

REPRESENTATIVENESS HEURISTICS: A LITERATURE REVIEW OF ITS IMPACTS ON THE QUALITY OF DECISION-MAKING

Jan Bílek, Juraj Nedoma, Michal Jirásek

***Abstract:** The representativeness heuristic is one of the cognitive shortcuts that simplify human decision-making. The simplicity provided by the heuristic brings advantages but also risks arising from a lack of information, leading to cognitive errors and biases. The aim of this study is to identify and evaluate the impact of biases connected to the representativeness heuristic on the quality of economic decision-making. For that purpose, a systematic literature review was conducted, and seventeen empirical studies were analyzed. The review found that the effect of the biases is indeed significant in the real world, namely in the area of business. Most of the studies analyzed the representativeness heuristics in investment and did not prove any strictly negative impact of heuristic decision-making. In fact, under certain circumstances, representativeness heuristics can be recommended. In addition to investment, we covered studies focusing on management, auditing, insurance and consulting. Although these studies show the possible impact of the heuristic on the quality of decision making, it is impossible to form general conclusions due to the lack of research in these fields. Alongside investment, further research into the use of the representativeness heuristics in various settings is recommended as well as research into the possible ways to reduce or even eliminate the negative side effects and biases of the heuristics.*

***Keywords:** Representativeness Heuristics, Systematic Review, Bias, Management, Decision-making*

***JEL Classification:** D21, L20, D70*

Introduction

People often use simple rules to make decisions because they do not have enough time, knowledge, information or cognitive capacity to solve the problem using more sophisticated procedures that would consider all the relevant information. These simple rules of thumb are called heuristics (Tversky and Kahneman, 1974), one of them being representativeness heuristics, which is the subject of this study. The general characteristic of heuristics is that they save resources (attention, effort, etc.) at the expense of accurate decisions. The representativeness heuristics facilitate answers to questions related to the probability of the realization of random events, the future development of variables or the probability that a specific object belongs to a certain group.

The aim of this study is to investigate the impact on the quality of decision making resulting from choosing the representativeness heuristics instead of more rational models. For this purpose, the term representativeness heuristics is analyzed and defined in the Theoretical Background chapter so that it is possible to use it and its related terms in other parts of the study. After that, the study describes the methodology used and the research question which is answered in the Results chapter.

The possible limitations of the study, as well as several suggestions for future research, are discussed in the final part of the study.

1 Theoretical Background

Heuristics are simple models that enable people to quickly find a feasible solution (Hillier and Lieberman, 2001) while ignoring some of the information (Gigerenzer, 2008). Generally, heuristics are easy to understand, use and explain (Katsikopoulos, 2011). An important characteristic of the heuristic approach is that it seeks an acceptable (good enough) solution and not the optimal one which is associated with more complex models of decision-making (Gigerenzer, 2008). In comparison with rational models, heuristic models are advantageous in terms of saving time, information and energy; and in specific cases, they can even be as accurate as ordinary rational models (Robins and Timothy, 1974). On the other hand, heuristics – by their very definition – lead to systematic errors, biases or deviations from the objective value (Tversky and Kahneman, 1974). At this point, it is important to say that the terms heuristics and biases and their relationships are understood differently in the literature (note the famous Rationality Wars – e.g., Samuels, Stich and Bishop, 2002). For this study, heuristics represent a simplified model of decision-making and the bias is a side-effect of using this model.

There are numerous heuristics, with representativeness, availability, anchoring, and adjustment being in the prominent role. The representativeness heuristic can be understood as decision-making based on the relationship between two objects (events, processes). In general, people assign an event Y to the event X based on the degree to which Y is representative of X, i.e. how much it resembles X (Tversky and Kahneman, 1974). For example, people can deduce someone's occupation based on a brief description of the person; they perceive specific attributes that they consider to be representative of a particular occupation or of the people pursuing this occupation. Additionally, when using the representativeness heuristic, people tend to place more importance on the current information and less importance on their overall knowledge (Liu and Du, 2016), which causes deviations from rational decision-making and likely affects the quality of decisions.

