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COMPLEX ADAPTIVE BEHAVIOR OF INVESTORS TO MARKET DYNAMICS: A PLS-SEM ANALYSIS

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ABSTRACT

The paper proposes a behavioral model of investment decisions under the Adaptive Market Hypothesis (AMH) in the Moroccan financial market. This model examines the existence of rationality alongside irrational behavioral biases that might affect investors, as well as investors' tendency to adapt to market conditions. The paper uses Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the proposed hypothetical model based on primary data collected from individual and institutional investors active in the Moroccan financial market. The results of the study show that, although investors tend to follow the rational decision-making process, some irrational biases might arise during this process. Specifically, the empirical evidence reveals that during the 'searching information" stage, investors are subjected to the disposition effect. Then, the losses accumulated because of the disposition bias attenuate the overconfidence bias, and prompt investors to correct their perception of risk rationally. Therefore, the findings are consistent with the adaptive investor behavior implied by the AMH theory. Regarding investor type, the study shows that individual and institutional investors are likely to be affected by behavioural biases alike. This study is the first to use a different approach, to empirically test the AMH, based on heterogeneous and adaptive investor behavior using primary data. This approach can provide a more accurate measure of investor behavior dynamics. The study is also the first to use the PLS approach to investigate adaptive investor behavior, both at the level of individual and institutional investors, in the Moroccan context. This study has implications for trading strategies and regulatory policies. Insights from the research make investors aware of their biases, which could help them try to de-bias themselves by complying with certain rational rules. In addition, the study findings suggest that investors can exploit arbitrage opportunities resulting from irrational behavior. Moreover, the results of the study enable policymakers to understand the real behavior of investors and take appropriate regulatory measures to prevent the market from being inefficient and unstable.

Keywords: *Adaptive Market Hypothesis, disposition effect, overconfidence bias*

INTRODUCTION

Market efficiency has long been a major issue for economists. According to the Efficient Market Hypothesis (EMH) (Fama, 1965, 1970), market prices always fully reflect all available information. This theory implies that investors are rational utility-maximizing agents who make investment decisions based on the axioms of Von Neumann and Morgenstern (1944) and Savage (1954). As part of rationality, investors attempt to follow specific logical procedures to make an

investment decision (Judge & Robbins, 2017; Robbins, 2002; Robbins & Judge, 2007). However, it is argued that investor rationality is bounded (Simon, 1982, 1991), because although investors strive to make rational decisions, they are often faced with a lack of relevant information, inadequate time, cognitive limitations, and the complexity of the environment. Accordingly, they forgo the optimal solution in favor of the 'satisficing' solution (March & Simon, 1958). Moreover, proponents of behavioral finance challenge the assumption of the perfect rationality by arguing that many psychological biases can affect investor decision-making and ultimately lead to market inefficiency (Ahmad, 2022; Ahmad et al., 2022; Baker & Ricciardi, 2014; Barberis et al., 1998; Daniel et al., 1998; Kahneman et al., 1982; Kahneman & Tversky, 1982; Koch & Nafziger, 2016;Shefrin & Statman, 1985; Tversky & Kahneman, 1974).They argue that, unlike the EMH theory, behavioral finance can be considered the most comprehensive and relevant framework for investor decision-making.

Empirically, studies on the EMH theory and behavioral finance reached mixed conclusions about the validity of these two paradigms. Indeed, some studies on the EMH confirmed the theory(Fama, 1970; Granger & Morgenstern, 1963; Lock, 2007; Stachowiak, 2004), while others refuted it (Al-Ajmi & Kim, 2012; Asem & Tian, 2010; Bley, 2011; De Bondt & Thaler, 1985; Miloş et al., 2020; Shi & Zhou, 2017; Smith, 2012). Meanwhile, studies focusing on behavioral finance fail to draw robust conclusions on anomalies contradicting the EMH theory. Fama (1998) asserts that these anomalies are not persistent as they disappear once the model, sample, or data frequencies change. Nonetheless, beyond these methodological problems, both the EMH theory and behavioral finance arguments can be considered partially valid and could be reconciled in a paradigm to better explain market behavior. In this perspective, Lo (2004, 2005) proposes the Adaptive Market Hypothesis (AMH) based on an evolutionary approach to economic anomalies. In this dynamic framework, rational and irrational thinking co-exist in an intellectually consistent manner and allow investor behavior to vary and adapt to market conditions. As a result, the market is neither efficient, nor inefficient, but adaptable. The AMH theory therefore implies a much more flexible view of market efficiency, which considers that the degree of market efficiency varies over time according to changing market conditions. Several studies were conducted to examine the AMH theory in different markets and proved its validity (Boya, 2019; Charfeddine & Khediri, 2016; El Oubani, 2022a,b; El Oubani & Lekhal, 2022; Ito et al., 2014; Lekhal & El Oubani, 2020; Okori & Lin, 2021; Phan Tran Trung & Pham Quang, 2019; Shahid et al., 2019; Souza de Souza et al., 2022; Tiwari et al., 2023).

From the AMH perspective, cognitive biases coexist with rationality in investment decisions, and investors tend to adapt to market conditions (Haselton et al., 2015; Mushinada & Veluri, 2019; Sharma & Firoz, 2022). These biases can be relevant mediators and moderators for agent decision-making. Decision biases widely discussed in the literature are the overconfidence bias (Daniel et al., 1998; Odean, 1998a; Mushinada & Veluri, 2018; Zhang et al.,2019) and the disposition effect (Cheng et al., 2013; Da Costa, et al., 2013; Dhar & Zhu, 2006; Frino et al., 2015; Odean, 1998b; Rau, 2014; Sharma & Firoz, 2022; Shefrin & Statman, 1985; Zhang et al., 2022). However, as the AMH theory is still in its infancy, models that include the most relevant behavioral biases need to be developed and validated in different contexts.

The goal of this study is to examine, in the Moroccan context, how rational and irrational behavior might simultaneously influence investor decision-making, as well as how investors tend to adapt to market conditions according to the AMH theory. That is, we examine whether behavioral biases, such as overconfidence and the disposition effect, can arise when investors attempt to follow the rational decision-making process and whether investor behavior adapts to market dynamics. Empirical results show that Moroccan investors try to follow the rational decision-making process, but during the 'information seeking' phase, they might be affected by the disposition bias and hence take excessive risks, which leads them to make suboptimal decisions and incur losses. Then, accumulated losses force them to assess risks rationally and be less overconfident. Thus, the coexistence of rational and irrational thinking in the investment decision

as well as the adaptive behavior of investors to market conditions confirm the AMH theory in the Moroccan context.

