The patterns of prediction, trade, and transfer of wealth from overconfident investors in the capital market: a case study in an experimental setting

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Abstract: Previous research demonstrates that investors classified as overconfident tend to make more prediction errors and trade at higher volumes than rational investors in the capital market, with the outcome of suffering greater trading losses. The current experimental research is presented here with the aim of further exploring these issues. According to its methodology, participants are classified into three groups based on their score of overconfidence: moderate, more overconfident, and less overconfident investors. The results of the current study demonstrate that the more overconfident investors committed more frequent prediction errors and traded in higher volumes in all markets than the less overconfident ones; and further, that this led to losses, except when the majority of all market players suffered from overconfidence due to bad news.

Keywords: overconfidence; self-deception; excessive trading; profit and loss.

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1 Introduction

The results of previous psychological research suggest quite convincingly that people are not always rational. Instead, as this research concludes, they are inclined toward various types of behavioural biases, which lead them to make errors in cognitive judgement. The specific bias that the current research focuses on is overconfidence. Psychologists have concluded that overconfidence frequently causes people to overestimate their knowledge, underestimate risks and exaggerate their ability to control events, and it is one of the most strongly documented behavioural biases. In their summary of the micro foundations of behavioural finance, De Bondt and Thaler (1995) state that overconfidence might be the most robust factor in the psychology of judgement. Psychologists, physicians and nurses, engineers, attorneys, negotiators, entrepreneurs, managers, investment bankers and

market professionals such as securities analysts and economic forecasters all exhibit overconfidence. Surprisingly, Griffin and Tversky (1992) suggest that experts tend to be even more overconfident than relatively inexperienced individuals.

Psychological evidence (Fischhoff et al., 1977; Lichtenstein and Fischhoff, 1977; Lichtenstein et al., 1982) also demonstrates that people who have low levels of knowledge tend to overvalue their beliefs leading to be overconfident. This implies that the lower the level of an individual's knowledge is, the greater the tendency to produce higher errors and the greater the opportunity to be more overconfident. On the other side, contributing psychological studies (Juslin et al., 1999; Klayman et al., 1999; Soll and Klayman, 2004) show that difficult problems involving the uncertainty also result in overconfidence; to the extent that they make more errors than when they are confronted with an easier problem. The interesting point to note in this study is that as securities trading in a capital market generally deals with uncertainty, there should be a group of investors who may be more overconfident than the other groups. Thus, one might conclude that more overconfident investors (MOI) are expected to exhibit higher mean of prediction errors than those who are less overconfident (i.e., more rational), and in fact, there is empirical research confirming this. The failure to minimise prediction errors has put the investors in an unprofitable position (Bloomfield et al., 1999; Kirchler and Maciejovsky, 2002). Other empirical research, however, (DeLong et al., 1990; Gervais and Odean, 2001; Hirshleifer and Luo, 2001) finds that overconfident behaviour does not, in fact, always end with transaction losses. This finding involved different research that does not apply to this current methodology.

Other empirical studies also demonstrate that overconfident behaviour will not only increase prediction errors, but also result in excessive trading volume. At the very least, the overconfident investors trade at a higher volume than rational ones. Both prediction error and excessive trading volume will encounter financial losses as documented by previous research. Odean (1999) suggests that overconfident investors tend to value the accuracy of their information so excessively that they neglect the risks leading to higher prediction error and trading loss. In addition, overconfident investors unconsciously tend to buy and sell securities at excessively high and low prices, respectively, and to perform transactions so frequently, that they subsequently lose money, as confirmed by Tvede (2002). All of these misperceptions, combined with higher commission fees due to higher trading volume, result in net losses from these transactions.

Since trading inherently involves uncertainty, it is suspected that there exists at least, one group of investors who may be referred to as MOI conducting overconfident trading. Meanwhile, Klayman et al. (1999) documented that knowledge level provides a method to classify levels of overconfidence. Therefore, this study uses this classification to examine the effect of the level of overconfidence on the trading activity. Based upon the above information, the issues are thus formulated as follows:

1   Do MOI produce higher prediction or price errors than less overconfident ones?

2   Do MOI trade in higher volumes than less overconfident ones?

3   Will there be transfers of wealth from MOI to less overconfident investors (LOI)?

2 Literature review and hypotheses

2.1 Literature review

According to Hogarth (1994), the most difficult problem when people encounter conditions of uncertainty is deciding the accuracy of predictions about the future. Unfortunately, with the benefit of only limited capability and knowledge, they have to solve these complex and probabilistic problems. Complicating such uncertain situations, they would undertake their decisions based on their level of confidence leading to further risks. Thus, when an increased level of confidence is factored in, the underlying risks will increase substantially.

2.1.1 The relationship between confidence and knowledge level

In dealing with uncertainty, people generally tend to process their decisions based on their level of confidence, here represented by the probability in holding beliefs which are true; whereas the magnitude of probability is determined by the level of knowledge. According to Winkler and Murphy (1968), there is an inverse relationship between the level of knowledge and level of confidence when dealing with uncertainty. People who have a high level of knowledge tend to exhibit a reduced level of confidence in the probability of their beliefs holding to be true. Conversely, those who have a low level of knowledge tend to exhibit an increased level of confidence about this same probability. Klayman et al. (1999) documented that the intersection of this level of knowledge with the level of confidence would determine the resulting level of overconfidence. Therefore, given that the factors contributing to this overconfidence vary among individuals, it may be assumed that the level of overconfidence similarly varies among individuals.