The problem with using the representativeness heuristic stems from the use of the interchangeable perception of probability and similarity. This can lead to serious errors as judgments of similarity are influenced by different factors than those that affect judgments of probability (Tversky and Kahneman, 1974). People often think they see patterns in a process which is in reality only random (Luo, 2012), or make decisions based on irrelevant information while ignoring the relevant (Johnson, 1983). For example, Watson (1998) found that management consultants often provide managers with similar solutions and advice even though the clients' problems differ – the problems they have already solved seem to be similar, i.e. representative, to the problems of new clients. However, by doing so, they ignore the importance of the possible differences.

Nevertheless, the representativeness heuristic is not worthless because in some cases it can produce even better (more accurate) results than sophisticated methods (Gigerenzer, 2008). This simple model can be particularly useful in investment and

trading, where it provides better decisions than those made using rational decision-making (Liu, 2016).

2 Methodology

This work is based on systematic review methodology, which can be defined as a method for identifying, evaluating and interpreting all the available research related to a research question (Keele, 2007). As Jesson et al. (2013) recommended, the aim of this work, the research question, keywords, and including/excluding criteria were defined at first.

The aim of this paper is to identify possible biases emerging from decision-making based on representativeness heuristics and the general quality of the results from the use of heuristics. The research is restricted to empirical studies from the field of business. The research question is as follows:

“What are the effects of making decisions using representativeness heuristics in business?”

In accordance with the principles of a systematic review, the search string for the database was chosen as follows: (*"representativeness heuristic" OR "representativeness bias"*) AND *"empirical"*. The search was limited to complete English texts and reviewed articles available on the EBSCOhost database.

The search results contained 77 articles that were further shortlisted. Firstly, their relevancy to the research was assessed based on a review of abstracts. The study excluded articles that were not related to representativeness heuristics as well as those that are only theoretical or not related to business. In total, 13 articles were included during the first stage. Another 17 were set aside as being partially acceptable with the need for further review. In these cases, not only were the abstracts reviewed, but also the methods, discussion and conclusion of the studies. The authors agreed that four additional articles would be included in the research, while the rest of the articles were excluded from the research. The final list of articles reviewed is contained in Tab. 1.

3 Results

Firstly, the study categorized the articles based on biases that emerge from the representativeness heuristics as in Tversky and Kahneman (1974). They defined six possible biases that are considered to be the result of representativeness heuristics:

1. Insensitivity to prior probability of outcome
2. Insensitivity to sample size
3. Misconception of chance
4. Insensitivity to predictability
5. Illusion of validity
6. Misconception of regression

Tab. 1: Studies reviewed

Authors, year	Area: Category (Tversky and Kahneman, 1974)	Methodology	Findings	Impact on quality of decisions	Solution to reduce negative effects
Joyce and Biddle, 1981	Audit: 1	Empirical research, six experiments (182 auditors)	Auditors might use irrelevant information due to representativeness heuristics	Significant, negative	Become aware of relevance of background information
Johnson, 1983	Consulting, audit: 1	Empirical research, experiment (66 students)	Ignoring part of the relevant information when assessing risk of bankruptcy	Negligible	Not proposed
Watson, 1998	Management Consulting: 1	Theoretical review, partially empirical research	Clients' situation seemingly representative for a group of already solved situations; consultations might not be optimal	Negligible	Not proposed
Jamal, 2000	Investment: 4	Empirical research, experiment (computer based heuristic decision making)	Using representativeness heuristics lead to underperformance compared to Bayesian methods; similar performance when representativeness heuristics combined with other heuristics	Significant, positive	Not proposed (assumed to be positive)
Brannon and Carson, 2003	Health Care: 1	Empirical research, experiment (182 students)	Representativeness heuristics are used in health care; disproportional importance is given to additional information; decisions based on simplified algorithms; possible incorrect diagnosis	Significant, negative	Further training and development
Wu et al., 2009	Investment: 4	Empirical research, quantitative methods	Expected overestimation of certain assets due to representativeness heuristics and underestimation due to conservatism; only the latter significant and important	Negligible	Not proposed, left for further research
Luo, 2012	Investment: 1	Empirical research, quantitative methods (financial markets data)	Better results in financial markets when using the representativeness heuristics under defined conditions.	Significant, positive	Not proposed (assumed to be positive)
Banumathy, 2014	Investment: 1, 6	Empirical research, quantitative methods (financial markets data)	Investors disproportionately value previous performance of funds (both negatively and positively)	Significant, rather negative	Not proposed, left for further research
Araghi and Esmacili, 2014	Investment: 1	Empirical research, quantitative methods (financial markets data)	Price and volume during IPOs lead to decision-making based on representativeness heuristics	Significant	Not proposed
Tekce, 2015	Investment: 1, 4	Empirical research, quantitative methods (financial markets data)	Influence of representativeness heuristics not significant; differences in use among various groups of investors (more often among women, old people, less experienced investors)	Negligible	Only general recommendations