We contribute to the existing literature in several ways. First, we develop a new parsimonious conceptual model under the framework of the AMH theory that includes rational decision-making and the most systematic behavioral biases, as well as investors' switching behavior form rational to irrational and vice versa. The validated model provides a robust conclusion in favor of AMH.

Second, our research enriches the literature on the AMH theory by providing a different methodology for studying this theory. Indeed, unlike previous studies on the AMH theory that use secondary data from financial markets and econometric models (Boya, 2019; Charfeddine & Khediri, 2016; El Oubani, 2022a,b; Ito et al., 2014; Lekhal & El Oubani, 2020; Phan Tran Trung & Pham Quang, 2019; Shahid et al., 2019), we use primary data as well as the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach to examine this theory. This can offer a more accurate measure of investor sentiment, as well as an alternative measure of investor behavior dynamics. A few studies used Linear Structural Relationships (LISREL) to examine the AMH theory (Lin, 2011; Mushinada, 2020; Mushinada & Veluri, 2019; Sharma & Firoz, 2022), but no study used the PLS approach, which seems to be more appropriate in this context. In fact, as our objective is to test a new hypothetical model under the framework of the new AMH theory, it is relevant to use the PLS approach, which is more suitable for examining a new theory than the LISREL approach. Additionally, as our hypothetical model is more predictive than confirmatory, the PLS approach is also more relevant to our research context than the LISREL approach.

Third, previous studies on the AMH theory focused primarily on the predictability of returns to examine this theory (for a detailed literature review, see Saldanha et al., 2023). However, in this study, we extend the investigation of the AMH theory to include the examination of heterogeneous and adaptive investor behavior to obtain a more comprehensive picture of the nature of adaptive financial markets.

Fourth, to the best of our knowledge, this is the first study to explore the influence of the disposition effect and the overconfidence bias, both at the level of individual and institutional investors, on the rational decision-making process in the Moroccan financial market.

The reminder is organized as follows. Section 2 presents the literature review and the development of the hypothetical model. Section 3 describes the methods used in the study. Section 4 shows the empirical results. Section 5 discusses the findings. Section 6 highlights the implications of the research. Section 7 concludes.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The AMH theory

This section discusses the AMH theory (Lo, 2004, 2005) as an alternative to the EMH theory (Fama, 1965, 1970). The EMH theory relies on the assumption of perfect investor rationality, which always leads to optimal decisions and thereby to market efficiency. However, empirical evidence shows that financial markets deviate from efficiency, including overreaction, under reaction, high volatility, and return predictability (Daniel et al 1998; De Bondt & Thaler, 1985; Shiller, 1981). These anomalies prompt some scholars to relax the assumption of perfect rationality and to consider behavioural biases in the development of financial models. The AMH theory attempts to reconcile rationality with behavioural biases to provide a theoretical basis for a new financial paradigm that could better model investors' financial decision-making and market efficiency.

The AMH is a new theory based on the Simon's notion of bounded rationality (Simon, 1955) and on an evolutionary perspective in which heuristics emerge, mutate, thrive, and disappear according to market conditions. In this advanced theory, agents are regarded as not perfectly, but rather boundedly rational or 'satisficers', and must learn and adapt to improve their capacities to survive in the dynamic market (Li et al., 2021). The primary components of the AMH theory are: (i) individuals act in their own self-interest; (ii) individuals make mistakes; (3) individuals learn and adapt to different environments; (iv) competition drives adaptation and innovation; (v) nature selection shapes market ecology; and (vi) evolution determines market dynamics.

The central point of the AMH theory is that people are generally rational but can switch to irrationality and vice versa as an adaptive response to changing market conditions, which involves the variation in the degree of market efficiency over time. Empirically, the AMH theory isoften tested by examining whether the predictability of returns is time-varying or not. A growing number of studies documented evidence for the AMH theory in the markets examined (El Oubani, 2022[a,b]; El Oubani & Lekhal, 2022; Ito et al., 2016; Lekhal & El Oubani, 2020; Phan Tran Trung & Pham Quang 2019; Shahid et al., 2019). Shahid et al. (2019) examined the AMH in the Pakistan stock market over the period 1992–2015 and found that the predictability of returns varies over time depending on some market conditions. In the Vietnamese financial market, Phan Tran Trung and Pham Quang (2019) conducted linear and non-linear tests based on the weekly returns from January 2005 to February 2019. They found that the predictability of returns is time-varying, which confirms the AMH theory. Based on linear and nonlinear tests, as well as the evolution of momentum-based trading strategies effect, Lekhal and El Oubani (2020) found that the degree of market efficiency varies over time with a tendency towards improvement in market efficiency. In addition, they found that the momentum profits evolve over time depending on the degree of market efficiency and certain market conditions. El Oubani and Lekhal (2022) proposed an agent-based model that validates the AMH theoryin developed and emerging financial markets. Ito et al. (2016) revealed that the degree of market efficiency in the US stock market is time-varying and event-dependent. Souza de Souzaet et al. (2022) indicate that the efficiency of financial firms' securities adapts to institutional factors, which confirms the AMH theory in the Brazilian financial market. Okorie and Lin (2021) reported that the COVID-19 pandemic has a significant influence on the degree of market efficiency in the four most impacted economies (the U.S., Brazil, India, and Russia). The study by Bosnjak (2023) also confirmed the AMH theory in the Croatian stock market, as the empirical findings support the time-varying nature of stock market. The same conclusion was reached by Aleknevičienė et al. (2022) in the Baltic stock markets. Bassiouny (2023) found that markets evolve between periods of efficiency and inefficiency, which corroborates the AMH framework.

However, the studies mentioned earlier focused mainly on the predictability of returns, neglecting other aspects of the AMH theory. Therefore, we extend the methodology to incorporate heterogeneous and adaptive investor behavior, which is an important implication of the AMH theory. Furthermore, because the AMH theory is still in its infancy, models need to be developed under the AMH framework to achieve an integrating theory that can challenge the EMH theory. Thus, we develop a new conceptual model under the AMH framework, which incorporates bounded rationality and systematic behavioral biases, to test the robustness of the AMH theory as a framework for explaining financial decision-making. Our conceptual model allows for direct testing of the AMH theory by exploring the existence of heterogeneous and adaptive investor behaviour. This model tests the following general hypothesis:

General hypothesis: Investors simultaneously exhibit rational and irrational behavior and adapt to market dynamics.

