Overconfidence in Finance: Overview and Trends

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Chapter Outline

6.1 Market Efficiency and Investor Rationality

Investor rationality is considered as one of the basic pillars supporting mainstream neoclassical finance theories that postulate market efficiency. Among these, we can find the efficient market hypothesis (EMH) that was first presented in the seminal paper by Fama (1965). Starting from the simple finding that stock prices in the Dow Jones Industrial Average tend to follow random walks (Fama, 1965), the EMH has, since then, evolved and yielded a very substantial level of empirical research in the area of finance. Over the years, the EMH has been one of the most, if not the most discussed theory in the area of finance, with several authors either trying to confirm its validity (mostly in the 1960s and 1970s) or attempting to dispute its practical relevance (mostly after 1980s). It is a market approach that relies on solid theoretical assumptions coming from the Economics field, such as perfect markets and rational investors, the latter being defined as subjects that always take decisions based on a utility maximizing mindset. In a context of perfect symmetric information and rational investors, markets should perform flawlessly, leading to equilibrium "fair" prices (Fama, 1970) that are based on fundamentals and incorporate all available information almost instantaneously. With this level of efficiency, it is impossible to consistently "beat" the market using special portfolio diversification or timing strategies. Any attempt to obtain above-average returns can only occur if investors are willing to take above-average risks, discarding any possibility of market failures or anomalies that can be exacerbated and exploited.

The assumption of investor rationality is one of the most debated issues when it comes to supporting EMH. As expected, it is very difficult to value securities rationally consistently in the medium to long-run and overtime EMH supporters were somewhat forced to acknowledge the presence of irrationality in the mindset of investors. However, they did not take it into consideration as a fundamental market mechanism leading to long-run or structural mispricing. Instead, they saw it as a temporary source of mispricing that is rapidly corrected in order to ensure that market efficiency holds. Therefore, the presence of irrational traders is considered to be irrelevant toward final price formation, as their trades are random, uncorrelated, and tend to cancel each other out. Furthermore, if irrational traders tend to correlate their trades, leading to mispricing, they are faced with the presence of rational arbitrageurs in the market who are going to explore prices differences, via hedging against close substitutes, restoring the "fair" values. Overall, market efficiency should hold even in the presence of irrationality. This conclusion is later confirmed by Fama (1998), when he admits that market anomalies can exist, due, not to investor irrationality, but rather to chance, namely technical issues. These anomalies are essentially short-term phenomena leading to market under and overreaction, however in the long-run they level each other out and market efficiency holds.

6.2 Overconfidence

Despite the persuasive arguments of the EMH supporters, the simple fact is that market reality in the 1980s moved away from efficiency in a consistent way, opening avenues for additional explanations that needed to go beyond investor rationality. This created an opportunity for a leap forward in literature, as authors started looking into alternative explanations for the "so-called" anomalies, especially when they showed remarkable resilience. This meant the advent of the behavioral finance field with possible reasons for specific trading patterns being attributed to psychological features, leading to a sudden interest in psychology literature, namely the seminal works of Kahneman and Tversky (1972, 1973, 1979). In this new field, investors were no longer regarded as basic rational decision-makers, but they were rather seen as complex subjects responding, not only to rationality, but also to other factors, such as psychological biases and limitations in information processing.

One of the critical events marking the need for a new set of explanations more oriented toward psychological biases, namely sentiment, was the Black Monday crash that took place in October 19, 1987. An average drop in stock prices of 22.6%, a fall much larger than expected when looking at the economic context, raised questions about the possibility of investors being influenced by more than just rationality, leading to the need to search for additional explanations (Shiller, 1987; Siegel, 1992). Shiller (1987) conducted a survey about the behavior of individual and institutional investors during the Black Monday crash and found that the majority interpreted the stock price collapse as the result of other investors'

psychology rather than fundamentals. Siegel (1992) could not explain the 1987 stock price crash with changes in profits and interest rates, and pointed at investor sentiment as a probable cause for this market anomaly. As expected, in this context, the concept of investor sentiment, considered as a collection of systematic biases in beliefs leading to trade based on nonfundamentals, emerged as a relevant issue to explain markets anomalies. This opened the path for a sequence of research developments that attempted to provide a more thorough view of the relationship between sentiment and asset prices (Barberis et al., 1998; Black, 1986; Daniel et al., 2001; DeLong et al., 1990).

