understand the characteristics of these investors better. The third section presents two regression models to investigate the relationship between the online experience of these investors, and their risk propensity and financial performance. We also look at the implications of financial education for both learning and trading. Finally, the last sections summarise our main findings, and discusses the results in light of the recent debate on the importance of online communities for peer-to-peer knowledge generation and sharing.

2 The Survey

The study sample included 229 investors of the Italian Web community *finanzaonline.com*. The data collection was realised through an online questionnaire posted on the

community website from July to October, 2013. The questionnaire was restricted to registered users, conducted anonymously, and investors responded in a voluntary manner. The questionnaire comprised four sections: (Sect. A) socio-economic status, where we collected information about education and qualifications, annual income, and the family background of investors; (Sect. B) financial literacy and investment activities, where we focused on motivation, learning efforts, the types of financial assets most frequently traded, and portfolio composition and performance; (Sect. C) forum participation and activism in the community, where we collected individual perceptions about the quality and usefulness of the forum, individual levels of activism, and commitment; (Sect. D) risk propensity, where we included a series of simulated choices under uncertainty. In this case, following a methodology commonly used in financial economics research (e.g., Donkers *et al.*, 2001; Weber *et al.*, 2002), we measured investors' sensitivity to downward and upward phases of the market, their implications for investment horizons, as well as considering investors' portfolio composition and their propensity to leverage and for risk taking. Following Hartog *et al.* (2002) and Guiso and Paiella (2008), we also included a simulated lottery. We used investors' responses to estimate their risk propensity at an individual level. The full text of the questionnaire is available upon request.

2.1 Descriptive Analysis

Our results (see Tab. 1) show first that the world of online finance is dominated by males, with only 4.4% of females among our sample of responders. This reflects the percentage of female investors (8%) among the total number of registered users by *finanzaonline.com*, according to the company's internal data. The age of *finanzaonline.com* investors ranged between 19 and 78 years with the average being 45 years, and with 27.2% of the population under 35 and 31.2% over 50. 46% of investors were employed in a private company (34.5%) or the state sector (11.8%), while the rest were categorised as business professionals (11.4%), entrepreneurs (8.3%), unemployed (5.7%) and independent traders (9.6%). The remaining 18% were involved in other non-specified occupations.

As regards to education, 44.1% of investors had a senior high school diploma, 31.4% a master degree, 7.9% a bachelor degree, 7.4% a junior high school diploma, 6.6% a post-graduate degree, and 2.6% a PhD.

In terms of personal annual income, 34% of the investors earn less than €25,000 yearly, 33.6% earn between €25,000 and 40,000, 21.8 % earn between €40,000 and €80,000, 7.4% earn between €80,000 and €120,000 and finally 3% of the investors earn a yearly income greater than €120,000.

Data showed that the typical investor of *finanzaonline.com* is self-taught. In fact, 79% of investors were found to have acquired their financial education by themselves, with only 13% having a university background in finance. While 68% of investors traded only for passion or for extra income, and 23.6% of them did so to manage family savings. Only 8.4% of investors within the sample viewed trading as a professional job. As regards training, most investors spent less than seven hours a week studying markets and techniques (about 62% of the sample), while a small minority (14.9 %) dedicated more