Psychological findings (Griffin and Tversky, 1992; Kahneman and Tversky, 1973, 2001) support the conclusion that the differences among those levels of overconfidence would lead to differences in interpreting and evaluating the same information, thereby producing different solutions. Previous psychological research reaches the same conclusion that overconfident behaviour tends to drive overconfident decision-makers to predict inaccurately to a greater extent than rational ones. This conclusion conforms to the theory of self-deception (Trivers, 2004), which predicts that when decision-makers unconsciously perceive that they possess an above-average capability, their biases will seek out information confirming their assumptions while ignoring or marginalising evidence to the contrary. In this case, the decision-makers are engaging in an insidious, and largely unanalysed form of self-deception. Moreover, people cannot perfectly control external indicators of their internal states, and this in turn leads to selection for the ability to read subtle cues such as facial expression, eye contact, posture, and tone of voice to infer the intentions of other individuals. Following self-deception theory, individuals are designed to exaggerate their positive qualities (e.g., convincing themselves that they are smarter or stronger than they really are), and this zealous belief in self can help to fool others about these qualities.

2.1.2 Overconfident investors in capital markets

Many researchers have elaborated upon overconfident behaviour in capital markets. Daniel and Titman (1999) found that when investors encounter too difficult tasks, with a feedback loop hat works slowly, overconfident behaviour tends to strengthen. In addition, overconfident behaviour reveals itself when the investors have to deal with relatively difficult asset valuation such as that dominated by intangible assets. The more concrete and real the asset is, the less the manifestation overconfident behaviour. Daniel and Titman (1999) further conclude that based on their observation of overconfident behaviour in the period of 1964 to 1997, there is no evidence to support the efficient market hypothesis, and that securities prices seem to be influenced primarily by overconfident behaviour.

According to Raghubir and Das (1999), this overconfident behaviour leads to undervaluation of risk as investors perceive their capabilities and information as superior to those possessed by others. They therefore convince themselves to engage in higher risk transactions, such as trading on newly listed and relatively small securities. Compounding these risks, they often make mistakes in determining the appropriate time to buy and sell the securities, and this trading strategy results in high losses. There is a trend towards selling appreciating securities too early and keeping depreciating securities too long, and this impacts their portfolios in a highly negative fashion; especially given that their securities are usually not well diversified, further magnifying the potential losses.

Odean (1998a) aptly demonstrates how these overconfident investors conduct their trading strategy. The researcher collected data from a discount brokerage house in the period of 1991 to 1996 in order to calculate returns based on trading position. The study examined investor behaviour during that period vis-à-vis the two competing theories which attempt to explain aggregate investor behaviour, namely the theory of rational expectation (Grossman and Stiglitz, 1980) and the theory of overconfidence (Daniel et al., 1998). The former theory predicts that when investors are rational, they will act rationally and not trade excessively, while the latter predicts that the overconfident investors will tend to trade excessively. The results show the aggregate perspective as supporting the later theory, where overconfident investors gain fewer profits than the market returns through trading so carelessly and underestimating the risks to the extent that they unconsciously engage in excessive trading. The expectations of the investors in the study apparently failed to account for the increased commission costs that their excessive trading incurred, and their portfolios suffered as a result.

2.1.3 Excessive trading phenomenon

The phenomenon of excessive trading in this context is expressed as the tendency for overconfident investors to trade too much, meaning that they order and execute their total trading volume at a relatively higher value than that of more rational ones. Their trading volume reflects the value of securities bought and sold at the prevailing market price. Empirical research lends support to the assertion that investors who suffer from overconfidence tend to trade excessively; to an extent greater than they would if they were more rational. Barber and Odean (1999, 2000) argue that the overconfident investors tend to be more actively engaged in their trading activities since they overvalue the accuracy of their own information. Such misperceptions would be stronger when the

information is only partially present and moreover is received late and unpredictably. This process of misperception generates investors who exhibit a tendency towards over and undervaluing securities to their detriment.

Numerous scholars have developed models to describe overconfident behaviour in the capital markets and demonstrate how such behaviour may lead to trading losses. Benos (1998) presents a model in which overconfident investors are inclined to trade too much, while Odean (1998b) develops and compares two models: the rational and the overconfident model of behaviour in the securities market. According to the rational model, since rational investors do better in assessing their expected profits from the trading, they will not make trades if the expected returns from their trading are insufficient to offset the possible costs. Overconfident investors, on the other hand, have unrealistic beliefs about their expected profit, and therefore they may engage in costly trading, even when their expected profits are insufficient to offset the costs of trading, simply because they overestimate the magnitude of expected profits. Other models of overconfidence (Caballe and Sakovic, 1998; Gervais and Odean, 2001) further confirm and lend support to these previous findings.

2.2 Hypotheses

2.2.1 Investor reactions when the market does not provide any information

Psychological research shows that individuals who have low levels of knowledge tend to display overconfident behaviour (Lichtenstein et al., 1982; Fischhoff et al., 1977; Lichtenstein and Fischhoff, 1977). This implies that the lower the level of an individual's knowledge is, the greater the tendency to be more overconfident. Thus, the less informed investors will also be more overconfident, and this research refers to them as just 'more overconfident' throughout the length of the study. Conversely, the higher the level of an individual's knowledge is, the greater the tendency to be less overconfident. Thus, the more informed investors will also be less overconfident, and this research refers to them as just 'less overconfident'. Psychological evidence also demonstrates that people tend to engage in overconfident behaviour when they deal with uncertain conditions, especially when they find that the problem is very difficult (Juslin et al., 1999; Klayman et al., 1999; Soll and Klayman, 2004).