Overtime, one of the factors behind sentiment clearly emerged as a relevant and controversial issue toward understanding investor behavior and market anomalies; overconfidence. Overconfidence is an important attribute of investors behavior leading to momentum anomalies. This idea is confirmed by the work of Daniel et al. (1998) when they consider that overconfidence and self-attribution working together can be behind overreaction and underreaction due to excessive reliance on private information. When new public information is released into the market and learning ensues, prices revert back to fundamentals. As expected, sequences of overreactions and underreactions and the subsequent corrections may be behind excess volatility, which is documented as one of the main impacts of overconfidence.

It is very difficult to define the concept of overconfidence or even to assess it, as it is nonobservable and occurs at the same time with other type of psychological phenomena in a mixture called "sentiment." There are many ways in which we can address it; we can think of it as an investor tendency to overestimate the precision of his/her knowledge about the value of an asset (Odean, 1998); as "the tendency to place an irrationally excessive degree of confidence in one's abilities and beliefs"[1] (Grinblatt and Keloharju, 2009); as "the overestimation of one's knowledge or precision of private information, or the interpretation thereof"[2] (Skata, 2008), or as "having mistaken valuations and believing in them too strongly"[3] (Daniel and Hirshleifer, 2015). All definitions focus on excess of confidence and belief, however, they differ when looking at scope and motivations. Grinblatt and Keloharju (2009) characterizes the type of excess as being clearly irrational whereas Odean (1998) and Daniel and Hirshleifer (2015) look only at asset valuation and Skata (2008) places the focus on private information. This divergence is a clear sign of lack of consensus in an area that encompasses many different perspectives and still has much to offer in terms of research.

Despite the fact that the term "overconfidence" started being widely used since the 1960s, today there is still a lot of unknowns about its sources, its implication, and its impact in finance. The intensity of the discussion regarding the concept of overconfidence is clearly a

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sign that this is not a residual topic for psychologists and finance academia. The dispute is so fierce that some simply claim that the phenomenon may not exist (Gigerenzer et al., 1991; Juslin, 1994) and may just be a glitch due to faulty methodological options applied to particular studies instead of a true cognitive bias. In fact, the flaws of the main methodology used in finance to assess this phenomenon support to a certain extent this view, as there is an enormous reliance on experiments and questionnaires, which are methods that cannot avoid biases, such as nonrepresentative sampling, small sample sizes, and artificial scenarios. Nevertheless, for others authors, these methodological flaws cannot eliminate the general validity of most tests that are based on real market data and have produced conclusive evidence that overconfidence is a relevant cognitive bias that takes different shapes (Ayton and McClelland, 1997; Glaser and Weber, 2007; Odean, 1998). In fact, DeBondt and Thaler (1995) confirms this perspective by stating that possibly one of most robust findings in the psychology of judgments is that people are overconfident.

6.3 Sources of Overconfidence

When looking at the reasons behind investor overconfidence, many issues can be considered as determinants of this behavior, but some authors (Skata, 2008; Menkhoff et al., 2013) consider that its main sources are miscalibration, better than average effect, illusion of control, and unrealistic optimism. These factors are normally assessed and explained in a separate way from a theoretical and empirical point of view, however, they tend to overlap or work together when triggering overconfidence in real market settings.

Overconfidence based on miscalibration occurs when people assign probabilities higher than they should to particular events. The confirmation bias may be one of the factors influencing this type of behavior with investors searching for and using an excessive amount of confirming evidence, while systematically neglecting contradictory evidence. Also, the "hard-easy effect" is a relevant issue (Fischhoff et al., 1977; Lichtenstein et al., 1982) with overconfidence being higher for difficult and very difficult tasks whereas easy tasks tend to be a source of underconfidence. The presence of clear and rapid feedback and the repetitive nature of a task may be important factors influencing miscalibration, however, there is still heated debate on whether overconfidence can be considered a stable feature or a dynamic process subject to external influence.

