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# Investment Decision-Making and Hindsight Bias

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## Abstract

We investigated the relationships between investment decision making and hindsight bias. Economic studies consider the agent's foresight perspective only, without taking into account the hindsight bias possible effects in the decision-making process. We studied the subject's overall perceived error by focusing on the causal relations between the estimate and memory errors and by analysing his confidence in estimates and memories, therefore, his meta cognitions. We found strong evidence for the consequences that hindsight bias can have on the investor's portfolio decisions: the portfolio allocation perception and therefore, the risk exposure.

**Keywords:** hindsight bias, decision making, memory, metacognitions.

## 1. Introduction

The approach followed by investors in allocating their money depends on their ability to remember and learn from past experiences. Before choosing how to allocate their money, investors consider many financial data, trying to transform them into useful information.

Classical economic literature assumes that economic agents may perform all these cognitive tasks very efficiently; agents are supposed to perfectly manage and remember all important information they acquire over time without omissions or errors. The standard rational choice theory assumes that investors are able to identify relevant information, to discriminate against irrelevant information, as well as to weigh and process them accurately.

*"The representative investor is assumed to understand the economy and the process determining asset prices; the individual investor frequently does not."* J. M. Keynes.

An intriguing approach to describe and, possibly, explain investment decisions may be the explicit consideration of psychological factors. In our research, we empirically investigate the behaviours of investors by identifying one of the most relevant memory distortion, the hindsight bias. Fischhoff (1975) was the first to study what he called *hindsight bias*; a person's tendency to distort a previous judgement in the direction of the new information after learning the real outcome of a situation or the correct answer to a question. It is based on empirical evidence showing that individuals, after receiving final information,

claim to have "known it all along," (Fischhoff, 1975), that is, once events have passed, they seem more understandable and also more predictable than they seemed at the beginning.

Hindsight and foresight perspectives differ formally in the information that is available to the observer. The hindsightful judge possesses final knowledge, that is, he or she knows what has really happened, in contrast to the foresightful judge.

Economic studies consider the agent's foresight perspective only, without taking into account the hindsight bias possible effects in the decision-making process.

Economic models consider investors as Bayesian decision-makers; they are supposed to be able to update their knowledge by simply acquiring new information. In order to do so, they are expected to clearly recall their original estimates (their priors), no matter the observed final information. Therefore, investors are ideally considered as those economic agents who can recognise their possible estimate errors and, consequently, they can modify their decisions in the future. The "supposed" ability to compare new information to previous expectations is fundamental.

Hindsight bias may compromise this ability so that individuals confuse their prior expectations with the new information. Because of the hindsight bias, investors may suffer from overconfidence because they believe they are better forecasters than they really are.

Our research asks three main questions about the judgemental differences between hindsight and foresight perspectives in investment decision-making:

1. How does the acquisition of final information affect the investor's decisions?
2. What is the "hindsight bias effect" in investment portfolio management?
3. What is the role of metacognitions<sup>1</sup> in decision making?

In order to answer the previous questions, we explored three possible hypotheses in an economic framework:

1. Reporting an outcome occurrence increases its perceived probability of occurrence, as seen by Hawkins and Hastie, whose results have not been fully explored in economics yet (Hawkins & Hastie, 1990).

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<sup>1</sup> Metacognition is the process of thinking about thinking.

2. Hindsight bias induces individuals to be overconfident and to overreact to new information (Camerer, Loewenstein, & Weber, 1989).

3. An individual's high confidence level in their a priori estimates (those made before knowing the outcome information) and a low confidence level in their recalled estimates (those recalled after receiving the outcome information) will induce hindsight bias for the subject (Werth, Strack, & Forster, 2002).

Our study extends Fischhoff's "between subjects" test design in the economics domain by introducing the following new elements:

1. We brought subjects into a simulated real-life investment situation adopting a narrative technique inspired by economic articles.

2. We involved two different kinds of subjects, PhD/Master students in economics and financial managers, in order to investigate the role of expertise on hindsight bias.

3. We analysed hindsight bias by directly collecting both cognitive and metacognitive variables.

4. We analysed the relations between the individuals' psychological attitudes and behavioural tendencies and their hindsight bias.

Our results confirmed the importance of hindsight bias in an economic decision-making context. In particular, we found that the Test-Group investors tended to exhibit hindsight bias once asked to recall their economic predictions (65% of financial managers and 45% of students).

If we consider that the investing activity asks for a long-lasting learning process, we realise the importance of hindsight bias.