Since securities trading in a capital market deals with uncertainty, there should be a group of investors who may be more overconfident, especially when the market does not provide any information as those in the beginning trading session (i.e., the pre-opening session). Thus, one might conclude that MOI are expected to exhibit higher mean of prediction errors than if they were fully rational, and in fact, there is empirical research confirming this (Bloomfield et al., 1999; Kirchler and Maciejovsky, 2002). In this pre-opening session, all investors possess relatively the same past market information such that no single investor accesses private information or any other market information that would make him better off than someone else. Due to the uncertainty of a trading session like this, all investors predict the securities prices based on their own knowledge levels. MOI who possess relatively lower knowledge, generally exhibit higher levels of prediction error than less overconfident ones. The literature further shows that owing to this overconfidence of the investors, they tend to trade excessively (Barber and Odean, 1999; Odean, 1999). With the above insights, the hypotheses are thus formulated as follows:

Hypothesis 1a   MOI show a higher mean of prediction errors than the less overconfident ones in the pre-opening market.

Hypothesis 1b   MOI trade at higher volumes than the less overconfident ones in the pre-opening market.

Previous authors (Barber and Odean, 2000; Odean, 1999; Raghubir and Das, 1999) show that as the overconfident investors experience trading losses, there is a transfer of wealth from the MOI to the less overconfident ones. The next hypothesis is therefore constructed as follows:

Hypothesis 1c   There is a transfer of wealth from the MOI to the less overconfident ones in the pre-opening market.

2.2.2   *Investor reactions when the market provides good news*

Referring to Kahneman and Tversky (2001, p.416), intuitive predictions are generated according to a simple matching rule: the predicted value is selected so that the standing of the case in the distribution of outcomes matches its standing in the distribution of impressions. In other words, people tend to undertake intuitive prediction by relating the predictability and the distribution of impressions. Therefore, as these two groups of more and less overconfident individuals receive the signal of good news, their respective predicted values will not be accurate. However, the more overconfident individuals will produce a higher mean of price errors than the less overconfident ones. This is further confirmed by the work of previous empirical research (Daniel et al., 1998).

In terms of investor beliefs, De Bondt (1993) argues that investors believe that the flows of income and securities prices do not follow a random walk; here meaning that the future values of securities are influenced by the previous ones. Unfortunately, MOI often undertake biased decisions as they observe consecutive securities prices. As the prices experience a period of increase, they predict that the price will continue to increase in future trading sessions, while also extrapolating the trend of falling prices towards a continuation of decline in the future, although such predictions are obviously not always true. Further empirical research (Bloomfield et al., 1999; Bloomfield and Libby, 1996; Camerer, 1987) concludes that as good news enters into the market, MOI who have relatively lower knowledge will tend to purchase securities at excessively high prices leading to trading losses. Due to this loss incurred, the aggregate market experiences a transfer of wealth from the MOI to the less overconfident ones. The next hypotheses are therefore postulated as follows:

Hypothesis 2a   MOI experience a higher mean of price errors than the less overconfident ones in the presence of good news signals from the market.

Hypothesis 2b   MOI trade at higher volumes than the less overconfident ones in the presence of good news signals from the market.

Hypothesis 2c   The presence of these good news signals results in a transfer of wealth from the MOI to the less overconfident ones.

2.2.3 Investor reactions when the market provides bad news

In support of the inverse argument to the previous section, empirical research (Bloomfield and Libby, 1996) convincingly documents that as bad news enters into the market, all investors expect a reduction in securities prices. The MOI will also usually predict that these prices will continue to decrease in subsequent trading sessions. Since they suffer from overconfidence, they overestimate the accuracy of their information and also tend to overvalue their level of knowledge. This leads them to sell the securities at a lower price and experience a net trading loss (Bloomfield et al., 1999; Camerer, 1987). This transaction loss then results in a transfer of wealth from the MOI to the LOI. With this in mind, the following hypotheses are presented below:

Hypothesis 3a   MOI experience a higher mean of price errors than the less overconfident ones in the presence of bad news from the market.

Hypothesis 3b   MOI trade at higher volumes than the less overconfident ones in the presence of bad news signals from the market.

Hypothesis 3c   The presence of these bad news signals results in a transfer of wealth from the MOI to the LOI.

3   Research method

3.1   Subjects

In the present study, 30 out of 150 students of The Master Program of Science and Management at Gadjah Mada University, Yogyakarta, Indonesia majoring in finance and accounting were randomly selected as artificial investors. These students had each already taken at least one of the following courses: portfolio theory, advanced financial management, and finance seminar. They had no previous experience in any securities trading activities. The selection of the participants conformed to the procedure of the standard test for calibration of confidence, as detailed in the following section.

3.2   Test for calibration of confidence

Overconfident behaviour from a sample set of observations can be measured from the score generated from the level of overconfidence. Following Klayman et al. (1999), anyone who attains a positive score for level of overconfidence can be classified as overconfident. Conversely, those who attain a negative level of overconfidence can be classified as under-confident. This cut-off is very important to accurately distinguish overconfident from under-confident behaviour, in order to mitigate misinterpretation of the data. It was determined that under-confident participants would not participate in the current research since real investors do not exhibit this characteristic. In so ignoring this group of under-confident investors, the goal of the present study involves only observation of overconfident investors. A possible further point of clarification is that the construct of overconfidence is meant to imply something stronger than mere confidence, since it relates to the aspect of knowledge. In other words, when confidence is amplified

by increased knowledge, it will tend towards overconfidence. Therefore, the researcher elected to focus on overconfidence rather than on confidence itself.

In the present experiment, levels of overconfidence of all participants were thoroughly observed. Following the framework of Klayman et al. (1999), the level of overconfidence was observed by conducting a test for the calibration of confidence. Such a test is a standard procedure to observe and measure the level of overconfidence by comparing the average number of correct answers to a series of questions with the average level of confidence of the respective answers based on sets of two-choice questions such as 'Which of these nations has a higher population:

a   China

b   India?'.