The better than average effect is based on psychological research showing that people, in general, tend to have an excessively optimistic view of themselves. Due to a very high intertwining with miscalibration, the better than average effect can be regarded as a type of miscalibration where the subject is not comparing its performance against an objective benchmark, but rather against a subjective view of other subjects' performance. In this setting, the self-serving or self-attribution bias becomes relevant (Babcock and Loewenstein, 1997; Taylor and Brown, 1988) with people assigning to themselves more

responsibility for success and less for failures, not giving the appropriate credit to others. Focusing highly on self-esteem, which is a crucial feeling at this level, people associate success with internal factors (skills, knowledge) rather than external ones (luck, weather).

Illusion of control occurs when people are led to believe that they can control events (tasks) that are just determined by chance (Taylor and Brown, 1988) leading to wrong probability assessment. This bias is normally grounded on the wrong perception that subjects that apply their skills to particular tasks through choice, familiarity, and involvement can actually influence the outcome of those tasks. An example of this illusion can be the fact of a particular individual simply believing that he/she has a probability higher than 50% of getting a specific outcome when tossing coin, just because he/she actually tosses the coin. Task involvement does not justify any change in probability which keeps being purely determined by chance, but the subject erroneously believes that the simple fact of intervening in the task can increase his/her odds of being successful.

Finally, unrealistic optimism is regarded as an error in terms of the assessment of future outcomes determined simply by being "better" or "having a brighter future" effects. Subjects prone to unrealistic optimism believe that positive events are more likely to happen to them, whereas negative events are less likely to happen. This bias tend to be especially higher when there is a strong desire for a particular outcome, the probability of being successful is high and there is a clear perception of control over the actual event. Overlapping with the better than average, the biased self-attribution and the illusion of control effects, the unrealistic optimism can be persistent when there is a strong perception of control and a strong commitment or emotional attachment (Skata, 2008).

6.4 Empirical Evidence on Overconfidence

As a reflection of its importance for subjects' decision making, overconfidence has produced a relevant track of publications in the field of behavioral finance with plenty of empirical evidence supporting the significance of this cognitive bias in financial markets (DeBondt, 1998; Glaser and Weber, 2007; Odean, 1998). Nevertheless, most of the financial evidence found about this topic is a mirror of the heated debate going on theoretically and there are critical divergences emerging when looking at the impacts of overconfidence over the stock market, for example, trading volume and trading profits, or when focusing on the determinants of overconfidence, such as learning, experience, age, gender, or type of market (online vs. offline). Even though these issues will be subsequently presented in an individual way, it is important to realize that in real market conditions impacts and determinants work together and are not easily distinguishable.

In terms of the implications of overconfidence, one of the most relevant focus on the relationship with trading volume and is documented, among others, by Odean (1998), Benos (1998), Biais et al. (2005), Glaser and Weber (2007), and Grinblatt and Keloharju (2009).

These authors do not share the same view and the debate is still going on to determine whether there is any relationship between overconfidence and trading volume. On one hand, by taking a narrower approach of overconfidence and focusing mainly on miscalibration, Biais et al. (2005) and Glaser and Weber (2007) claim that there is no relationship between overconfidence and trading volume. On the other hand, by taking a broader view of overconfidence that considers different settings and contexts, the remaining authors arrived to the conclusion that overconfident investors trade more. A fact also confirmed by Glaser and Weber (2009) that in a later study, using a sample of 215 online investors, uncovered a positive relationship between better than average effect and trading frequency. Overall, overconfident investors are seen as having lower expected utilities, relying more on their private information and stock picks, and holding riskier and less diversified portfolios. This situation tends be more significant in bull markets with aggregate overconfidence having a boost and determining also higher levels of individual overconfidence. A conclusion reinforced by Chuang and Lee (2006), when showing that overconfident traders are more prone to trade on relatively riskier assets, after experiencing market gains.