Our research was mainly inspired by Werth, Strack, and Forster's (2002) paper "Certainty and Uncertainty: The Two Faces of Hindsight Bias." We adopted a similar approach to assess the participants' hindsight bias;

## 2. Methodology

We collected data from 25 Master and PhD students attending courses in Finance and Economics at Bocconi University and from 35 financial managers from a leading Italian bank. Bank executives were all financial advisors usually assisting private investors. On average they had 3-years experience in investment management.

### 2.1 The instruments

The instruments used in the course of our study consisted of questionnaires and tests. The paper-and-pencil experiment took place at Bocconi University and Unicredit Bank headquarters in Milan. When the subjects arrived, they were seated at tables and separated from each other for the duration of the experiment. They were then given a set of instructions that were read out loud to them after they had the chance to read them individually. Subjects were not informed about the aim of the test. Each experimental session lasted about 40 minutes. Students received on

average €6 in compensation, according to their forecasting and remembering performances.

### 2.2 Experimental Design

The experiment is divided in 2 phases: the estimate and memory phase.

In the first phase participants read a newspaper-like article dealing with an hypothetical economic scenario. They were presented with details on financial markets and invited to take real-world investment decisions.

After that, they were asked to answer two different questionnaires.

#### First Questionnaire

Composed of three different sets of questions it elicited subjects' economic estimates and preferences on several economic variables.

*The first set* of questions investigated subjects' expectations on the future economic developments given the information they were provided within the text. Subjects were therefore invited to estimate the probability for each of the four presented scenarios:

- (i) the economy would develop with low inflation,
- (ii) the economy would develop with high inflation,
- (iii) the economy would stagnate with low inflation and
- (iv) the economy would stagnate with high inflation.

*The second set* of questions asked the subjects to reveal their estimates on future returns from different forms of investments: stocks, bonds and real estate.

*The third set* invited the subject to reveal his preferences on investment allocations.

After each set of questions, subjects were also invited to reveal their level of confidence in each single answer they gave by replying the following question:

"Please write down your confidence level in your previous answer (1=min; 10=Max)."

#### Second Questionnaire

Composed of 62 questions divided into seven sets, they were aimed to investigate investors' personal experience in managing money, their investment goals, strategies, their decision-making approach.

The second part of the experiment, the memory phase, took place two weeks later; participants were randomly divided into two groups, the Test Group and the Control Group, following Fischhoff's "between subjects experimental design".

The two groups members were invited to solve different tasks.

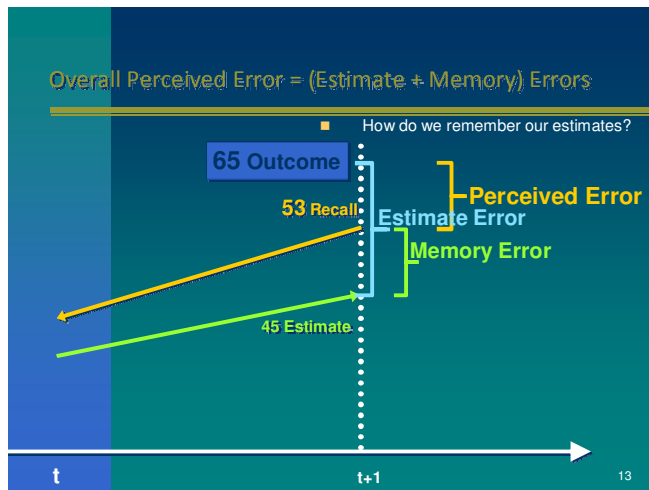
Test-Group subjects had to read the second and final part of the article dealing with the developments of the previously described economy; they received what we called the real *outcome*. Subsequently, they were asked to remember the estimates they gave in the first phase of the test.

Alternatively, Control-Group subjects were simply asked to remember the estimates they gave in the first test phase *without* receiving any further information.

### Dependent Measures

For each group we computed:

1. the estimate error (Est.Err.): the distance between the original estimates and the real outcome;
2. the memory error (Mem.Err.): the distance between the recalled estimates and the originally given answers;
3. the correlation between the two errors;
4. the correlation between the level of confidence in the answers originally provided by the subjects' and their memory errors.