The following sections outline the constructs of our hypothetical model and the specific hypotheses.

Rational decision-making

Rational theory assumes that investors follow a logical procedure to reach an optimal solution to a given problem (Daft, 2004; Gianakis, 2004; Judge & Robbins, 2017; Osland et al., 2006;Robbins, 2002; Robbins & Judge, 2007).Rational Models with different logical steps were developed to describe the process of rational decision-making. Mintzberg et al. (1976) proposed a rational model with three elementary phases, namely, identification, development, and selection. Identification involves determining the nature of a problem and gathering relevant information. The development stage implies the search for essential information and problem-solving methods. The selection phase indicates recognizing a problem and evaluating alternative solutions to make an optimal choice.

Our proposed model used the modified Mintzberg et al. (1976) model (Lin, 2011; Mushinada, 2020) to test investor rationality. This model consists of three phases, namely, demand identification, searching information, and evaluating alternatives. We assume that an investor tends to follow these steps logically when making investment decisions. Thus, based on the model of Mintzberg et al. (1976), we test whether Moroccan investors follow the logical stages of the rational decision-making process or not. Hence, we formulate the following specific hypotheses:

H1: Once the investor has identified his demand (decision problem), he moves on to the next step, which is the search for information.

H2: After gathering the necessary information, the investor evaluates the alternatives to make the best investment decision.

Nevertheless, it is recognized that, although trading decisions comply with the rational decision-making process, psychological biases might exist in the minds of investors according to behavioral finance theory (Lin, 2011; Mushinada, 2020; Mushinada & valuri, 2019; Sharma & Firoz, 2022). Behavioral finance theory (Kahneman & Tversky, 1974), which considers cognitive constraints (De Bondt, 2010) and recognizes the concept of bounded rationality (Simon, 1957; 1982), could be considered the most comprehensive and relevant framework for investor decision-making (Batra & Kumar, 2018).

Because of cognitive constraints, investors invoke heuristics to decide when to stop their search for information. Tversky and Kahneman (1974) argue that individuals rely on simple heuristics that cause systematic biases and errors in decision-making. Accordingly, Kahneman and Tversky (1979) proposed the prospect theory, as an alternative to the expected utility theory. The key element of prospect theory is an S-shaped value function that is concave in the domain of gains and convex in the domain of losses, which means that individuals tend to be risk averse when they make gains and risk seeking when facing losses. Consequently, investors drive their actual decision-making away from rationality.

Building on the impact of human psychology on decision-making, some behavioral models were developed to model the actual investment decision-making. For instance, Daniel et al. (1998) developed a model, based on overconfidence and self-attribution biases, that involves under reaction to public information and overreaction to private information. Price dynamics resulted from this model reproduce the general short run momentum and long run reversal. Therefore, Behavioral finance might explain the psychological principles of investment decision-making (Kapoor & Prosad, 2017), as well as the psychological implications for financial markets (Paule-Vianez et al., 2020).

Empirically, several studies document that individuals are not perfectly rational and that behavioral biases might influence the rationality of investors. Farhana and Jannatul (2023) found that Bangladeshi investors are not rational due to the significant influence of different behavioral biases on investors' investment decisions. Sharma and Firoz (2022) reported that behavioral biases are significantly related to investor rationality and negatively affect rational decision-

making. Kumar and Goyal (2016) found that, although investors follow the rational decision-making process in their investment decision, behavioral biases appear at different phases of this process.

Systematic behavioral biases

Empirical evidence revealed that investors do not always act rationally, and that behavioral biases are significantly related to investment decisions (Ahmad & Wu 2023; Bakar & Yi, 2016; Baker et al., 2019; Bhatia et al., 2020). These biases can lead to irrational decisions and have a negative impact on financial markets (Barberis & Xiong, 2009) and investor performance (Ahmad & Wu 2023). Barber and Odean (1999) highlight two common mistakes made by investors:(i) excessive trading caused by overconfidence, and(ii) the tendency to disproportionately hold on to losing investments while selling winners, which is caused by the disposition effect. We therefore include these two biases in our hypothetical model.

Disposition effect

Disposition bias (Shefrin & Statman, 1985), one of the most documented investor biases in the behavioral finance literature, is considered a typical decision bias among investors in financial markets (Li et al., 2021) and affects both institutional and individual investors (Locke & Mann, 2005; Odean, 1998b; Shu et al., 2005; Van Dooren & Galema, 2018). It indicates the tendency to sell winning assets quickly and hold on to losing assets for a long time. This bias is a direct implication of prospect theory, mental accounting, the regret effect, and self-control (Shefrin & Statman, 1985). Several empirical studies confirmed the existence of this bias in different markets (Andreu et al., 2020; Barber et al., 2007; Bharandev & Rao, 2019; Breitmayer et al., 2019; Feng & Seasholes, 2005; Grinblatt & Titman, 1992; Li et al., 2021; Odean, 1998b; Shapira & Venezia, 2001; Sharma& Firoz 2022; Weber & Camerer, 1998; Zhang et al., 2022).Barber et al. (2007) analyzed all trading activities on the Taiwanese financial market for five years and found that, overall, investors are more likely to sell winners at a faster rate than losers. Weber and Camerer (1998) conducted an experiment to test whether subjects exhibit the disposition bias and reported that, contrary to Bayesian optimization, people do tend to sell winners and keep losers, proving the existence of the disposition effect. Analyzing the trading records of 10000 accounts at a large discount brokerage house, Odean (1998b) found that investors have a strong preference for realizing winners over losers, and that this behavior is not explained by rational factors. Zhang et al. (2022) offered evidence that the disposition effect exists among Chinese retail investors, which is consistent with prior study by Li et al. (2021). Muhl and Talpsepp (2018) showed that investors are prone to the disposition bias under both bull and bear market conditions. Bouteska and Regaieg (2018) highlighted the existence of the disposition bias across different groups of Tunisian investors and found that this effect is more pronounced in bull markets.

The disposition effect adversely affects an investor's rational decision-making. Sharma and Firoz (2022) revealed that the disposition effect has a strong influence on investor rationality and affects their investment decisions, which is consistent with other studies (Andreu et al., 2020; Haryanto et al., 2020; Prosad et al., 2017). However, some studies argue that the magnitude of the disposition effect varies across countries due to cultural differences (Breitmayer et al., 2019), social interactions (Heimer, 2016), and different market conditions (Lee et al., 2013). Therefore, it is of great importance to study the disposition effect in different contexts.