When looking at the impact of overconfidence on trading profits, there is also a clear disparity in empirical evidence. Benos (1998) believes that overconfident traders are more aggressive and therefore tend to enjoy "first-mover" advantages in most trades, leading to higher profits. This is achieved only by enjoying aggressiveness benefits without incurring in high risk taking. A view shared by Hirshleifer and Luo (2001) that believe that overconfident traders exploit better mispricing. Their trading aggressiveness is justified by risk underestimation and overestimation of trading strategies, showing a superior ability to use their information in a more intensive way. On a different perspective, Gervais and Odean (2001) found that overconfident traders tend, on average, to achieve lower gains, as the additional trading volume and the additional volatility they create in markets affects negatively their trading performance. This effect is explained by excessively small asset holding time-windows, leaving no time for assets to adjust to expected values, and higher trading commissions. The same result was obtained by Cheng (2007) based on a sample of 159 students from various academic institutions in Singapore.

Moving away from impacts and looking at the determinants of overconfidence, it is relevant to observe that perspectives on the evolution of overconfidence overtime also are a source of controversy with the possibility of positive, negative, and neutral relationships between experience/learning and overconfidence. On a neutral perspective, while holding confidence levels constant, Hirshleifer and Luo (2001) consider that overconfident traders learn very little and tend to hold their confidence level even when having a bad performance. This is a relevant theoretical result that may not apply in a real market situation, as confidence levels are expected to fluctuate with feedback from past performance. Taking a different stance, Gervais and Odean (2001) propose a negative correlation between experience and overconfidence. They conducted a dynamic study in an attempt to assess changes

in overconfidence levels mainly due to self-attribution bias. Unlike Hirshleifer and Luo (2001), they allowed confidence levels to change with past performance. Based on this assumption, they managed to eliminate individual overconfidence through learning, allowing traders to have frequent, rapid, and clear feedback. With an increase in experience levels, traders recognized their true skills and adjusted their overconfidence levels to zero. Nevertheless, the aggregate level of market overconfidence was not eliminated, because there was a constant entry of new overconfident traders and an exit of experienced traders. Menkhoff et al. (2013) also found results similar to Gervais and Odean (2001), in terms of individual confidence. By looking at a pool of institutional investors, investment advisors, and individual investors, these authors uncovered a negative relationship between overconfidence levels and experience, with institutional investors being, on average, the least overconfident. These results are consistent with Linnainmaa (2011) and Grinblatt and Keloharju (2009) pointing at the fact that investors at the beginning of their careers are more overconfident, trade more, and hold riskier assets. Finally, sharing a totally opposite view and focusing on a positive relationship between experience and overconfidence, there are studies pointing at the fact that more experienced subjects tend to be more overconfident (Heath and Tversky, 1991; Kirchler and Maciejovsky, 2002). Positive feedback reinforcing self-attribution of past successes and illusion of control tend to be some of the factors behind this type of relationship.

Some of the significant ambiguity found before is partly explained by the fact that age of subjects is used as a proxy for experience. However, age may not be always be an appropriate choice, because it is too general and does not directly relate to breadth and intensity of investment experience. When age is considered independently from investment experience, as shown in the study by Menkhoff et al. (2013), experience and age tend to work in opposite ways when determining overconfidence. In general, this result may point at the fact that older investors have poorer investment skills, despite their higher experience level (Korniotis and Kumar, 2011).