Table 1: Descriptive statistics of the sample

Demographic information	Percentage	Standard error
Males	95.6	0.0140
Females	4.4	0.0014
age <35	27.2	0.0290
age <35 and <50	41.6	0.0330
age >50	31.2	0.0310
Type of job		
Employed in a private company	34.5	0.0310
Employed in the public sector	11.8	0.0210
Professionals	11.4	0.0210
Entrepreneurs	8.3	0.0180
Unemployed	5.7	0.0150
Independent traders	9.6	0.0190
Other	18.0	0.0250
Education		
Senior high school diploma	44.1	0.0330
Junior high school diploma	7.4	0.0170
Master degree	31.4	0.0310
Bachelor degree	7.9	0.0180
Post graduate degree	6.6	0.0160
PhD	2.6	0.0110
Income (last year)		
Less than 25,000 Euros	34.0	0.0330
Between 25,000 and 40,000 Euros	33.6	0.0310
Between 40,000 and 80,000 Euros	21.8	0.0270
Between 80,000 and 120,000 Euros	7.4	0.0170
More than 120,000 Euros	3.0	0.0110
Financial education		
Self taught investors	79.0	0.0270
University pedigree in finance	13.0	0.0220
Hours spent studying trading techniques		
Less than 7 hours per week	62.0	0.0320
More than 7 and less than 20 hours per week	23.1	0.0280
More than 20 hours per week	14.9	0.0240
Motivations of trading		
Passion or extra-income	68.0	0.0310
Managing family savings	23.6	0.0280
Professional job	8.4	0.0180
Information sources used for trading		
Online platforms	89.5	0.0200
Traditional bank channels	9.6	0.0190
Financial advisor	0.9	0.0060
Time spent trading per day		
Less than 1 hour	59.9	0.0320
Between 1 and 2 hours	13.0	0.0230
Between 2 and 3 hours	8.3	0.0190
More than 3 hours	18.8	0.0260
Portfolio Size		
Less than 5,000 Euros	8.3	0.0180
Less than 25,000 Euros	29.7	0.0310
Between 25,000 and 100,000 Euros	33.2	0.0310
Between 100,000 and 250,000 Euros	19.2	0.0260
More than 250,000 Euros	17.9	0.0250
Portfolio yields (last year)		
Less than 0	15.7	0.0240
Null	11.4	0.0210
Between 2% and 5%	30.6	0.0300
Between 5% and 10%	26.6	0.0290
Higher than 10%	15.7	0.0240
Participation to the forum		
No participation at all	31.9	0.0310
Minimally	37.6	0.0320
Active participation	30.5	0.0300
Risk propensity		
Strongly risk adverse	17.0	0.0250
Moderately risk adverse	78.0	0.0270
Risk-loving	5.0	0.0140

than twenty hours per week to training. In addition, it is worth noting that the majority of investors dedicated even less time to training at the beginning of their trading experience: about 75% spent less than seven hours a week, while only 9.6% studied for more than twenty hours.

The main information sources used by investors were online platforms (89.5% of the sample), with only a minority using traditional banking channels (9.6%). Only 0.9% of investors asked advice from a financial advisor to manage their portfolio. In general, investors used financial news sites, blogs, and forums as their main sources of information. Online broker services, technical analysis sites, the mainstream press, and Italian stock market web pages were rarely used. Finally, investors responded that they not use traditional media or recommendations from personal contacts.

Relating to investment behaviour, more than half of investors (59.9%) spent less than an hour a day trading, while 18.8% of the rest traded more than three hours a day. Concerning the size of the investment portfolio, 33.2% of investors worked with a portfolio between €25,000 and 100,000, 19.2% between €100,000 and 250,000 and 17.9% more than €250,000. About one third of investors declared a portfolio value smaller than €25,000 (of which 8.3% less than €5,000).

As regards to investment portfolios' composition, most investors traded shares and corporate bonds. In terms of performance, 30.6% of investors achieved a yield between 2% and 5%, while 26.6% had a yield between 5 and 10%. Considering the rest of the sample, 15.7% of the investors reported negative returns, 11.4% null returns, with 15.7% of investors obtaining returns higher than 10%.

Looking at how investors use the communication platform of *finanzaonline.com*, in a lot of cases, investors did not participate at all (31.9%) or participated only minimally (37.6%). About 30% of the sample of investors participated actively in online communication platforms. This must be judged in light of recent literature on online communities, which indicates that majority of online users by and large do not actively participate in information or knowledge sharing (e.g., Schneider *et al.*, 2013; Preece *et al.*, 2004). This is called «participation inequality» (or the «1% rule»), i.e., those who participate actively in an online community (the so-called «heavy contributors») are rarely more than 1% of the total number of investors involved. Typically, a minority of users participate occasionally (the so-called «intermittent contributors») and the greater part benefits from the common pool of knowledge without contributing to it (the so-called «lurkers») (e.g., Fesenmayer and Wang, 2004; Bravo, 2010).