The participants were instructed to answer 15 out of 25 sets of questions that were randomly chosen. Specifically, the participants were required to click randomly the numbers of the related questions shown in the screen. Every participant could not observe the questions before he or she had clicked those numbers. Every one was not allowed to change his or her choices after clicking the numbers. For each set of question, participants choose the answer that they thought was more likely to be right and indicated on a scale from 50% to 100%, how sure they were about their answers.

When the average level of confidence was higher than the average of correct answers, that participant was assigned a positive score for overconfidence, and when the average level of confidence was lower than the average of correct answers, the participant was assigned a negative score for overconfidence. As stated above, the current research only deals with participants who attained a positive score for overconfidence. Due to budget as well as laboratory constraints, the experimenter only focused on 30 participants who were classified into three groups based on their level of overconfidence. The first group was labelled as MOI, consisting of ten participants who were randomly selected from the top-level-overconfident ones. In line with Klayman et al. (1999), it was expected that these investors would have the least correct answers among all participants. This relationship was tested to identify whether the deviation between the average confidence across questions for a subject and the number of correct answers, that is the underlying overconfident score, correlates with the number of incorrect answers. The test demonstrates that there is a significant and positive correlation between those two figures at p-value of 0.007. The second group was labelled as LOI, consisting of ten participants who were randomly selected from the bottom-level-overconfident ones. These investors, it was hypothesised, would have the most correct answers among all participants; therefore, they were actually the rational ones. The last group was labelled as moderate investors and which consisted of ten participants who were randomly selected from the middle-level of overconfident ones. All investors in those three groups participated in securities trading to discover the market price of the securities and determine the underlying trading value. However, the performance of moderate investors is excluded from the analysis to achieve the greatest difference.

3.3 The trading

In this current experimental design, all participants were required to join in computerised artificial markets, similar to those used by Bloomfield et al. (1999), and Bloomfield and Libby (1996). The market prices in this research reflected those of the Indonesia Stock Exchange, in which a pre-opening market is implemented to discover the market price that will become the barometer of the expected price of the majority of market players for each trading day. The pre-opening market in this research took place in approximately 4 minutes.

In this research, the participants had to make judgements about the value of the securities based on the financial reports and other available information related to the previous prices of the assigned securities. The research design offered the participants the freedom to choose any approach they deemed effective in predicting the value of the securities. Thus, in each trading session, all participants were required to deliver their orders representing the number of securities they wanted to buy or sell at predicted values. In order to achieve internal validity, the research design applied various controls, as follows:

- There were 12 trading rounds during the day, each of which comprised of three trading sessions, so that the participants would be able to maintain their stamina for the duration of the research sessions. It took around 4 minutes to finish a trading session; therefore approximately 3.5 hours were required to complete all trading sessions.

- Three different securities were randomly selected in each trading session to increase the probability of transactions occurring. Thus, all investors traded those three securities with one another in each trading session to discover the prevailing market prices of the underlying securities one at a time. The prevailing market price basically reflects the aggregate of investor beliefs about what the price should be. Participants would then continue trading in the next trading session to discover the subsequent market values, and so on.

- There were, in total, 36 different kinds of securities available to be randomly allocated into 36 trading sessions of three different securities. All participants had the opportunity to observe and take advantage the prevailing market prices from the previous trading session and other available information to predict the market prices of the securities in the following trading session. However, the participants may not simultaneously buy and sell the same security in any given session. In addition, short selling was not allowed to limit the complexity and isolate other confounding factors.

- The real names of the securities were exchanged with numbers to reduce research bias due to the reputations of the represented companies

- The research design also allowed for the provision of cash motivation to encourage the participants to trade seriously. Participants were informed that three randomly selected participants would receive payment equal to their profits. In addition, all participants also received the same amount of money as a participation fee.

This research design called for asymmetric information in all trading sessions so that there was no single participant who could access any private information that would make him better off than the others. All participants were given the same company financial reports to predict the value of the securities. Given their different levels of overconfidence, though, it was assumed that they would have different predictions of the value of the securities. In other words, since each participant had different levels of knowledge and confidence, a range of predicted values for these securities was expected. Conversely, the MOI, as irrational investors who have less knowledge and higher confidence, are expected to overvalue their knowledge, underestimate risks and exaggerate their ability to control events, with the result of more errors in their respective prediction values. Therefore, they were expected not only to exhibit more frequent price errors but also to engage in more excessive trading, to an extent greater than LOI.

3.4   Treatments

The current research was implemented by applying three different kinds of treatments. The treatments dealt with different kinds of information that entered into the market which might influence the way the investors undertook the trading. Those treatments consisted of the absence of market information, the presence of good news and the presence of bad news. The signals of good news were modelled on previous empirical research designs and consisted of information about repurchases of the securities (Daniel et al., 1998), recommendations from the analysts to buy the securities (Stickel, 1995), the announcement of bonuses for the managers (Teoh et al., 1998), and a profile of a candidate for Finance Minister who seems to be generous to the market (Stickel, 1995). The signals of bad news were also modelled on previous research and consisted of initial public offerings (Daniel et al., 1998), recommendations to sell the securities from the analysts (Stickel, 1995), the failure of the company to avoid or reduce their tax burden (Teoh et al., 1998), and the increasing interest rate for borrowing capital (Stickel, 1995). According to Cook and Campbell (1979), researchers are allowed to implement different treatment towards the same participants with the aim of increasing the number of observations. Such repeated measurement is justified and valid in the event that the experimenter can only access a single population. It was expected that the treatments would manifest different effects on the prediction errors, trading volume, profits and losses to both more overconfident and LOI, as they have different levels of knowledge and confidence.