Gender is also a relevant topic in the research of overconfidence and one in which the level of consensus seems higher. Given the same level of knowledge, most of the empirical research in finance so far is pointing at the fact that males tend to be more overconfident than females (Barber and Odean, 2002; Benos, 1998; Odean, 1998). With men showing higher levels of self-attribution bias (Beyer, 1990; Meehan and Overton, 1986) and finance being connoted as a typical male topic, there is support to find higher overconfidence among men (Lundeberg et al., 1994) leading to higher trading activity and lower returns. In a study focused on more than 35,000 households and limited to small investors from a single large brokerage firm, Barber and Odean (2002) confirmed the male predominance in terms of overconfidence when they found higher average turnover and trading activity for accounts managed by men, leading to higher transaction costs and to lower returns. Overall, single men have 85% of portfolio turnover compared to 53% of single women.

Finally, on the issue of the impact of online trading on overconfidence, it is important to distinguish between two different perspectives. On one side, it seems that going online can be considered as a source of overconfidence due to illusion of knowledge and illusion of control. On the other side, there are reasons to believe that going online can reduce overconfidence as an isolated atmosphere can avoid distractions and lead to higher levels of concentration. Most of the evidence supporting the former view comes from the work of Barber and Odean (2002) that surveyed approximately 1600 traders that moved from telephone to Internet-based trading. With the Internet supplying a larger quantity of data and traders having higher control over trades and portfolios, there are reasons to believe that two relevant overconfidence sources may come into play: illusion of knowledge (higher quantity of information) and illusion of control (a more direct involvement in trades). The results obtained by Barber and Odean (2002) confirm this view by showing that there is a higher turnover online leading to lower average returns, however, they are disputed by some because they do not account for relevant factors, such as sensation seeking or learning effects associated the novelty of online trading. On a different note and supporting the latter view, in 2007, Chen revisited this topic and found that traders in online environments tend to have higher performance and take less risk than their offline counterparts, being therefore less overconfident (Cheng, 2007). In a context where being online is no longer a novelty, the main argument for this outcome is related with the fact that overconfidence tends to be higher in highly interactive and open offline environments where traders are exposed to very diverse and intensive stimuli, including head to head competition with peers, that can be significant distractions. In such an exposed competitive environment, overconfidence comes mainly via better than average effect with traders wanting to be seen as successful when compared to peers. On the other hand, the level of overconfidence online is smaller because there are fewer distractions, more concentration, and less competition.

6.5 What Next for Overconfidence in Finance?

By looking at the quantity and quality of publications on overconfidence in financial markets, either from a theoretical or an empirical point of view, it seems that we are now witnessing a stagnation period after an intense peak. The 1980s and especially the 1987 crisis were critical stages in the early days of the behavioral finance research boom, leading to a publishing frenzy that made its way to top journals and gave notoriety to particular authors. However, this did not mean that overconfidence became immediately a hot topic as well, as most initial approaches to behavioral finance were essentially general, lacking a clear understanding of all the specificities included in the so-called investor "sentiment." Only with time, did authors manage to get to grips and focus on the specifics of behavioral finance, and this led to a progressive surge of interest in the overconfidence topic. The peak of this interest seemed to have taken place in the period between the mid-1990s and 2007. During this time, there were several publications in reputed journals and some authors gained considerable reputation by being associated with this topic. Names like Barber, Odean, Gervais, Glaser, Weber,

Benos, Hirshleifer, among others emerged in this period, being their pioneering work still considered as main references in the area. After 2007, it seems that the quantity and quality of publications simply decreased with some of the most prominent names no longer publishing frequently in high rank journals.

The above tendency seems to be pointing at some contextual forces at play that may have led to a loss of relevance of this particular topic. From the loss of relevance of the individual investor decision making to the emergence of a new political agenda focusing mainly on promoting market efficiency, there are several factors contributing to a loss of appeal of overconfidence. All of them being reinforced by a medium-term context of market stability where anomalies have somewhat been contained due to high central bank and government intervention after the 2008 sub-prime crisis, decreasing the frequency and relevance of this type of phenomena. In such a scenario, research funds and academic interest seem to have followed the political agenda leading to a lack of interest in topics considered residual at present time.