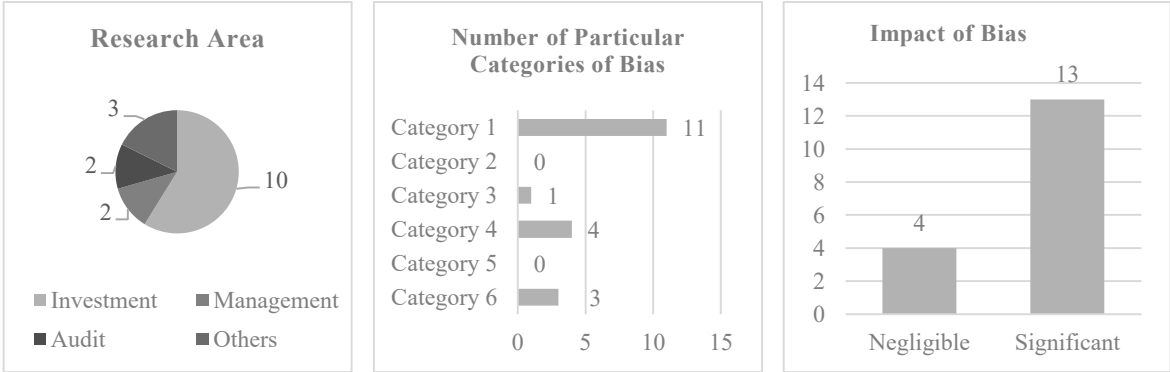
Authors, year	Area: Category (Tversky and Kahneman, 1974)	Methodology	Findings	Impact on quality of decisions	Solution to reduce negative effects
Shane et al., 2015	Investment: 4	Empirical research, experiment	Influence of representativeness heuristics on Technology Licensing Officer (decision on employees' inventions); decision influenced by the assessed person's gender, country of origin, industry experience and ease of working with her or him	Significant	Gaining practical knowledge
Woodland and Woodland, 2015	Investment: 6	Empirical research, quantitative methods (betting data)	Biases in football betting due to decisions based on historical (even less probable) results and ignorance of regression to the mean	Significant, negative	Not proposed
Liu, 2016	Investment: 1	Empirical research, quantitative methods (financial markets data)	Overconfident and heuristic traders have better results than rational traders and create a more stable and efficient market	Significant, positive	Not proposed (assumed to be positive)
Arend et al., 2016	Management: 1	Empirical research, questionnaires and quantitative methods (102 entrepreneurs, 99 executive managers)	Entrepreneurs use heuristic decision-making more often than managers; rate of use of heuristics depends on environmental dynamics, confidence, age and education; decision-making based on representativeness heuristics is beneficial in stable environment and positive risk aversion of an entrepreneur	Significant, positive (under certain circumstances)	Use representativeness heuristics only in stable environments and low risk
Croitoru, 2016	Macroeconomics: 1	Empirical research, quantitative methods (financial markets data)	Natural rate of interest and potential output overestimated in economic expansion due to representativeness heuristics, which causes problems for efficient monetary politics	Significant, negative	Focus on input validity in predictions
Woodland and Woodland, 2016	Investment: 6	Empirical research, quantitative methods (financial markets data)	Similar to Woodland and Woodland (2015) supports the influence of representativeness heuristics and regression to the mean bias in baseball betting	Significant, negative	Not proposed
Jaspersen and Aseervatham, 2017	Insurance industry: 3	Empirical research, experiment (272 participants)	People do not insure for situations that happened recently as they assume that they happen only once over a long time (i.e. they wrongly assess probabilities)	Significant	Not proposed

Source: Authors

As Fig. 1 shows, the majority of empirical articles on representativeness heuristics is in the area of investment, followed by auditing, management, insurance and health care. Regarding the classification of Tversky and Kahneman (1974), see Fig. 1, the category of insensitivity to prior probability of outcome was identified the most often, 11 times (the individual categories were mentioned by the original authors or assigned during the review process). Insensitivity to predictability and misconception of regression were less frequent. The possible reason why illusion of validity (Category 5) is not contained in the research is probably its similarity to insensitivity to

predictability bias (Category 4). Overall, 13 articles support the assumption that the use of representativeness heuristics can have a serious impact on real world decision-making. This impact can be both negative and positive, depending on the decision setting and other factors. Solutions (for the reduction of negative impacts) were only proposed in five studies and, unfortunately, this was often only stated in a general theoretical form.