3.5   Measurements

3.5.1   Variable measurement

The causal relationship examined in the present research is the influence of overconfidence on the trading volume and magnitude of the prediction or price error. Thus, the independent variable in this experiment is the level of overconfidence of all participants in their groups of investors: namely, the MOI, the LOI, and the moderate investors (see Section 3.2). The dependent variables in this experiment are the trading volume and the prediction or price error. The trading volume reflects the value of securities sold or bought at the prevailing market price, nominated in local currency, Indonesian Rupiah (IDR). The value for prediction error reflects how much the predicted

values of the securities deviate from their fundamental values in the pre-opening periods, expressed in the ratio below (Bloomfield et al., 2000), whereas the price error reflects how much the bid/ask prices of the securities deviate from their fundamental values in the main trading periods, expressed into the ratio below. The fundamental prices of all securities are predicted with reference to Bernard (1994). Thus,

$$\text{Prediction error} = \frac{(\text{Predicted value} - \text{Fundamental value})}{\text{Fundamental value}}$$

$$\text{Price error} = \frac{(\text{Bid/ask price} - \text{Fundamental value})}{\text{Fundamental value}}$$

3.5.2 Measurement of profit and loss

The level of accuracy in prediction would determine the accuracy of the prevailing market prices. Both inaccurate prediction values for securities in the pre-opening periods and inaccurate bid/ask prices in the main trading periods would be expected to lead to inaccurate market prices that deviate from their fundamental values. Following Bloomfield et al. (1999), profit or loss of securities trading was measured by how much the market price deviated from its fundamental value. Profit or loss was calculated based on the assumption that capital gain/loss was ignored. Thus, profit or loss was measured by the difference between the prevailing market price and the fundamental one. The profit or loss for any specific security being traded was therefore generated from the following formulae:

- bid order: profit and loss will be generated when prevailing market prices are lower and higher, respectively, than the fundamental one

- ask order: profit and loss will be generated when the prevailing market prices are higher and lower, respectively, than the fundamental one.

4 Results

4.1 Experiment 1: trading activities in pre-opening markets

4.1.1 The presence of prediction errors

In Experiment 1, the investors tended to be overconfident when they entered into the pre-opening market. In this market, all investors possessed insufficient information to beat the market since there was no market information available to support their strategy except closing market prices from the previous trading session and other financial reports of the underlying public companies. Such insufficient information promoted uncertainty, in turn triggering the appearance of overconfident behaviour. Thus, facing such uncertainty, overconfident investors tended to predict the value of the securities based only on their own knowledge and confidence, ignoring other public information. This behaviour guided them to overestimate the precision of their own knowledge and the accuracy of their own information. Table 1 shows the results of the tests of prediction errors of the observed investors dealing with uncertainty in the pre-opening markets.

Table 1   Summary of the test of means of prediction errors in the pre-opening markets

Market condition	The number of observations*		Mean prediction error		Standard deviation		P-value
	MOI**	LOI***	MOI	LOI	MOI	LOI	
A Pre-opening1_1	80	80	–2.947	–2.017	1.349	1.056	0.000
B Pre-opening2_1	80	80	–2.178	–1.797	1.147	0.788	0.042
C Pre-opening3_1	80	80	–2.418	–2.033	1.038	0.971	0.017

Notes: *This paper requires 80 observations in each type of market condition to meet the
normality test using the trimming technique. All of discussions were conducted
based on that sum of observations; **MOI: more overconfident investors;
***LOI: less overconfident investors.

As shown in Table 1, MOI experienced a higher mean of prediction error than the LOI in each of the three pre-opening markets. A T-test for the equality of means shows that the mean difference of prediction errors between those two observed investors in each pre-opening market is significant. This supports the argument that the MOI significantly produce a higher mean of prediction error than the LOI. Those findings reflect that the MOI are engaged in self-deceptive behaviour in these three pre-opening markets, and support Hypothesis 1a.

4.1.2   The examination of trading volume

In these pre-opening markets, the observed investors documented trading volume as reflected in the following Table 2. As is clear in Table 2, the MOI tended to demonstrate a higher mean of trading volume than the LOI. A T-test for the equality of means verifies that the mean difference of trading volume between those two observed investors is significant. This demonstrates that the MOI trade at significantly higher mean volumes than the LOI, and this confirms Hypothesis 1b.

Table 2   Summary of the test of mean trading volume in the pre-opening markets

Type of overconfident investors	The number of observations	Mean trading volume (in IDR*)	Standard deviation	P-value
A More overconfident investors	80	65,462.500	18,166.987	0.000
B Less overconfident investors	80	54,493.438	19,360.034	

Note: *IDR = Indonesian Rupiah, the Indonesian currency

This finding strengthens the evidences that due to overconfidence, the MOI tend to trade excessively or at least execute a higher volume of trades than the less overconfident ones (Odean, 1999; Barber and Odean, 1999, 2000). Figure 1 shows the trading volume of those two groups of investors in the pre-opening markets. As evident in Figure 1, the MOI conducted their transactions at trading volume exceeding those of the LOI in all pre-opening markets except the last one.