The increasing regulation of markets, a higher level of trading/financial products complexity, higher levels of market concentration, more information disclosure, the advent of algorithm trading and high-frequency trading (HFT) seem to be overwhelming forces in today's markets leaving fewer room for individual investors and uninformed nonautomated decision making. Typically, individual investors are easier to study in behavioral finance and also tend to be the ones more prone to cognitive biases in terms of decision making, mainly overconfidence. However, their role in today's markets has been diminished because institutional traders with higher levels of experience backed by time-tested algorithms, relying on high frequency trading, and covering a higher range of information sources have increased their proportion of market participation, supporting most of the trading action. Additionally, most of the decision making these days, either in terms of institutional or experienced individual investors, is highly dependent on computers, as they are normally the ones placing final orders in an almost stand-alone automated basis, trying to reduce as much as possible the potential for any human error caused by nonrational biases. In such a scenario, it is becoming harder and harder to study and understand the psychological factors actually contributing to orders because they are not so clear.

Additionally, it seems that some of the loss of relevance of overconfidence is also due to the fact that market efficiency is now at the top of political agenda among governments and securities commissions around the globe. In fact, overtime, overconfidence has always been regarded by some as an undesired source of volatility in markets, as it normally appeared associated to crises with relevant economic impacts. Governments and securities commissions are specially affected in terms of their credibility by crises episodes and obviously do whatever they can to avoid them. In fact, most of the work done by regulators in recent years has aimed at increasing market efficiency levels by reducing the impact of many biases affecting price formation, including overconfidence. Tighter regulations, higher levels of information disclosure, trading stops, short-selling restrictions, bans on inside trading,

and more intense reporting are just examples of means used to control mispricing. With the help of high-speed computing, it is now also possible for authorities to effectively have higher levels of control over trading, making life harder for investors that do not conform to established rules. This is occurring in a time where the legal and fiscal systems have also evolved to close any loopholes in terms of illicit behaviors.

At present, overconfidence is not desirable and has been somewhat subdued, however, this does not mean that overconfidence is no longer a significant force in today's real markets. There are essentially four reasons to believe that overconfidence has adjusted to present day market conditions and can still be a relevant topic in the research agenda. The first is market momentum. It is important to remember that markets have entered into a rather stable bull stage since the 2008 crisis with central banks providing safety for most investments, either based or not on fundamentals. In such a context, overconfidence may still be present at normal levels, as investors tend to be more overconfident during bull periods, however, it may not be so easy to see it, as underreaction or overreaction, which are some of the key indicators of the existence of overconfidence, are contained within controlled ranges. The second relates to the fact that algorithm trading does not eliminate overconfidence in trades even though it is aiming at that. In fact, what algorithm trading does is transferring overconfidence biases from the final decision to the choice of key indicators or corresponding weights that are going to be used in decision making. This change does not eliminate overconfidence, instead it just makes it more difficult to be identified and properly assessed. The third is higher transparency levels. Markets are now forcing listed companies to disclose more information and the internet helps more private information to become public in a faster way. This fact can contribute to better price formation and faster feedback to investors leading them to learn better, fostering lower overconfidence levels, however, it may also be responsible for higher overconfidence by reinforcing the illusion of knowledge associated with more information available. The fourth is higher market complexity. From the human investor side, it seems that higher levels of experience are now required to perform trading using more complex platforms and products. This, in principle, is expected to be a source of lower overconfidence, however, we have also seen that it can lead to higher overconfidence due to self-attribution, illusion of control, and illusion of knowledge effects associated with higher experience levels. The simple fact of addressing a higher level of complexity can lead on its own to overconfidence via the "hard-easy effect."

From a normative standpoint, and even though overconfidence has a negative connotation, it is important to realize that it should not be simply discarded as a market nuisance with no added value. To a certain extent, overconfidence can be a significant force to create opportunities and attempt new trading dynamics. It has been proven that overconfident investors research more and trade more aggressively based on private information, leading to higher incorporation of information on price formation (Hirshleifer and Luo, 2001; Odean, 1998). Therefore, when being part of a team of traders, overconfident subjects can

provide the group with valuable information (Bernardo and Welch, 2001). Additionally, overconfidence motivates investors to participate in different markets or asset classes that may be unfamiliar or riskier creating new opportunities. Even though they tend to follow different paths and strategies from other investors, they provide constant challenges to the group that can help it evolve and develop new strategies. A fact recognized by active fund managers that, being aware of these benefits, tend to devise specific incentives to foster overconfidence and aggressive behavior.