Given its indisputability, the disposition effect might arise even if investors tend to follow the rational decision-making process. Accordingly, we test whether the disposition effect occurs during the phases of the rational decision-making process. Thus, we predict:

H3: The disposition bias exists in the minds of investors and might appear during the phases of the rational decision-making process.

This hypothesis is divided into three sub-hypotheses:

H3.1: The disposition bias can arise during the 'demand identification' phase.
H3.2: The disposition bias can arise during the 'searching information' phase.
H3.3: The disposition bias can arise during the 'evaluating alternatives' phase.

Overconfidence bias

Another common and systematic bias affecting people's decision-making is the overconfidence bias (Daniel et al., 1998; Gervais & Odean, 2001; Odean, 1998a; Prosad et al., 2017). De Bondt and Thaler (1985) affirmed that people's overconfidence may be the most robust outcome in judgment psychology. The overconfidence bias suggests that investors systematically underweight publicly available information and overweight their private information (Daniel et al., 1998). Overconfident investors overestimate their abilities, knowledge, and future expectations (Odean, 1998a,b), which leads them to increase their investment decisions (Metawa et al., 2019). The idea that this bias is considered dominant can be explained by the fact that it is reinforced by other behavioral biases, particularly the self-attribution bias (Chuang & Lee, 2006; Daniel et al., 1998; Hirshleifer, 2001; Li, 2010; Mishra & Metilda, 2015; Mushinada and veluri, 2019; Statman et al., 2006).

Many studies showed that overconfidence is closely related to investor rationality (Lin 2011; Mushinada 2020; Mushinada & Vuleri, 2019; Sharma & Firoz, 2022) and significantly affects investment decision-making (Metawa et al., 2019).It can therefore explain trading volume and excessive market volatility (Chuang & Lee, 2006; Darrat et al., 2007; Gervais & Odean, 2001; Griffin et al., 2007;Kuranchie-Pong& Forson, 2022; Mushinada & Veluri, 2018; Statman et al., 2006). Nevertheless, overconfidence can lead investors to underperform. Indeed, by exposing themselves to excessive risk and engaging more in trading (Daniel & Hirshleifer, 2015), overconfident traders are most often unable to obtain higher returns (Zhang et al., 2019).

Despite the universality of overconfidence bias, cultural differences tend to intensify or dampen it (Chuang and Lee, 2006; Chui et al., 2010; Heine & Hamamura, 2007; Hofstede, 2001). Consequently, it is relevant to examine the overconfidence bias in a different context, such as the Moroccan financial market.

As the overconfidence bias is considered dominant and ubiquitous across different investor groups, we expect this bias to emerge although investors attempt to follow the rational decision-making process. The following hypotheses are therefore constructed:

H4: The overconfidence bias can emerge during the phases of the rational decision-making process.

This hypothesis is divided into three sub-hypotheses:

H4.1: The overconfidence bias might emerge during the 'demand identification' phase.
H4.2: The overconfidence bias might emerge during the 'searching information' phase.
H4.3: The overconfidence bias might emerge during the 'evaluating alternatives' phase.

Adaptive decision-making behavior

Behavioral finance identifies many psychological biases that exist in the minds of investors and cause them to act irrationally. The previous sections reviewed the most common biases, namely the overconfidence bias and the disposition effect, and showed that these biases might arise despite investors attempting to follow the rational decision-making process. However, it is argued that these biases are not simply irrationalities but rather systematic adaptations (Haselton

et al., 2015). Indeed, behavioral biases are not time-invariant; they emerge, mutate, and disappear in response to market conditions, according to the AMH theory. Therefore, the goal of this study is to examine the relationship between rationality, overconfidence, and the disposition effect in a dynamic setting. The overconfidence bias and the disposition effect, which might emerge from the rational decision-making process, can influence each other (Ho, 2011; Trejos et al., 2019) trough risk perception (Abul, 2019; Awais et al., 2016; Dominic & Gupta, 2020; Holzmeister et al., 2020; Ishfaq et al., 2017), and thereby lead to a rational or irrational decision depending on past returns. Ho (2011) revealed that the disposition effect is explained by the level of overconfidence, the higher the overconfidence of investors, the greater the disposition effect (Kadous et al., 2014). This is because positive returns make investors overconfident in their initial stock selection, leading them to take excessive risks and be reluctant to sell losers because of the disposition effect. In this case, investors might perform poorly (Odean, 1998b; Sharma & Firoz, 2022; Zhang et al., 2019). Nonetheless, when losses become large, investors become less overconfident and rationally evaluate risk to avoid accumulating losses. In this way, investors move from rationality to irrationality and vice versa, depending on market conditions.

This switching behavior can be explained by the AMH theory, which states that investor behavior evolves depending on market conditions. Indeed, investors try to be rational in their decision-making, but might fall into irrationality because of behavioral biases such as the disposition effect and the overconfidence bias, which might cause losses. Nevertheless, by accumulating losses due to the disposition bias, investors correct their perception of risk, which reduces their overconfidence and forces them to become rational again. Investors therefore adapt to changing market conditions. Accordingly, we test the following hypothesis:

H5: Investors are subject to behavioral biases during the rational decision-making process, but poor performance, caused by the disposition effect, leads them to be less overconfident and thus to act rationally.

Moderating effect of investor type

An interesting question is whether psychological biases are more likely to affect individual investors than professional investors or not. Comparing the overconfidence of individual investors with that of professional investors, some studies suggest that individual investors are more overconfident in their perceived information and abilities than professional investors (Barber & Odean, 2000; Benartzi & Thaler, 1995; Chuang & Susmel, 2011; Gervais & Odean, 2001; Liu, 2016; Odean, 1998b).However, Lai et al. (2013) provided evidence that both retail and institutional investors are overconfident during bull and bear markets. Similarly, Jaiyeoba et al. (2020) found that the difference in the level of overconfidence between retail and institutional investors is insignificant in Malaysia.

With respect to the disposition bias, Feng and Seasholes (2005) and Barber et al. (2007) found that professional investors are less affected by this bias than individual investors. Kahya and Ekinci (2022) concluded that the disposition effect is prevalent for all types of investors, but less so for institutional investors. Talpsepp (2011) showed that individual investors are more prone to disposition bias than institutional investors. Da Costa et al. (2013) found that more experienced investors have a lower disposition effect. In addition, Dharma and Koesrindartoto (2018) affirmed that the disposition effect exists in Indonesia, but it can be reverted bystimulating personal responsibility. Nevertheless, Razen et al. (2020) reported that professional investors hold on to losing stocks more eagerly than non-professional investors.