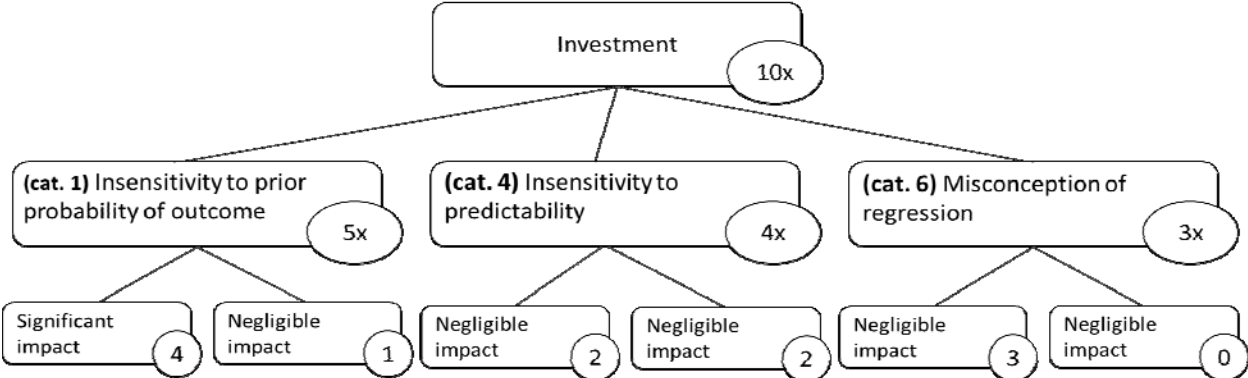
Fig. 1: Number of articles according to area, biases and significance of impact



Source: Authors

Since most of the studies were related to investment (either betting or financial investment), this area was examined in greater detail. The results of the assessment are summarized in Fig. 2. In general, a congruence in the detected biases is observable. In particular, insensitivity to the prior probability of outcome and misconception of regression were considered to be biases with a significant impact (in 80% of the relevant studies for insensitivity to prior probability and in all the studies for misconception of regression).

Fig. 2: Investment Area Analysis



Source: Authors

Only Tekce (2015) stated that insensitivity to prior probability was a bias with negligible impact. Some authors considered insensitivity to prior probability as positive (Liu, 2016; Luo, 2012), and the positive characteristic of this bias was also found by Esmaceli (2014) and Banumathy (2014). Therefore, it can be concluded that if investment decision-making based on representativeness heuristics leads to insensitivity to the prior probability of outcome bias, similar or even better results can be expected in comparison to rational models.

From the studies in which misconception of regression bias was identified, there is the implication that investors make their decisions based on prior results and expect their recurrence in the future, meaning they ignore regression to the mean. This finding is also confirmed by Banumathy (2014), who discourages investors from investing based on previous results. As he stated, past success in investment funds does not always mean success in the future, especially when only a short period is taken into account. Similar results were also obtained in sports-betting studies (Woodland and Woodland, 2015, 2016), where betting on previously successful teams was not confirmed to be profitable. In all cases, the misconception to regression bias was considered to be negative, and therefore it is highly recommended to avoid this bias as much as possible.

Only half of the studies which considered insensitivity to predictability bias reported a significant impact on investment decisions. Taking into account the ambiguity of the results, it is difficult to support the statement that investors are making their decisions based on characteristics which they consider indicators of good investment. Nevertheless, in the studies which support the significant effect of this bias, the impact is not perceived negatively as Jamal (2000) even identified a positive impact and Shane (2015) does not exclude it.

Articles relating to management, auditing and other areas concluded that the effects of biases caused by the use of representativeness heuristics are negative. Almost each study is related to the bias of insensitivity to the prior probability of outcome. An experiment conducted by Johnson (1983) confirmed the statement that people ignore some of the relevant information when deciding about the possibility of a company's bankruptcy, which is in contrast to the other five studies. However, the author also adds the negligible impact in the conditions of the real world.