This would indicate that cooperation in knowledge generation and sharing in online communities is problematic (e.g., Ling *et al.*, 2004). For instance Preece *et al.* (2004) performed a survey analysis on the 75 MSN bulletin board communities to understand the motivations behind the lack of users' active involvement in online communities, so-called «lurking». They found that the small amount of contributions from many community users has often nothing to do with the classic free-riding in cooperation situations. Rather, it may be due to the lack of technical competence of users, lack of knowledge of the online community or general distrust of the dynamics of the community. Park *et al.* (2014) showed that, if the sense of belonging to the community and the perception of the utility of shared information can explain active contributions of certain users, a

low opinion of one's personal level of knowledge is the main factor inhibiting others to contribute actively.

In this respect, the case of the *finanzaonline.com* community was positive, as more than 10% of the investors contributed considerably to information and knowledge sharing. As discussed above, it is worth noting that these results may be influenced by a «self-selection bias» whereby investors who have voluntarily chosen to respond to our questionnaire may be the same individuals who were usually more likely to share information and communicate to the online community.

In our case study, the relatively high rate of active participation by investors was due to the need for knowledge-sharing channelled by the forum, which is the main communication platform of the *finanzaonline.com* website. Most investors considered the online forum of *finanzaonline.com* useful for: *i*) seeking advice from more experienced investors, *ii*) gauging market behaviour, *iii*) collecting data and information for their economic evaluations, and *iv*) finding investment ideas. They were less receptive to the opportunity to meet new people with whom to share information and knowledge. Most investors spent less than one hour per day (51.1%) or at most two hours (30.6%) per day in information and knowledge sharing activities on *finanzaonline.com*. The others spent more than two hours per day on the forum. On the other hand, results also showed that investors were generally very demanding in terms of knowledge sharing. Investors' opinion of the average expertise of others involved in the community was not positive.

Finally, regarding investors' risk attitude, our results showed that 17% were strongly risk averse, about 78% moderately risk averse and 5% as very risk-loving. This indicates that online communities do not necessarily attract risk loving investors. On the other hand, it is probable that the most risky seeking investors, due to over-confidence bias (e.g., Oskamp, 1965; Hoge, 1970; Slovic, 1973), tend to underestimate the importance of information and knowledge generated by the community.

2.2 A Profile of the Typical Online Investor

Previous studies have highlighted the key role of online communities in generating knowledge and promoting collective learning processes (e.g., Anderson, 2009; Palloff and Pratt, 2005). Similarly, our results showed that *finanzaonline.com* is viewed as a useful platform to develop appropriate interpretations of market behaviour, get investment ideas and look for advice from more experienced investors. Hence, this allows investors to develop experience and practical skills. Our hypothesis was that these learning processes could be even more important for less experienced and less skilled investors. More precisely, we assumed that the forum should be seen as a financial education platform especially by those who *i*) taught themselves how to invest, *ii*) had a lower level of education or qualifications and *iii*) had no experience in trading through traditional channels. This meant that online communities in effect act to complement rather than replace traditional educational institutions (e.g., university, training in traditional financial institutions etc.).

Our results largely corroborate this hypothesis, as self-taught investors had different characteristics compared with the rest of the sample (see Tab. 2). Indeed, in 56% of cases

Table 2: Differences between self-taught investors and trained investors

	Self Taught (%)	Standard error	Trained investors (%)	Standard error
High school diploma	56	0.033	30	0.03
Rely on the opinions of other investors*	87	0.022	65	0.032
Less than 1 hour per day studying trading techniques°	65	0.032	50	0.033
Less than 1 hour per day studying trading techniques (beginning of the investment activity)**	78	0.027	60	0.032

Notes: The symbol «*» means Cramér's $V = 0.26$, p -value = 0.00; the symbol «°» means Goodman and Kruskal's gamma = -0.31, p -value = 0.05; the symbol «**» means Goodman and Kruskal's gamma = -0.4, p -value = 0.02.