Figure 1 Investor trading volumes in the pre-opening markets
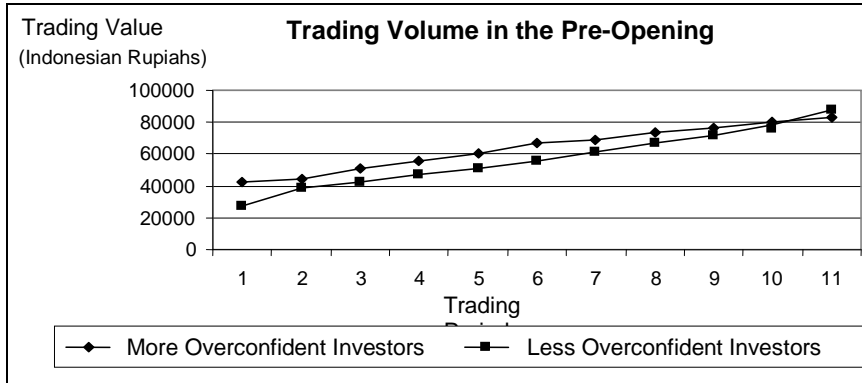
4.1.3 Profits and losses

The next significant finding of the current research regards the profits and losses generated from various strategies of the underlying investors. According to the rules implemented in the Indonesia Stock Exchange, bid orders at the highest price and ask orders at the lowest price will be automatically traded first. The present study documents that MOI tended to deliver their bid orders at a high price and ask orders at a low price. In other words, the MOI tended to buy the securities at a price higher than the fundamental price, and also to sell them at a price lower than their fundamental price, such that this disparity resulted in losses. Table 3 summaries the test of the mean profits and losses generated from the security trading in the pre-opening markets.

Table 3 Summary of the test of mean profits and losses in the pre-opening markets

Type of overconfident investors	The number of observations	Mean profits and losses (in IDR)	Standard deviation	P-value
A More overconfident investors	80	–2,059.600	2,837.329	0.000
B Less overconfident investors	80	–554.700	1,266.622	

As represented in Table 3, due to overconfidence, both groups of more and LOI experienced trading losses. According to a statistical analysis of the results, the T-test for the equality of means demonstrates that the mean difference of profits and losses between those two observed investors is, in fact, significant. Since these two groups of investors statistically experienced different losses, this finding fails to support Hypothesis 1c. There is an interesting corollary that since these two groups of investors experience losses, there may be presumed to exist a third group: namely, moderate investors, who actually profit from the transactions. Given that this group was excluded from the present research, it is difficult to draw firm conclusions, though this might be a possible avenue of future research. This implies that there is a transfer of wealth from the MOI and the LOI to the moderate ones, accordingly.

Figure 2 illustrates that both the MOI and the LOI experience losses from the beginning to the 9th period of trading in those pre-opening markets. In this case, both

groups of investors had the opportunity to buy the securities at a higher price or sell at a lower price than their fundamental price. In the remaining periods, the LOI recorded higher profits than the MOI and then those both groups suffered from losses again during the 12th trading period.

Figure 2   Investor profits and losses in the pre-opening markets
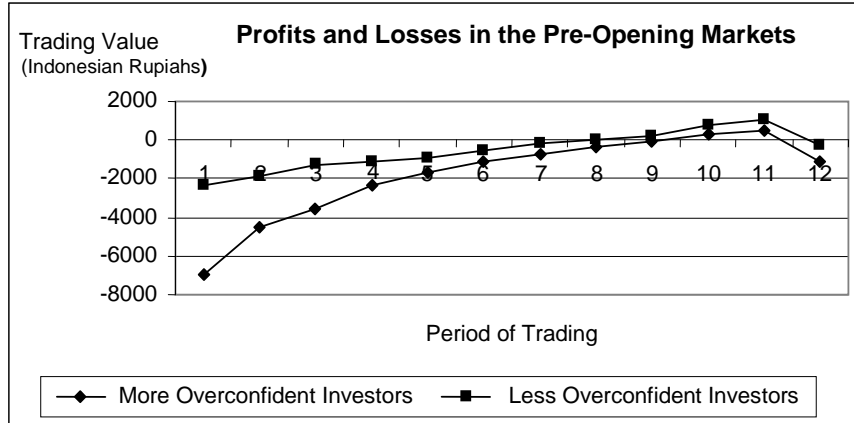
4.2   Experiment 2: trading activities in the presence of good news

4.2.1   The performance of price errors

In this session, all investors received some signals of good news; but since each group of investors possessed a different level of knowledge and confidence, this news was responded to differently. According to Kahneman and Tversky (1973), when people receive good news, they tend to overestimate their predictions; however, the rational investors would still be expected to commit fewer prediction errors than the irrational investors.

It is evident that when the signals of good news enter into the market, the two groups of investors experience different means of price errors, statistically. The MOI achieve a higher mean error in pricing than the LOI (see Table 4). Thus, due to overconfidence, MOI tend to overvalue their knowledge and perceive that they have accurate information and ignore available public information leading to a higher mean error in pricing. This suggests that the MOI engage in self-deceptive behaviour, because they fail to demonstrate that they have the ability to predict accurately. This finding supports previous research by several authors (Bloomfield et al., 1999; Gervais and Odean, 2001; Kirchler and Maciejovsky, 2002) and also supports Hypothesis 2a.

Table 4   Summary of the test of mean price error in the good news periods

| Market condition	The number of observations		Mean price errors		Standard deviation		P-value
	MOI	LOI	MOI	LOI	MOI	LOI	
Good news periods	80	80	–2.890	–2.162	1.758	1.116	0.004

4.2.2 Trading volume

In Experiment 2, all investors received signals of good news in various forms. Previous empirical research (De Bondt, 1993) documents that when observing the presence of a bullish market due to good news, overconfident investors tend to increase their bid prices as well as the volume of securities they want to buy so that they subsequently increase their trading value. This leads them into a false perception that they have a better opportunity to close the transactions and in turn gain profits. Based on the hypothesis of self-deception, investors tend to buy more securities and sell fewer securities in the presence of good news signals. Unfortunately, other finding (Nofsinger, 2002) argues that overconfident investors tend to buy the risky and small capitalisation ones and sell the profitable ones, resulting in an under-diversification of their portfolio.