As previous studies are therefore inconclusive, results might depend on the context of the study. Consequently, we introduce the type of investor (individual *vs.* institutional) as a moderating variable in our model in order to examine this question in the Moroccan context. Thus, we test the following hypothesis:

H6: The type of investor (individual vs. institutional) can moderate the relationship between the stages of the rational decision-making process and behavioral biases.

The constructed hypotheses allow us to design our conceptual model.

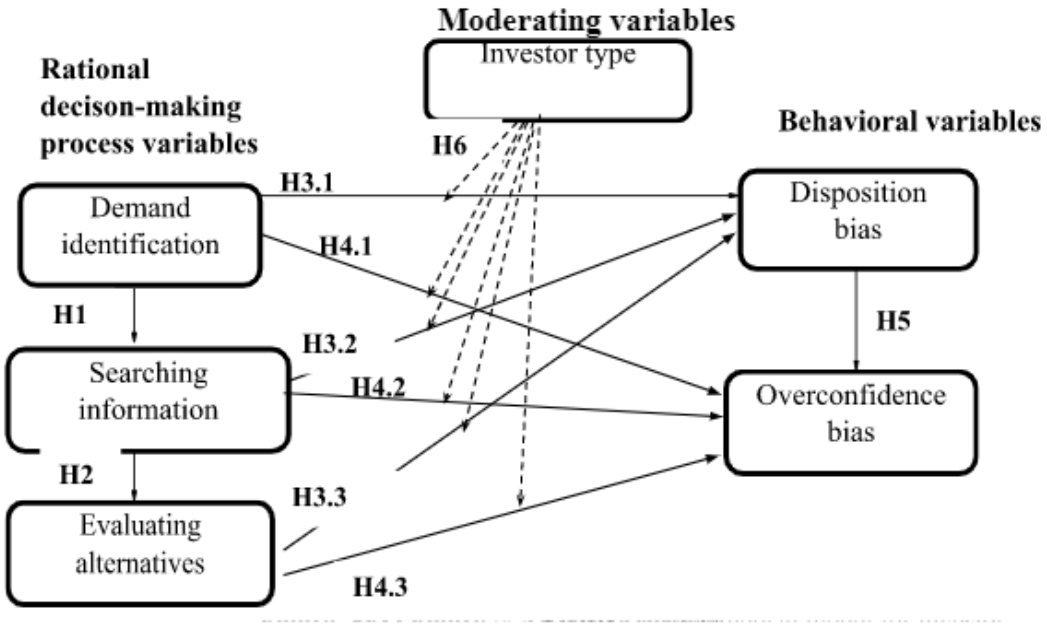

Figure 1.. Hypothetical model for investor decision-making

METHODS

This study attempts to investigate the AMH theory via examining whether investors simultaneously possess complex rational and irrational thinking logics in their investment decisions, and whether they tend to adapt to market conditions. To this end, we perform a cross-section analysis using the Partial Least Squares approach to Structural Equation Modeling (PLS-SEM) that constructs a comprehensive path associating the rational decision-making process and cognitive biases. The PLS-SEM approach allows us to simultaneously examine the relationships between different latent variables.

Sample

This paper used primary data collected by structured questionnaire from experienced individual and institutional investors active on the Moroccan stock exchange. The questionnaire was designed to capture data regarding investor rationality and behavioral biases. The data were collected over two different periods, from September 2020 to November 2020, and then in May 2023. The sample comprises 114 respondents, including 35 institutional investors. The 10-times rule proposed by Barclay et al. (1995), widely accepted in the PLS-SEM literature (Memon et al., 2020), recommends that the sample size should be equal to ten times the largest number of formative indicators employed to measure one latent variable (Hair et al., 2017). Following this rule, the calculated minimum sample size is 40. This study used 114 valid responses, which is sufficient to obtain reliable results (Hair et al., 1998), especially as we propose a parsimonious

model (Kline, 2005). Both individual and institutional investors were selected to ensure a representative sample.

Questionnaire

The primary data used to examine investor decision behavior were collected by structured questionnaire. The questionnaire is based on 12 items constructed on the basis of a literature review of psychological, theoretical, and empirical studies (Daniel et al., 1998; Gervais & Odean, 2001; Kahneman & Tversky, 1979; Lin, 2011; Mushinada, 2020; Mushinada &Vuleri, 2019; Shefrin & Statman, 1985). The items are designed for three phases of the rational decision-making process and two behavioral biases, namely the overconfidence bias and the disposition effect. The first part identifies the type of investor (individual *vs.* institutional). The second part includes the three stages of the rational decision-making process based on the model of Mintzberg et al. (1976), which offers a parsimonious model for conceptualizing the rational decision-making procedure in the hypothesized model (Lin, 2011). The three stages modified from the model of Mintzberg et al. (1976)are: demand identification, searching information, and evaluating alternatives. Each stage represents a latent variable measured by 2-4 items. The third part deals with two behavioral biases, namely the overconfidence bias and the disposition effect. Each bias is regarded as a latent variable measured by 1-4 items. Apart from the items in the first part, which are nominal variables, all items adopt six-point Likert-type scales ranging from "strongly disagree" to "strongly agree".

As an important data collection instrument, the questionnaire must be valid. Therefore, we need to ensure the reliability and validity of our questionnaire. To guarantee the content-related validity of the items, the questionnaire was reviewed by three academic experts in language and communication, two institutional investors, and four individual investors. Their opinions were important in improving the clarity of the items.

Table 1. Questionnaire items

Construct	**Item**	**Label**
Demand identification	Investing in the stock market can be an opportunity to increase my wealth	X1
	Investing in the stock market allow me to diversify my portfolio	X2
Searching information	Before choosing a financial product, I refer to fundamental information, such as financial statement, financial communication…	X3
	For investment information, I seek recommendation from specialists, analysts, and financial consultants	X4
Evaluating alternatives	Before investing in the stock market, I analyze the financial performance of a company to invest in its stocks	X5
	Before choosing financial product, I consider the future growth for the related industry	X6
	Before choosing a financial product, it is necessary for me to assess the relative risk	X7
Disposition bias	I am often reluctant to realize losses	X8
Over confidence bias	I am sure that I can make the right investment decision	X9
	I believe I can predict the future trend for my investment in stocks with a fair degree of accuracy	X10
	Past success makes me invest more in stocks	X11
	I rely heavily on my private information to make an investment decision	X12

Then, to test the reliability of internal consistency and convergent validity, we used Principal Component Analysis (PCA) (using SPSS21) based on the pre-test involving 22-convenience sample. Moreover, PCA was performed to ensure that items related to each latent variable are represented by a single factor. We extract a single factor with an eigen value greater than 1. If more than one principal component is extracted, we run the PCA again with a Varimax rotation. The PCA results show that only one factor was extracted for all latent variable items, and that all extracted factors explain more than 60 percent of the variance, which is acceptable. The item correlation matrix for convergent validity and Cronbach' alpha for internal consistency reliability enable us to retain only items that are strongly and positively correlated, and for which Cronbach' alpha is greater than 0.5. Thus, the instrument is fit for further analysis. Table 1 shows the retained items of each latent variable for the final questionnaire, together with their labels.