Table 3: Education level and size of the investment portfolio

	Less than 5,000 Euros	Between 5,000 and 10,000 Euros	Between 10,000 and 25,000 Euros	Between 25,000 and 100,000 Euros	Between 100,000 and 250,000 Euros	Higher than 250,000
Less educated (high school diploma at most)	16 88.89%	11 45.83%	12 50%	40 56.34%	21 47.73%	12 30%
More educated (higher than high school diploma)	2 11.11%	13 54.17%	12 50%	31 43.66%	23 52.27%	28 70%

Notes: The two variables showed a significant statistical association (Goodman and Kruskal's gamma = 0.29, p -value = 0.02).

self-taught investors had a senior or junior high school diploma, which dropped to 30% for more formally trained investors. The key point here is that self-taught investors have used online communities as a means to compensate for their gap in financial education. Indeed, these investors were more likely to rely on the opinion of other online investors for their economic evaluations (87%, against 65% of the more trained investors).

Furthermore, financial education was also found to have triggered learning effects. If we look at the time dedicated to studying markets and investment techniques at the moment of questionnaire completion, and the investors' early trading experience, not only do self-taught investors spend less time learning in the present period; they also dedicated less time for learning at the beginning of their trading experience. This means that for self-taught investors, online exposure, e.g., information sharing and peer-to-peer opinion in virtual communities, was more important than the technical knowledge acquired after hours of personal learning effort.

Education also has other important effects for online investors. Firstly, more educated investors managed larger portfolios (see Tab. 3). Secondly, they relied more frequently on traditional press and news sites for financial information (Cramér's $V = 0.23$, p -value = 0.04). On the other hand, there were no differences in terms of time spent trading each day, the number of transactions completed in a year, the use of leverage, and regarding the opening of positions during the night or the category of asset traded more frequently. This meant that the more educated investors did not actually follow different

investment strategies, they just had more basic competence and were capable of exploiting a variety of information sources better than the self-taught investors.

It is worth noting that education also influenced investors' online exposure. Our results showed that the higher the investor's education level, the lower their engagement in the forum in terms of hours per day was (Goodman and Kruskal's gamma = -0.24, p-value = 0.02). In particular, 80% ($SE = 0.026$) of investors usually spent less than two hours per day on the forum, with 47% ($SE = 0.033$) of those having attained a high school diploma. Investors with a high school diploma made up the majority (65%, $SE = 0.032$) of those who usually spend more than two hours a day on the forum. This would indicate that education, and exposure to online information and knowledge sharing, were significantly associated for this sub-group.

As we have seen, the forum was more important for less educated investors who looked at online experience as a means to complement the gap in their educational background. Finally, results showed that there was no relationship between the investors' education level, and in their perception of the forum's function and the perceived competence of the typical investor involved in the community. This can be explained by the fact that more educated investors were also probably more demanding in terms of other subjects' competence. It is likely that more trained investors were capable of maximising information and knowledge from their online exposure, e.g., they were online less but gained higher benefits as they are more capable of capturing valuable information.

Finally, it is interesting to note the association between investors' previous experience and the use of the online forum. Investors with previous experience of traditional investment services perceived the forum as a tool to understand market trends, explore investment ideas, and meet new people. This meant that previous investment experience through traditional intermediaries induced people to trust the information available in the forum more. This could be due to the scepticism of investors towards traditional institutions and trading intermediaries, that has induced a socially shared over-confidence on the importance of the independence and autonomy of peer-to-peer information and knowledge sharing.

2.3 Independent investors

Given the novelty of the figures making up our study sample, it is important to understand whether independent investors have any peculiar characteristics. In terms of independent investors, we mean any investor who has neither an employment contract of any kind, nor a VAT position, while spending most of their time involved in trading activities. Our results showed that these investors had an average income lower than the other investors. Indeed, 54% earned less than €25,000 per year, a percentage that dropped to 31.7% for the rest of the sample. With regard to demographic variables, there is no difference between independent and non-independent investors, as is the case also for the type of financial training received.

Significant differences existed in terms of motivations for investing (Cramér's $V = 0.55$, p-value = 0.00): while the biggest group of investors viewed trading as a means to earn extra-income, independent investors invested mostly as a job or solely for passion. They

spent more time studying financial markets and investment techniques. This was true at both the time of questionnaire completion (Cramér's $V = 0.51$, $p\text{-value} = 0.00$) and at the beginning of their trading experience (Cramér's $V = 0.37$, $p\text{-value} = 0.00$). Furthermore, they spent more time in trading activities (Cramér's $V = 0.46$, $p\text{-value} = 0.00$), and in doing so completed a larger number of transactions per year (Cramér's $V = 0.31$, $p\text{-value} = 0.00$).