4 Discussion

The main finding of the research is the fact that most of the authors rate the impact resulting from the use of the representativeness heuristic as significant. Some authors (Liu, 2016; Luo, 2012; Jamal, 2000) argue that the impact is positive, which means that the use of heuristics brings equivalent or even better results than the rational models which consider all the available information and are more detailed and analytically oriented. This fact is in contrast with Tversky and Kahneman's (1974) findings that heuristics-based decision-making leads to systematic errors. However, this thesis can be assumed to be very general and does not deny the possibility that the heuristic model can be valuable in specific cases, an idea which is also supported by Gigerenzer (2008) and Robins and Timothy (2017).

The implications of the previous research for decision-making are particularly useful for stock-market investment. Representativeness heuristics appear to overcome the results of rational decision-making, as particular biases showed positive effects in two out of three cases. However, using representativeness heuristics is recommended only when eliminating the misconception of regression bias, which in all of the studies was related to negative results. Although the authors of the individual studies do not suggest a solution for eliminating this bias, the basic rule is not to make a decision purely on the grounds of previous results and therefore on the expectation that the same results will happen again.

As has already been stated, most of the studies did not offer possible solutions to prevent or at least limit the negative impacts resulting from the biases related to representativeness heuristics. Therefore, further research may explore possible ways of supporting heuristics models, making them more precise and accurate, while maintaining their simplicity. In this context, Jamal (2000) discovered that using a combination of several simple heuristic models can lead to the same results as using Bayesian-based decision making. Further research could also focus on the use of the representativeness heuristics beyond the area of investment, which has already been thoroughly examined. Finally, Johnson's (1983) proposition – to answer the question why some information (so called “base rates”) has still been largely ignored – may benefit our understanding of decision-making.

It is necessary to mention that the findings of this study are limited by the number of studies analysed – after an evaluation of the abstracts and an application of the necessary criteria, only seventeen articles remained. Additionally, most of the authors focused on representativeness heuristics in the area of investment. This is probably due to the availability of data on the financial markets. Therefore, other areas like management or auditing were not analysed in detail in the review, and so it was impossible to draw any detailed conclusions. Considering the limitations of the studies under review, it is important to note that researchers undertaking quantitative studies need to quantify (mathematically define) heuristic decision-making. For example, for this purpose Tekce (2016) used parts of models from different researchers, while changing and reconstructing other parts to create his own model. In this context, the overall consistency of the studies analysed may be questioned. Although the findings from the studies are synthesized in this review, individual findings are based on different methods and approaches, and build on slightly different definitions. Nevertheless, this inconsistency is not considered to be a crucial problem for the review and its implications.

Conclusion

By their definition (ignoring or emphasizing some aspect of the available information), simplified decision-making models, including the representativeness heuristic, lead to systematic errors (biases). However, as this review illustrates, the results from simple decision-making rules do not have to be worse than when using a rational model; it mainly depends on the situation and context.

In the first chapter, the study focused on theoretical concepts and the definition of important terms, while taking into account different perspectives. The methodology described in the second chapter enabled the authors to answer the research question in the results section of the study. The results section consists of an analysis of seventeen empirical studies that were chosen using predefined criteria. The analysis revealed a broad scale of biases and errors that can occur when using the representativeness heuristic. The study then focused on the impact of these biases and investigated whether the impact was positive or negative. At the end of the study, several questions and problems were suggested as topics for future research.

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Contact Address

Ing. Jan Bilek

Masaryk University Faculty of Economics and Administration, Department of Corporate Economy

Lipová, 41a, 602 00, Brno, Czech Republic

Email: 405733@mail.muni.cz

Phone number: +420549491710

Bc. Juraj Nedoma

Masaryk University Faculty of Economics and Administration, Department of Corporate Economy

Lipová, 41a, 602 00, Brno, Czech Republic

Email: 405240@mail.muni.cz

Phone number: +420549491710

Ing. Michal Jirásek

Masaryk University Faculty of Economics and Administration, Department of Corporate Economy

Lipová, 41a, 602 00, Brno, Czech Republic

Email: mijirasek@mail.muni.cz

Phone number: +420549491710

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