Next, a confirmatory factor analysis was conducted with Smart-PLS software using 114 confirmatory samples to test the reliability, convergent validity, and discriminant validity of the items of the questionnaire.

DATA ANALYSIS

The paper utilized PLS-SEM (Wold, 1973) to examine the proposed research model. This method simultaneously examines the correlation between the latent variable and its measures, as well as the direction and magnitude of the relationship between the different latent variables. We chose to use PLS-SEM because it is suitable for small or moderate sample sizes and non-normal data distributions, as well as for predictive models. In fact, PLS is a soft modeling approach to SEM, with no assumptions on the data distribution. In addition, as the goal is to develop a new model from a predictive perspective, based on the recent AMH theory, PLS-SEM is a more relevant method for our study.

The PLS method consists of two sub-models, that is, a measurement model and a structural model. The measurement model (outer model) is conceptualized to investigate how the observed variables and the latent variable are related, whereas the structural model (inner model) measures the relationships between the latent variables.

We tested our hypothetical structural equation models in two steps. First, we explored the relationship between the rational decision-making process and two behavioral biases in a dynamic framework. Second, we introduced the type of investor (individual *vs.* institutional) as a moderating variable to examine whether being an individual or institutional investor has an impact on the relationship between the stages of the rational decision-making process and the behavioral biases or not. Concretely, to investigate the moderating effect Mbetween an independent variable X and a dependent variable Y, we introduce a multiplicative variable ($X * M$) that represents the interaction effect between the independent variable and the moderating variable. Two equations should be tested:

$$Y = a + bX + cZ \qquad (1)$$

$$Y = a + bX + cZ + d(X * Z) \quad (2)$$

If the coefficient d is significant and the coefficient of determination R^2in equation (2) is greater than that in equation (1), the moderating effect is confirmed.

The hypothetical model is validated according to some criteria. For the validity of the measurement model, we refer to the internal consistency reliability, convergent validity, and discriminant validity. The internal reliability is evaluated by Cronbach' alpha, which must be higher than 0.5, and Composite Reliability (CR), with the minimum threshold of 0.7. To test

convergent validity, we employ Average Variance Explained (AVE) that should be greater than 0.5 (Chin, 1998), and factor loadings, which should be greater than 0.5. As for discriminant validity, we refer to the root square of the AVE, which should be greater than the correlation of all other constructs.

With respect to the structural model, the R^2 and Q^2 are referred to as the predictive quality of the hypothesized model, which should be greater than 0.1 (Croutsche, 2002) and 0, respectively. Next, relationships between latent variables are assessed by the significance of standardized path coefficients between these variables using the bootstrap method.

RESULTS

Table 2. Descriptive statistics, CR and AVE

Construct	Item	Mean	SD	Normalized Kurtosis	skewness	Loadings	CR	AVE
Demand identification	X1	4.69	1.35	-0.30	-0.78	0.790	0.869	0.769
	X2	5.12	1.13	2.80	-1.64	0.956		
searching information	X3	5.08	1.38	1.71	-1.60	0.945	0.759	0.624
	X4	4.12	1.69	-0.85	-0.61	0.595		
Evaluating alternatives	X5	4.33	0.84	0.01	-0.99	0.932	0.852	0.661
	X6	5.12	0.97	-0.85	-0.65	0.783		
	X7	5.51	0.81	1.40	-1.54	0.709		
Disposition bias	X8	3.48	1.52	-1.01	-0.12	1	1	1
Overconfidence bias	X9	3.76	1.32	-0.37	-0.81	0.823	0.846	0.580
	X10	4.22	1.35	-0.12	-0.56	0.745		
	X11	3.90	1.54	-0.73	-0.46	0.777		
	X12	3.49	131	-0.52	-0.61	0.696		

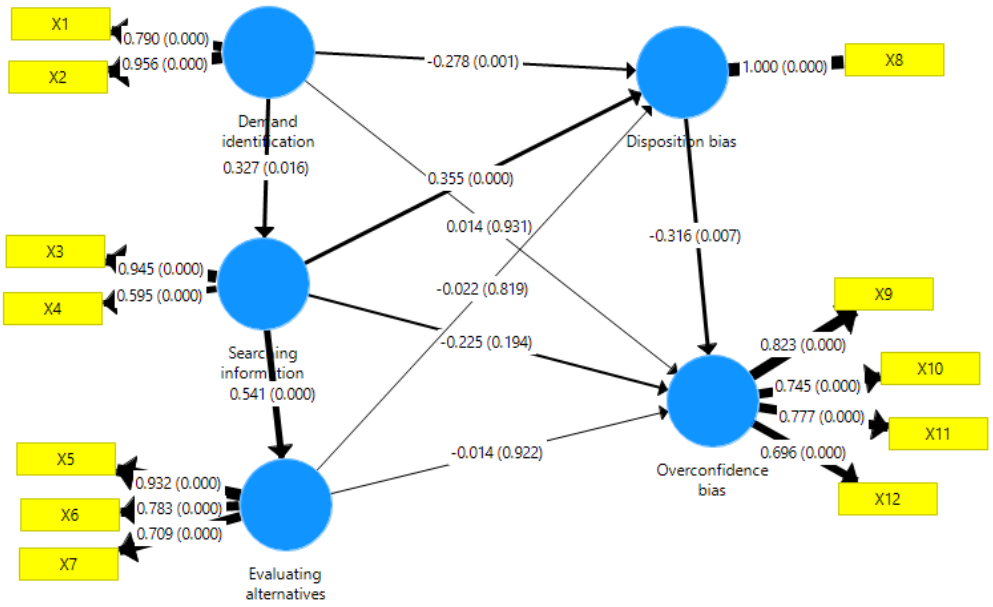

Figure 2. Structural Model

Table 2 shows that the normalized kurtosis is negative for some items and strongly positive for others, indicating that the distribution of the data is different from the normal distribution.