As regards to investment choices, independent investors traded the same categories of financial assets as the others (mainly equities and bonds), however unlike the latter, they used more leverage instruments (Cramér's $V = 0.2$, $p\text{-value} = 0.04$) and had higher portfolio performance on average (Cramér's $V = 0.22$, $p\text{-value} = 0.03$). They showed a similar risk propensity to others within the sample.

Regarding the perception and use of the online forum, results indicated that independent investors used blogs and forums less as sources of information (Cramér's $V = 0.19$, $p\text{-value} = 0.01$). However, similarly to other investors, most perceived the forum as a useful tool to find information or to gauge market trends. Moreover, in unison with other investors, they had a predominantly negative opinion of the reliability and skills of the forum's average investor, and they were influenced by these opinions even less than other investors (Cramér's $V = 0.21$, $p\text{-value} = 0.03$).

2.4 Risk propensity

Risk is a key element of investment strategies, especially in times of market volatility and high uncertainty. An interesting question is whether exposure to online information and knowledge sharing helps investors to calculate the risk probabilities of their trading options more rationally. First, our results showed that younger investors had a higher risk propensity ($F = 6.04$, $p\text{-value} = 0.01$). Therefore, learning-by-doing and experience gained from trading helped investors to mitigate their expectations. In fact, the effect of trading experience in developing learning-by-doing skills is evident when considering the positive effect that a higher number of operations (Goodman and Kruskal's gamma = 0.71) and more studying (Goodman and Kruskal's gamma = 0.64) on reducing investors' risk propensity had ($F = 2.74$, $p\text{-value} = 0.04$). Trading experience permitted investors to develop self-monitoring, analysis, and learning capabilities that seemingly helped them to calibrate their risk options more rationally.

Furthermore, we did not find any correlation between risk attitude and portfolio returns. Taking more risks did not lead to higher performance. This violates one of the basic assumptions of modern portfolio theory, which posits that there is a positive relationship between expected returns and investment risk, in that achieving higher returns depends on accepting increased levels of risk (e.g., Sharpe, 1964).

3 Regression models

In order to understand the implications of risk propensity, we built a linear regression model that looked at the relation between individual risk propensity and other

variables. We first built a model of the relation between practical experience, financial education, and participation in the forum with investors' risk propensity. We assumed that trading experience is a function of the number of hours per day spent on trading. Furthermore, we assumed that the level of financial education of investors depended on the amount of time spent studying investment techniques and market analysis. Regarding engagement in information and knowledge sharing in the forum, we considered two variables: the first measured how much investors considered the forum to be a source of reliable information, and the second measured how long investors actively participated in forum discussions.

We assumed that both investment experience and the study of trading techniques reduced investors' risk propensity. To support this hypothesis, Guiso and Jappelli (2008) identified a positive correlation between portfolio diversification and financial education, showing that the lack of basic finance knowledge could be the cause of frequent over-exposure to market risks. This was corroborated by an analysis of the Customers' Survey of the Unicredit Group for 2007, which contained indicators of portfolio choices, financial education, and other demographic characteristics of a sample of 1686 investors (citation needed here).

With regard to participation experience in the forum, our hypothesis was that exposure to online information and knowledge sharing, should allow investors to reduce the cost of information research and skill acquisition. This consequently increases the level of personal financial education and trading experience. As a result, this is expected to help investors to control their risk propensity. We therefore hypothesised the existence of a negative relationship between risk propensity, and both participation in online information and knowledge sharing, and the perception of the forum's reliability. Finally, we included age and education of the investors as control variables.