6.6 Conclusions

Overall, and despite a recent downward tendency in publications, there are reasons to believe that overconfidence is still a very relevant force in today's markets and should keep fostering new avenues of research and publications in financial markets. It is now probably harder to research overconfidence in markets due to some of the inhibiting factors mentioned before, however, it may also be more rewarding. For instance, new lines of research associated with the impact of algorithm trading or increasing market complexity on overconfidence, among others, are still unexplored fields that can yield significant contributions and relevant publications. As securities' commissions and market players have a strong belief that they are now dealing with more efficient markets, I guess they would be extremely interested in knowing how efficient markets are and to what extent psychological biases are still determining actual trading decision making, because they still are.

References

Ayton, P., McClelland, A., 1997. How real is overconfidence? J. Behav. Decis. Mak. 10 (3), 279–285.

Babcock, L., Loewenstein, G., 1997. Explaining bargaining impasse: the role of self-serving biases. J. Econ. Perspect. 11 (1), 109–126.

Barber, B., Odean, T., 2002. Online investors: do the slow die first? Rev. Financ. Studies 15 (2), 455–487.

Barberis, N., Shleifer, A., Vishny, R., 1998. A model of investor sentiment. J. Financ. Econ. 49 (3), 307–343.

Benos, A., 1998. Aggressiveness and survival of overconfident traders. J. Financ. Markets 1 (3–4), 353–383.

Bernardo, A., Welch, I., 2001. On the evolution of overconfidence and entrepreneurs. J. Econ. Manage. Strat. 10 (3), 301–330.

Beyer, S., 1990. Gender differences in the accuracy of self-evaluations of performance. J. Personal. Soc. Psychol. 59 (5), 960–970.

Biais, B., Hilton, D., Mazurier, K., Pouget, S., 2005. Judgmental overconfidence, self-monitoring and trading performance in an experimental financial market. Rev. Econ. Studies 72 (251), 287–312.

Black, F., 1986. Noise. J. Finance 41 (3), 529–543.

Cheng, K., 2007. The trader interaction effect on the impact of overconfidence on trading performance: an empirical study. J. Behav. Finance 8 (2), 59–69.

Chuang, W., Lee, B., 2006. An empirical evaluation of the overconfidence hypothesis. J. Banking Finance 30 (9), 2489–2515.

Daniel, K., Hirshleifer, D., Subrahmanyam, A., 1998. Investor psychology and security market under and overreactions. J. Finance 53 (6), 1839–1885.

Daniel, K., Hirshleifer, D., 2015. Overconfident investors, predictable returns, and excessive trading. J. Econ. Perspect. 29 (4), 61–88.

Daniel, K., Hirshleifer, D., Subrahmanyam, A., 2001. Overconfidence, arbitrage and equilibrium asset pricing. J. Finance 56 (3), 921–965.

DeBondt, W., 1998. A Portrait of the Individual Investor. Eur. Econ. Rev. 42 (3–5), 831–844.

DeBondt, W., Thaler, R., 1995. Financial decision-making in markets and firms: a behavioral perspective. Jarrow, R. et al., (Ed.), Handbooks in Operations Research and Management, vol. 9, Elsevier Science, Amsterdam.

DeLong, B., Shleifer, A., Summers, L., Waldmann, R., 1990. Noise trader risk in financial markets. J. Polit. Econ. 98 (4), 703–738.

Fama, E.F., 1965. The behavior of stock-market prices. J. Bus. 38 (1), 34–105.

Fama, E.F., 1970. Efficient capital markets: a review of theory and empirical work. J. Finance 25 (2), 383–417.