The present study concludes that the MOI traded in higher volumes than the less overconfident ones due to the signals of good news, as reflected in Table 5. According to the results of a T-test for the equality of means, the mean difference between the trading volumes of those two observed investors is significant. In other words, those two groups of investors traded at significantly different volumes. In this case, the MOI perceived their knowledge to be superior and their information to be more accurate, and thus they responded to the incoming signals of good news with a belief that the market prices of the securities would continue to increase throughout subsequent trading periods. This false belief guided them to trade excessively in order to gain higher profits by delivering orders to buy the securities in numerous quantities at higher prices relative to their fundamental price. Their strategy led to a higher trading volume compared to the LOI, and this finding supports Hypothesis 2b.

Table 5   Summary of the test of means of trading volume in the good news periods

Type of overconfident investors	The number of observations	Mean of trading volume (in IDR)	Standard deviation	P-value
A More overconfident investors	80	149,928.750	67,872.260	0.000
B Less overconfident investors	80	115,466.250	27,174.534	

Figure 3   Investor trading volume in the good news periods
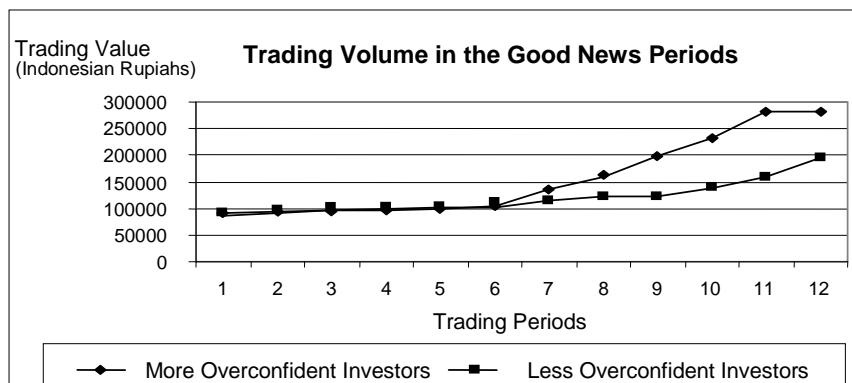
The trading performances of both groups of investors in these good news periods are also presented in Figure 3. As represented in Figure 3, both groups of investors exhibited similar trading volumes from the first through the sixth trading periods, though the MOI tended to outpace their less overconfident peers for the duration of the trading periods. This figure shows that the MOI traded at higher volumes, on average, than the less overconfident ones.

4.2.3 Profits and losses

Previous research has documented that due to an influx of positive news, MOI tend to underestimate risks and trade securities carelessly, leading to transaction losses (Bloomfield et al., 1999; Camerer, 1987), and the present research also supports this conclusion, (see Table 6). As shown in Table 6, the mean profits and losses of the MOI were statistically different from that of the LOI. This demonstrates that in the presence of good news signals, the MOI were inclined to underestimate the risks by delivering the orders to buy the securities at an excessively higher price relative to their fundamental ones, with the predictable result of trading losses. The LOI, however, traded more conservatively, with the realisation of profits as the result. Thus, there was a transfer of wealth from the MOI to the LOI, and this finding supports Hypothesis 2c.

Table 6   Summary of the test of mean profits and loses in the good news periods

Type of overconfident investors		The number of observations	Mean of profit and loss (in IDR)	Standard deviation	P-value
A	More overconfident investors	80	−16,636.100	7,618.117	0.027
B	Less overconfident investors	80	6,557.087	5,345.426	

Figure 4   Investor profits and losses in the good news periods
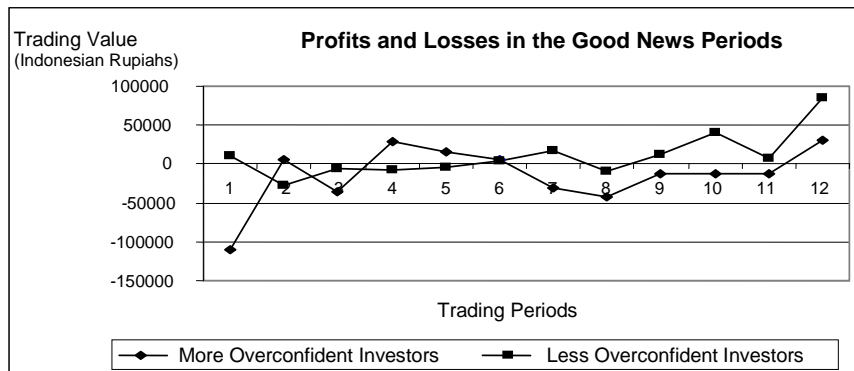
An interesting finding here is that the profits of the LOI are not equal to the losses from the MOI. In light of the argument in Experiment 1, this implies that there may exist a transfer of wealth from the MOI to both the LOI as well as to the moderate investors. Figure 4 represents the profits and losses of the observed investor groups in the presence of good news signals. As highlighted in Figure 4, the LOI performed better than the more

overconfident ones. The LOI gained high profits in the tenth and twelfth periods especially that placed them in the lead of the competition.

4.3 Experiment 3: trading activities in the presence of bad news

4.3.1 The performance of price errors

The current study also demonstrates that in the presence of bad news signals from the market, the two groups of investors showed significantly different mean error in price judgements, as presented in Table 7. The table also clearly shows that the MOI exhibited a higher mean error than the LOI, and this result lends support to Hypothesis 3a.

Table 7   Summary of the test of mean price errors in the bad news periods

| Market condition	The number of observations		Mean of price errors		Standard deviation		P-value
	MOI	LOI	MOI	LOI	MOI	LOI	
Bad news periods	80	80	–2.104	–1.770	0.909	0.751	0.019

4.3.2 Trading volume

In Experiment 3, all investors received the bad news signals in various forms. According to the hypothesis of self-deception, MOI tend to sell numerous securities when they observe the signals of bad news. They generally assume that the bad news will reduce the market price and they believe that the market price will continue to decrease in subsequent periods. Therefore, they are inclined to place their ask orders at a lower price, expecting to sell the securities as soon as possible. Table 8 details the significant difference between trading volumes of the two groups when presented with bad news signals. This demonstrates that the presence of bad news signals engenders an increased trading volume from the MOI vis-à-vis the LOI, and this, in turn, supports Hypothesis 3b.