More formally, the model was defined by the investors' risk propensity $i(r_i)$ as a dependent variable and a vector of independent variables X_i , composed of age (A_i), educational qualification (T_i), the amount of time spent trading activity (O_i), the time spent studying markets and techniques M_i , the participation rate in forum discussions (D_i), and the perception of forum's reliability (F_i), as follows:

$$(1) \quad X_i' = (1, A_i, T_i, O_i, M_i, D_i, F_i)$$

The model was defined as follows:

$$(2) \quad r_i = X_i' \beta + u_i$$

where $\beta_i = (\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$ was the vector of regression coefficients and the error term. Table 4 shows that age and education level had no impact on risk propensity. Only the time spent in trading activity had a weak negative relationship with risk propensity. It was found that direct trading experience can reduce individual risk propensity, i.e., learning-by-doing allows investors to understand how to make money with less risky options. Coherent with these results, direct experience in trading led to more realistic

Table 4: Regression coefficients of the risk propensity model

Risk propensity	Coef.	Std. err.	T	P > t	Beta
Age	0.014	0.023	0.59	0.553	0.056
Educational qualification	0.27	0.244	1.11	0.271	0.102
Time spent trading**	-0.533	0.279	-1.91	0.059	-0.205
Hours for learning	0.193	0.342	0.56	0.575	0.060
Online exposure to communication	-0.126	0.304	-0.42	0.679	-0.040
Forum reliability*	0.613	0.309	1.99	0.049	0.192
Constant*	16.105	1.839	8.76	0.000	0.000

Notes: The R^2 of the regression is 0.09 and the F-statistic is 2.06 with a p-value equal to 0.063. The symbols «*» and «**» indicate that the null hypothesis of a zero valued coefficient were rejected at the 5% and at 10% significance levels respectively.

expectations, probably due to the accumulation of negative experience and the development of self-control capabilities.

Furthermore, while participation in forum discussions had no effect on investors' risk propensity, the perception of forum reliability had a positive and significant impact on risk propensity. This meant that the more the forum was perceived as being useful and reliable by investors, the more their risk propensity tended to increase. It is worth noting that Zhu *et al.* (2012) came to similar conclusions through a series of field and lab experiments. They found that participation in online communities induces higher risk taking behaviour as investors might receive social support by others, which in turn tends to reinforce the self-confirmation bias. This effect occurs only for investors who are more exposed towards information sharing in the community.

3.1 Investment Portfolio Performance

In order to understand the impact of certain variables on the performance of investors' portfolio, we first examined bi-variate relationships between performance and investors' activism in the forum. Secondly, we checked whether *i*) participation in forum discussions, *ii*) forum reliability, and *iii*) time spent studying had a positive impact on portfolio performance. For this purpose, we built an ordinal logistic regression model.

Regarding the bi-variate analysis, results showed a significant association between investors' portfolio performance and the number of hours spent studying (Cramér's $V = 0.22$, p-value = 0.03). Secondly, results showed a weak but significant association (Goodman and Kruskal's gamma = 0.19, p-value = 0.00) between performance and the number of yearly transactions, suggesting that multiple operations generally implied higher productivity, most likely due to learning effects. This also held true for the size of the portfolio, which was positively related to the level of performance (Goodman and Kruskal's gamma = 0.2, p-value = 0.00): larger portfolios led to higher returns.

By analysing the relationship between portfolio performance and the communication medium used to look for information, we found a positive effect only for the role of information sites (Cramér's $V = 0.21$, p-value = 0.04). No evidence was found for a positive effect of blogs and forums. Neither the perception nor the mode of use of the online forum had any effect on portfolio performance.

The next step of the analysis was to investigate the relationship between portfolio performance, experience in trading, financial education, and level of participation in the forum in more detail. Given that performance categories were naturally ordered, we applied an ordinal logistic regression model (e.g., Agresti, 2002). First, we considered a proportional-odds cumulative-logit model (e.g., McCullagh, 1980), e.g., a parsimonious model that can be represented as a set of binary logistic regressions, where the parameters of the covariates are the same across all the different regression equations. After a Brant's test on parallel regression assumptions (e.g., Brant, 1990), which revealed that the proportionality assumption was violated, we applied a generalised cumulative-logistic model (e.g., Kang Fu, 1999; Williams, 2006), which was less parsimonious in terms of parameters but allowed us to relax the proportionality assumption.

We considered the portfolio performance categories as dependent variables of the generalised logistic model and the same explanatory variables defined in the previous section as covariates, i.e., the time spent trading by investors $i(O_i)$, the time spent studying markets and techniques (M_i), the participation rate in forum discussions (D_i), the perception of forum reliability (F_i), considering age (A_i) and education qualification (T_i) as control variables.