Fama, E., 1998. Market efficiency, long-term returns, and behavioral finance. J. Financ. Econ 49 (3), 283–306.

Fischhoff, B., Lichstenstein, S., Slovic, P., 1977. Knowing with certainty: the appropriateness of extreme confidence. J. Exp. Psychol. 3 (4), 552–564.

Gervais, S., Odean, T., 2001. Learning to be overconfident. Rev. Financ. Studies 14 (1), 1–27.

Gigerenzer, G., Hoffrage, U., Kleinbolting, H., 1991. Probabilistic mental models: a Brunswikian theory of confidence. Psychol. Rev. 98 (4), 506–528.

Glaser, M., Weber, M., 2007. Overconfidence and trading volume. Geneva Risk Ins. Rev. 32 (1), 1–36.

Glaser, M., Weber, M., 2009. Which past returns affect trading volume? J. Financ. Markets 12 (1), 1–33.

Grinblatt, M., Keloharju, M., 2009. Sensation seeking, overconfidence and trading activity. J. Finance 64 (2), 549–578.

Heath, C., Tversky, A., 1991. Preference and belief: ambiguity and competence in choice under uncertainty. J. Risk Uncertainty 4 (1), 5–28.

Hirshleifer, D., Luo, G., 2001. On the survival of overconfident traders in a competitive securities market. J. Financ. Markets 4 (1), 73–84.

Juslin, P., 1994. The overconfidence phenomenon as a consequence of informal experimenter-guided selection of Almanac Items. Organ. Behav. Hum. Decis. Process. 57 (2), 226–246.

Kahneman, D., Tversky, A., 1972. Subjective probability: a judgment of representativeness. Cogn. Psychol. 3 (3), 430–454.

Kahneman, D., Tversky, A., 1973. On the psychology of prediction. Cogn. Psychol. Rev. 80 (4), 237–251.

Kahneman, D., Tversky, A., 1979. Prospect theory: an analysis of decision under risk. Econometrica 47 (2), 263–291.

Kirchler, E., Maciejovsky, B., 2002. Simultaneous over and underconfidence: evidence from experimental asset markets. J. Risk Uncertain. 25 (1), 65–85.

Korniotis, G., Kumar, A., 2011. Do older investors make better investment decisions? Rev. Econ. Stat. 93 (1), 244–265.

Lichtenstein, S., Fischhoff, B., Philips, L., 1982. Calibration of probabilities: the state of the art to 1980. In: Kahneman, D., Slovic, P., Tversky (Eds.), Judgment Under Uncertainty: Heuristics and Biases. Cambridge University Press, Cambridge.

Linnainmaa, J., 2011. Why do (some) households trade so much? Rev. Financ. Studies 24 (5), 1630–1666.

Lundeberg, M., Fox, P., Punccohar, J., 1994. Highly confident but wrong: gender differences and similarities in confidence judgments. J. Educ. Psychol. 86 (1), 114–121.

Meehan, A., Overton, W., 1986. Gender differences for success and performance on piagetian spatial tasks. Memill Palmer Q. 32 (4), 427–441.

Menkhoff, L., Schmeling, M., Schmidt, U., 2013. Overconfidence, experience and professionalism: an experimental study. J. Econ. Behav. Org. 86 (1), 92–101.

Odean, T., 1998. Volume, volatility, price and profit when all traders are above average. J. Finance 53 (6), 1887–1934.

Shiller, R., 1987. Investor Behaviour in the October 1987 Stock Market Crash: Survey Evidence, National Bureau of Economics Research, Working Paper No. 2446, Cambridge, Massachusetts.

Siegel, J., 1992. Equity risk premia, corporate profits forecast and investor sentiment around the stock crash of October 1987. J. Bus. 65 (4), 557–570.

Skata, D., 2008. Overconfidence in psychology and finance—an interdisciplinary literature review. Financ. Markets Inst. 4, 33–50.

Taylor, S., Brown, J., 1988. Illusion and well-being: a social psychological perspective on mental health. Psychol. Bull. 103 (2), 193–210.