Besides, the data are negatively skewed, which differs from the normal distribution in which the skewness coefficient equals zero. The large standard deviation (SD) of the items implies a large dispersion of the investor views, which is consistent with the heterogeneous behavior of investors documented by behavioral finance. Therefore, the data are not normally distributed, which justifies the use of the PLS-SEM method in our research.

Figure 2 depicts the estimation of our hypothetical model that explores the relationship between the rational decision-making process and behavioral biases, as well as the tendency of investors to adapt to market dynamics. This figure shows the measurement model and the structural model. Specifically, it illustrates the factor loadings and standardized path coefficients between the different latent variables.

The measurement model evaluates the internal consistency reliability, convergent validity, and discriminant validity. Internal consistency reliability is assessed based on Composite Reliability (CR). Table 2 shows that all items have a CR ranging from 0.75 to 1, which is higher than the minimum required (0.7). This confirms the internal consistency of the constructs. For convergent validity, we use the factor loadings generated by the PLS algorithm. Conventionally, factor loading should be higher than 0.5 (Roussel et al., 2002), which implies that more than 50 percent of the variance of the observable variable is explained by its construct. Figure 2 demonstrates that all the factors (loadings)of the manifest variables are greater than 0.5, which is meaningful. In addition, the AVE can be used to evaluate the convergent validity (Fornell & Larcker, 1981). Table 2 reveals that the AVE for all constructs is greater than 0.5. Thus, the model achieves convergent validity.

To assess the discriminant validity of the measurement model, we compared the correlation between the constructs with the square root of the AVE. Table 3showsthat discriminant validity is assured because the square root of the AVE of each latent variable is greater than the bivariate correlation of the other variables. This means that the constructs are more closely correlated with their items than with the items of the other latent variables.

Table 3. Correlation between latent variables and square root of AVE

	1	2	3	4	5
1. Disposition bias	Unique indicator				
2. Overconfidence bias	-0.377	0.762			
3. Evaluating alternatives	0.086	-0.158	0.813		
4. Demand identification	-0.169	-0.010	0.301	0.877	
5. Searching information	0.252	-0.307	0.541	0.327	0.790

Overall, all the validity conditions of the measurement model were met, namely, reliability, convergent validity, and discriminant validity. Consequently, we continued the analysis by testing the relationships between the latent variables of the structural model.

First, we evaluated the predictive quality of the model based on the coefficient of determination (R^2) generated by the PLS algorithm. The latent variables included in our hypothetical model globally explain 10.7 percent of the 'searching information', 29.3 percent of the 'evaluating alternatives', 13.4 percent of the 'disposition effect', and 19 percent of the 'overconfidence bias'. Thus, all coefficients are greater than 0.1, which is the minimum to ensure the predictive quality of the model. Furthermore, all Q^2 coefficients (Fernandes, 2012)for the endogenous variables are greater than 0. The model is therefore significantly predictive.

Regarding the relationships between the latent variables in the structural model, the standardized path coefficients between the variables were calculated using the bootstrap method with 5000 iterations. The bootstrap results in Figure 2 indicate that all the relationships between the stages of the rational decision-making process are positive and statistically significant. Indeed, the

relationship between the 'demand identification' stage and the 'searching information' stage is significant at 1 percent, and the relationship between the 'searching information' stage and the 'evaluating alternatives' stage is significant at 1 percent. These findings support hypotheses H1 and H2.

The results also show that 'demand identification' has a negative impact on the 'disposition effect'($p - value < 0.01$), which does not confirm hypothesis H3.1. In addition, the relationship between the 'demand identification' stage and overconfidence bias is not statistically significant($p - value > 0.1$). Hypothesis H4.1 is therefore not confirmed. Nonetheless, the findings illustrate that the 'searching information' stage is positively and significantly related to disposition bias($p - value < 0.01$), which confirms hypothesis H3.2.

As for the relationship between the 'searching information' stage and overconfidence bias, the empirical results reveal a negative but non-significant relationship($p - value > 0.5$), thus rejecting hypothesis H4.2. Nevertheless, there is an indirect relationship between the 'searching information' stage and overconfidence bias through the disposition effect. The 'searching information' stage significantly and positively affects the disposition effect, which in turn significantly and negatively influences the overconfidence bias($p - value < 0.01$).This means that the disposition bias mediates the relationship between the 'searching information' stage and the overconfidence bias. This implies that investors become irrational during the 'searching information' stage due to their sensitivity to the disposition bias, but that because of the accumulated losses generated by this bias, investors become less overconfident and correctly assess risk, indicating their adaptive behavior. This finding confirms hypothesis H5.

Moreover, the empirical results show the absence of statistically significant direct relationships between all stages of the rational decision-making process and overconfidence bias, which does not support hypotheses H4.1, H4.2, and H4.3.

Table 4. Results of Hypotheses Testing

Tested relation	**Coefficient d**	**t-value**	**p-value**
Demand identification → Disposition bias	0.293	1.826	0.068
Demand identification → Overconfidence bias	0.165	0.874	0.383
Searching information → Disposition bias	0.065	0.377	0.706
Searching information → Overconfidence bias	-0.057	0.318	0.750
evaluating alternatives → Disposition bias	-0.152	1.151	0.250
evaluating alternatives → Overconfidence bias	0.251	1.456	0.146

To examine whether individual investors are more prone to cognitive biases than institutional investors, we introduced investor type (individual vs. institutional) as a moderating variable in the hypothetical model. Specifically, we investigated whether investor type could moderate the relationships between the stages of the rational decision-making process and the two cognitive biases. The results of the PLS algorithm in Table 4 show that the coefficient of the moderating effect (coefficient $d$in equation (2)) is not significant for all the relationships tested ($p - value > 0.05$), which invalidates hypothesis H6.

DISCUSSION

This study used PLS-SEM to examine the relationships between the rational decision-making process and two behavioral biases, namely the overconfidence bias and the disposition effect, as well as investors tendency to adapt to market conditions in the Moroccan context. The results indicate that all the relationships between the stages of the rational decision-making process are positively and statistically significant. Indeed, the 'demand identification' stage predicts the 'searching information' stage, which in turn predicts the subsequent decision-making stage, namely the 'evaluating alternatives' stage. As a result, investors focus primarily on a rational decision-making process. These finding are consistent with those of previous studies (Lin, 2011; Mushinada, 2020; Mushinada and Valuri, 2019; Sharma & Firoz, 2022). The results also confirm the model of Mintzberg et al. (1976).