We hypothesised that good trading experience and better understanding of the technical analysis of markets would be positively related to portfolio performance. This is coherent with previous studies that identified a strong link between investment experience and performance (e.g., Nicolosi *et al.*, 2009; Elliot *et al.*, 2008; Feng and Seasholes, 2005). For instance, by using data from the National financial capability Study, Lusardi and Mitchell (2011) examined the levels of financial education of a sample of about 1,200 individuals, and showed that more robust financial education improves the computing capabilities of investors and led to more competence in planning pension plans.

Behrman *et al.* (2012) conducted a survey on a sample of about 13,000 individuals in Chile. They found that financial education has a higher impact than basic education on wealth and on the best choices for pension plans. More recently, Guiso and Viviano (2013) developed a survey on financial education, collected from a sample of approximately 1,600 customers of an Italian bank, and derived data on investment decisions of the same subjects during the financial crisis of September 2008. They found a positive correlation between financial education, and the ability of investors to enter and exit the market with better timing, so achieving higher performance.

We hypothesised that the perception of reliability and use of the forum would have had a positive effect on investors' trading skills, thanks to the benefits of information and knowledge sharing supplied by the forum. As before, we considered age and educational level as control variables.

More formally, the model was defined by the portfolio performance of the investor i and the vector of independent variables $i(R_i)$, as follows:

$$(3) \quad X'_i = (A_i, T_i, O_i, M_i, D_i, F_i)$$

Table 5: Regression co-efficients of the portfolio performance model.

Performance category	Coef	Std. err.	Z	P > z	Conf. I	95%
1						
Age**	-0.024	0.014	-1.710	0.087	-0.051	0.003
Educational qualification*	0.539	0.271	1.990	0.047	0.008	1.070
Hours trading	-0.134	0.171	-0.790	0.432	-0.469	0.201
Hours studying	-0.370	0.339	-1.090	0.275	-1.035	0.295
Online exposure to discussions	0.436	0.282	1.550	0.122	-0.116	0.989
Forum reliability	0.032	0.181	0.180	0.858	-0.322	0.386
Constant	1.397	1.268	1.100	0.271	-1.088	3.881
2						
Age**	-0.024	0.014	-1.710	0.087	-0.051	0.003
Educational qualification	-0.063	0.174	-0.360	0.717	-0.405	0.278
Hours trading	-0.134	0.171	-0.790	0.432	-0.469	0.201
Hours studying*	0.616	0.255	2.410	0.016	0.115	1.116
Online exposure to discussions	-0.240	0.213	-1.130	0.259	-0.658	0.177
Forum reliability	0.032	0.181	0.180	0.858	-0.322	0.386
Constant	1.646	1.179	1.400	0.163	-0.664	3.956
3						
Age**	-0.024	0.014	-1.710	0.087	-0.051	0.003
Educational qualification	0.080	0.163	0.490	0.626	-0.240	0.399
Hours trading	-0.134	0.171	-0.790	0.432	-0.469	0.201
Hours studying*	0.795	0.244	3.260	0.001	0.317	1.272
Online exposure to discussions	-0.184	0.211	-0.870	0.382	-0.597	0.229
Forum reliability	0.032	0.181	0.180	0.858	-0.322	0.386
Constant	-0.791	1.145	-0.690	0.490	-3.036	1.453
4						
Age**	-0.024	0.014	-1.710	0.087	-0.051	0.003
Educational qualification	-0.213	0.225	-0.950	0.344	-0.653	0.228
Hours trading	-0.134	0.171	-0.790	0.432	-0.469	0.201
Hours studying*	0.951	0.311	3.060	0.002	0.341	1.561
Participation in discussions	0.025	0.294	0.080	0.933	-0.551	0.601
Forum reliability	0.032	0.181	0.180	0.858	-0.322	0.386
Costant	-2.144	1.384	-1.550	0.121	-4.857	0.568

Notes: The pseudo of the regression is 0.092, the LR statistic is 35.83 with a p-value of 0.0019. The symbols «*» and «**» indicate that the null hypothesis of zero valued coefficients were rejected at the 5% and at 10% significance levels respectively.