### 3. Test Results

Here we present the correlation between the two types of error, the memory and estimate errors for the 2 populations of examined subjects by considering a “between subjects” analysis:

Within the hindsight biased students:

$$\text{Corr. (Est.Err; Mem.Err.)} = 0.757.$$

Whereas, within the hindsight biased financial managers:

$$\text{Corr. (Est.Err; Mem.Err.)} = 0.921.$$

### Hindsight Bias and Metacognitive Variables

We also analyzed the relations between hindsight bias and metacognitive variables (confidence in estimate,  $C^e$ , and confidence in recall,  $C^r$ ) by calculating a linear regression model. In particular, we tried to find a connection between the overall perceived error, resulting from the interplay of estimate and memory error, and the two metacognitive variables,  $C^e$  and  $C^r$ :

$$M_{t+1}^o = aC^e + bC^r + \varepsilon$$

The statistical support for the above relationship is weak: the adjusted  $r^2$  is just 0.345.<sup>2</sup> However, the signs of the regressor coefficients are as expected. Indeed, the coefficient of  $C^e$  is positive, while the coefficient of  $C^r$  is negative. Therefore, the more confident is the subject in his estimates and the more unconfident is in his memories, the stronger the hindsight bias will be. Once informed about the real outcome, subjects with a high level of confidence in their original estimates and a low level of confidence in their memories perceived the outcome as their own estimate.

### Hindsight Bias and Self-Confidence

In order to investigate the role of the subject's self-confidence, we analysed the connection between his estimate errors and his confidence in the reliability of his estimates, as well as his memory errors and the confidence in his memories. In agreement with the paper “Certainty and Uncertainty: The Two Faces of Hindsight Bias” (Werth, Strack, & Forster, 2002), we expected that the higher the confidence in estimate was, the smaller the estimate error would be. Data show that:

$$\text{Corr. (} C^e \text{; Mem.Err.)} = -0.674$$

$$\text{Corr. (} C^r \text{; Mem.Err.)} = -0.904$$

### Hindsight Bias and Expertise

In order to investigate the interplay between degree of expertise and hindsight bias, we compared the memory errors of the two groups. We noticed that, hindsight bias appeared in 65% of cases for financial managers and in 45% of cases for students.

This result reveals that the financial managers' recalled estimates were more “biased” towards and concentrated around the real outcomes than the students' recalled estimates. By looking at the answers given to the psychological profiling questionnaires, we may find that the motivational incentives to appear “right” were stronger for the financial advisors than for the students, and this may explain the stronger memory distortion for bankers.

### How To Predict Hindsight Bias

In order to identify potential predictors for hindsight bias, we analyzed the relationship between the subjects' answers to the profiling questionnaire and their memory errors.

The hindsight biased average subject appears to be a wise investor, who is informed about financial markets and who collects a lot of information before taking an investment decision. He also cares about long-run revenues and diversifies his investments.

But if we analyse the answers provided by the biased subject to that questionnaire, we realise that he usually reveals relevant contradictions: for example, even if the subject is convinced to be very expert in managing his investments, he describes himself as extremely insecure for

<sup>2</sup> Low  $r^2$  are quite common in the experimental economic literature.

common decisions. Moreover, the observed subjects stated that they do not care about losses in the short run if high revenues can be gained in the long run, but, at the same time, they stated that they strongly prefer safe investments with low revenues. They also revealed to have a good memory, but, at the same time, they also show a low level of confidence in their recalled estimates.

### Hindsight Bias and the Investor's Uncertainty

We considered all these underlying contradictions as a warning factor on the probable existence of hindsight bias for those subjects. Therefore, we designed a specific questionnaire containing a mixed set of similar contents but differently phrased questions in order to detect conflicts on the investment aims.

By calculating what we called "cognitive dissonance index" we transformed an implicit information on the subject's information process into an explicit measure: This has been done by taking into account the number of similar content questions answered in opposite ways and by measuring their distances in terms of scores.<sup>3</sup> We recognized a positive relation between the cognitive dissonance index and the hindsight bias occurrence. Financial advisors may use this index in order to predict and, therefore, avoid their customers' potential hindsight bias effect improving their relation satisfaction and, consequently, their trust in the investment advisor.

### Conclusions

This study presents cognitive explanations for the individual's behaviour in investment decision-making. In order to identify the hindsight bias effect, we analysed subjects overall perceived error by focussing on the causal relations between the estimate and memory errors. We experimentally tested PhD students in economics and financial advisors. We asked participants to forecast economic scenarios and to accordingly decide how to invest their money after reading an article about the state of an hypothetic economy. About half of the students and two thirds of the financial advisors belonging to the Test Groups tended to confuse their original predictions with the information they received at the end of the test, therefore revealing hindsight bias. Hindsight bias was so consistent that it prevented subjects to recognise their estimates errors. On the contrary, and because of that, they revealed overconfidence in their predictions and decisions, showing the "I knew it all along" bias. From an economic perspective, hindsight bias can have significant consequences on the investment behaviour of the average investor because it may alter the perception of his asset allocation and, therefore, his risk exposure.

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<sup>3</sup> See the Model section.

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