Table 8   Summary of the test of mean trading volumes in the presence of bad news signals

Type of overconfident investors	The number of observations	Mean of trading volume (in IDR)	Standard deviation	P-value
A More overconfident investors	80	115,814.060	81,179.984	0.000
B Less overconfident investors	80	47,365.625	15,881.095	

The trading performances of both groups of investors in these bad news periods are further analysed in Figure 5. Upon examination of Figure 5, it is clear that the MOI traded in higher volumes than the LOI, with this disparity becoming increasingly pronounced as the trading periods progressed.

Figure 5   Investor trading volume in the presence of bad news signals
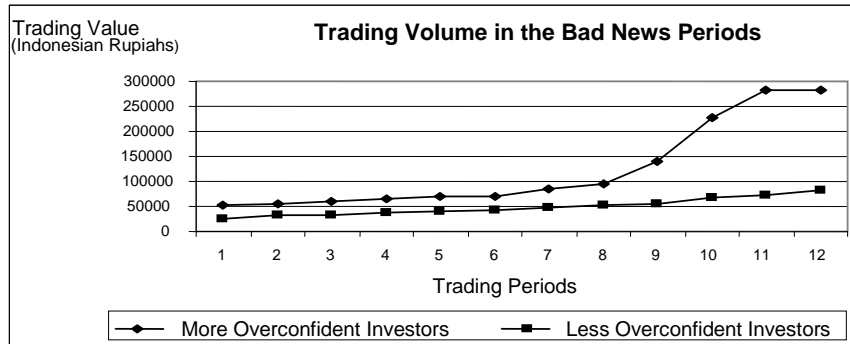

4.3.3 *Profits and losses*

With the benefit of statistical analysis on the attainment of both profits and losses, both investor groups achieved amazing results, since both groups of investors recorded profits, as detailed in Table 9. Both groups of investors enjoyed the same profit, statistically speaking, and this implies a transfer of wealth from the moderate investors to both groups of investors; therefore, this finding does not support Hypothesis 3c. It is interesting that in this case, the moderate investors experience losses, as they may react too slowly when the signals of bad news enter into the market. Previous authors (Camerer et al., 1989) have documented the tendency of moderate investors to spend a lot of time making decisions carefully, and in this manner act cautiously and miss emerging opportunities. Therefore, in light of the current study, it may be posited that the moderate investors have unconsciously surrendered the opportunity to gain profits. Additionally, in a situation where the majority of the market players suffer from overconfidence, the market demonstrates a similarly overconfident market price, and this implies that MOI have an opportunity to profit.

Table 9   Summary of the test of mean profit and loss in the bad news periods

Type of overconfident investors	The number of observations	Mean of profits and losses (in IDR)	Standard deviation	P-value
A More overconfident investors	80	27,663.338	2,443.530	0.633
B Less overconfident investors	80	14,535.788	1,360.957	

Figure 6 reflects the net profits and losses generated from the respective strategies of the observed investor groups. It is evident from Figure 6 that in the earlier bad news periods, both MOI and LOI experienced net losses and the moderate investors experienced net profits. Starting from the middle of the fourth period, both groups of investors experienced net profits, and these profits continued to increase until the end of the trading period; whereas the moderate investors experienced net trading losses. On average, the MOI documented higher net profits than that of the LOI in the presence of bad news signals.

Figure 6 Investor profits and losses in the presence of bad news signals
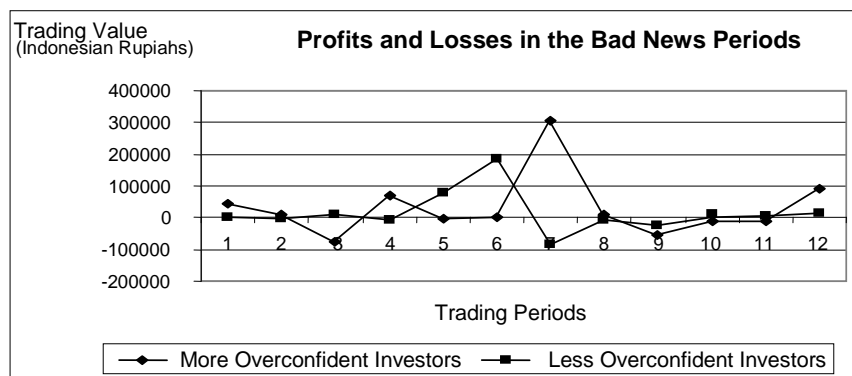
5   Conclusions

This paper focuses on the way that overconfident investors conduct their trading activities in response to the implemented treatments. The results suggest that due to conditions of overconfidence, the MOI tend to demonstrate a higher mean of prediction error and trade in higher volumes than the LOI in all observed markets. In conducting the trading improperly, the MOI experienced trading losses, leading to a transfer of wealth to the moderate investors and the LOI in the pre-opening and good news market periods, respectively. When the majority of market players suffer from overconfidence due to bad news, however, both the MOI and the LOI gained profits while the moderate investors suffered losses.

As the research design of the present study did not allow the investors to use short selling techniques in conducting their trading activities, a suggestion for future research is to explore overconfident behaviour in an experimental setting when short selling is allowed in the interest of comparison with the current results. A further possibility is to involve participants who have previous experience in securities trading as research samples subjects in order to more closely approximate a natural market setting. In doing so, though, it would be advisable to enact controls so that potential extraneous variables remain constant.

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