The model was defined as follows:

$$\begin{aligned}
 \text{logit}(p_{i1}) &= \log \frac{1}{1 - p_{i1}} = \alpha_1 + X_i' \beta_1 \\
 \text{logit}(p_{i1} + p_{i2}) &= \log \frac{p_{i1} + p_{i2}}{1 - p_{i1} + p_{i2}} = \alpha_2 + X_i' \beta_2 \\
 (4) \quad \text{logit}(p_{i1} + p_{i2} + p_{i3}) &= \log \frac{p_{i1} + p_{i2} + p_{i3}}{1 - p_{i1} + p_{i2} + p_{i3}} = \alpha_3 + X_i' \beta_3 \\
 \text{logit}(p_{i1} + p_{i2} + p_{i3} + p_{i4}) &= \log \frac{p_{i1} + p_{i2} + p_{i3} + p_{i4}}{1 - p_{i1} + p_{i2} + p_{i3} + p_{i4}} = \alpha_4 + X_i' \beta_4 \\
 \text{and } p_{i5} &= 1 - p_{i1} + p_{i2} + p_{i3} + p_{i4}
 \end{aligned}$$

where p_{ij} was the probability that an investor ($i = 1, \dots, 229$) was at least in the j -th category of performance R_i and $\beta_i = (\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$ the vector of regression coefficients.

Table 5 shows that the age of investors had a negative significant effect in all performance levels. This means that older investors had a lower probability of passing to

higher performance levels. This supports previous studies that have shown a decline of computational capabilities (Lusardi, 2012) and more investment mistakes among older investors (Agarwal *et al.*, 2009).

Our results also indicated that participating more in discussions and considering the forum as a reliable system had no impact on the investors' probability of improving their performance. If we consider the first performance category, we can see that the only factor that helped investors was educational qualifications. If we consider all the other categories that led to better performance, the only way to increase the likelihood of reaching a higher performance level was more hours spent studying markets and investment techniques.

This would indicate that only a robust basic education can help investors to improve portfolio performance and also exploit the knowledge available in the community. On the other hand, the online exposure of investors did not compensate for investors' educational gap.

4 Conclusions

Our work aimed to provide a precise picture of a relatively new category of investors, i.e., online investors, as well as to understand the implications of education and learning on their trading. First, we found that these new investors were profoundly heterogeneous in their background, motivation, and expertise. Online investors include non-professional and semi-professionals, independent investors, investors who are simply looking for extra-income, and people who trade for leisure or for their work. This includes formally trained investors with considerable experience, who shifted towards online finance looking for information and knowledge, but also self-taught investors who try to find an easy way to learn in the online world. This makes it difficult to consider the self-taught category as entirely unique.

It is worth noting that by looking at the impact of education on investors' learning, performance, and risk control, serious doubts should be raised concerning e-collective intelligence and the positive role that online communities can play for information and knowledge sharing in finance. It is widely acknowledged that virtual communities can channel knowledge generation and sharing processes in situations where online users collaborate for a common purpose, and are guided by shared values, such as developing an open source software or a virtual encyclopaedia (e.g., Adler, 2001; Bravo, 2010). This however is questionable in a typical market competition situation, such as in financial communities, where individual, self-interested motivations are stronger than communitarian identities. In this respect, an interesting topic would be to compare more «traditional» knowledge generation and sharing online communities and financial communities, as there are reasons to expect certain differences in terms of values and collaborative attitudes in the latter.

Furthermore, independent of certain severe limitations of the study conducted here in terms of nationality and limited sample, our results confirm the importance of financial literacy and formal training for online investors. However, as suggested by Jappelli (2010), in countries like Italy, where the social security system has created institutional

barriers against financialisation and the overall proliferation of markets as a unique institutional mechanism for resource allocation, higher levels of financial illiteracy in the wider population are expected. It is interesting to note that this is also found in online investor communities, where investors should intrinsically be motivated to improve their expertise and knowledge of markets. Although our study was not addressed to test financial literacy, the fact that more formally trained investors performed better, are less risky in their trading choices, and more able to identify reliable information and knowledge from online sources, indicates that any initiative to increase financial literacy in the population could balance the gap between professionals and online investors. This could also create conditions for more equalitarian access to market opportunities by an increasing variety of individuals who are ever more attracted to finance.

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