Nevertheless, although investors attempt to follow the rational decision-making process, their rationality is bounded (Simon, 1955, 1982), so they might rely on simple heuristics resulting in the emergence of some cognitive biases (Tversky & Kahneman, 1974). With this in mind, we tested whether some behavioral biases could arise from the stages of the rational decision-making process. The empirical results illustrate that the relationship between the 'demand identification' stage and the disposition effect is significantly negative, suggesting that if demand identification increases, the disposition effect decreases. This implies that when Moroccan investors want to invest, they first try to make a rational decision and are therefore less sensitive to the disposition bias at this stage. Moroccan investors are also not sensitive to overconfidence bias at this stage, as the relationship between the 'demand identification' stage and the overconfidence bias is not statistically significant. On the other hand, the study shows that the 'searching information' stage accurately predicts the emergence of the disposition bias, implying the predisposition of Moroccan investors to ride their losers too long during the information-seeking stage. This is because they ignore information that does not match their initial assessment, and therefore continue to hold on to their losing stocks. The results of the study are consistent with previous studies that this bias exists among investors when making investment decisions in financial markets, and that it strongly affects their rationality (Andreu et al., 2020; Haryanto et al., 2020; Prosad et al., 2017; Sharma & Firoz, 2022).However, these findings do not confirm those of Lin (2011), who finds that this relationship is not significant in the Taiwanese market. They also contradict those of Sharma and Firoz (2022), who find no statistically significant relationship between these variables in the Indian equity market.

Despite the direct relationship between the 'searching information' stage and the overconfidence bias is not significant, there is a significant and negative indirect impact of the 'searching information' stage on the overconfidence bias through the disposition bias. In fact, the 'searching information' stage has a significant positive impact on the disposition effect, which in turn has a negative and significant impact on the overconfidence bias. Consequently, the disposition bias mediates the relationship between the 'searching information' stage and the overconfidence bias. This finding suggests that Moroccan investors become irrational during the 'searching information' phase because of their sensitivity to disposition bias.

The ultimate reason for investing is to increase wealth, but if the investor realizes losses, he will take excessive risks and be subject to the disposition effect, in line with prospect theory (Kahneman & Tversky, 1979).Loss aversion and risk perception are the most relevant elements in investment decision-making under risk (Abul, 2019; Ahmed et al., 2022; Dominic & Gupta, 2020; Holzmeister et al., 2020),and explain the disposition effect. Overconfidence bias might also contribute to risk-taking and thus to the disposition effect (Ho, 2011; Kadous et al., 2014).

However, the influence of behavioral biases causes investors to lose their money (Jaiyeoba & Kumar, 2018). Then, the accumulated losses push investors to become less overconfident about their initial assessment, and to rationally evaluate risk without being affected by the

overconfidence bias. This adaptive behavior explains the significant relationship between the 'seeking information' stage and the 'evaluating alternatives' stage on the one hand, and the insignificant relation between the 'evaluating alternatives' stage and the disposition bias on the other hand. That is, investors tend to correct their perception of risk and rationally assess alternatives to make a rational decision. Thus, these results are consistent with previous in confirming the AMH theory (Aleknevičienė et al., 2022; Bosnjak, 2023; El Oubani & Lekhal, 2022; Okorie & Lin, 2021; Mushinada, 2020).

Furthermore, the empirical findings show no statistically significant direct relationships between all stages of the rational decision-making process and overconfidence bias. These findings contradict those of Kuranchie-Pongand Forson (2022), who reported the presence of overconfidence bias on the Ghana stock market during the Covid-19 outbreak. They also contradict some studies that found overconfident traders dominating the market (Daniel et al., 1998; Gervais & Odean, 2001; Odean, 1998a; Prosad et al. , 2017). This could be because Moroccan investors might be less susceptible to overconfidence bias than investors in other markets due to cultural differences (Chuang and Lee, 2006; Chui et al., 2010; Heine & Hamamura, 2007; Hofstede, 2001).

Overall, the empirical findings of the study confirm the existence of rational and irrational behavior dynamics, which is consistent with the AMH theory. Therefore, this validates our methodology based on the study of adaptive investor behavior using primary data and offers an alternative method for examining the AMH theory compared to that based on secondary data extracted from the financial market at the aggregate level.

This study also investigated whether behavioral biases have a stronger impact on the investment decisions of individual investors than on those of institutional investors. To this end, the hypothetical model included investor type as a moderating variable between the stages of rational decision-making and behavioral biases. Some studies indicate that institutional investors are less sensitive to psychological biases than individual investors (Barber et al., 2007; Chuang & Susmel, 2011; Ekinci, 2022; Feng & Seasholes, 2005; Gervais & Odean, 2001; Liu, 2016).Nevertheless, our empirical results show that investor type does not influence the relationships between the stages of the rational decision-making process and the two behavioral biases, which contradicts the findings of the studies aforementioned, but confirms those of Lai et al. (2013) and Jaiyeoba et al. (2020), who stated that individual and institutional investors are likely to be impacted by behavioral biases alike. Indeed, atmospheres surrounding all groups of investors lead them to form beliefs for various psychological reasons, and then they try to find ways to rationalize these beliefs based on rational explanations (Shermer, 2012), which is consistent with the cognitive dissonance theory (Festinger, 1957).

THEORETICAL AND PRACTICAL IMPLICATIONS

The results of the paper have both theoretical and practical implications. As far as theoretical implications are concerned, the proposed and validated model explains how actual investment decisions are made in the financial market, and thus unveils the market behavior that remains a puzzle for scholars. The model also adds further evidence in favor of the recent AMH theory as an alternative to the EMH theory. Furthermore, the methodology used in this study, based on a parsimonious conceptual model including the rational decision-making process and the main behavioral biases affecting investors (disposition effect and overconfidence bias), could provide a more accurate direct assessment of the AMH theory than its indirect assessment based on the predictability of returns.

In terms of practical implications, our findings are useful for both investors and regulators. Indeed, psychological biases are one of the obstacles to making rational investment decisions, and

need to be eliminated (Batra & Kumar, 2018). The main finding of the study is that disposition bias is a prevalent psychological bias that influences investment decisions in the Moroccan context. This finding can make investors aware of the magnitude of this bias and prompt them to try to overcome it by complying with rational rules. These rules might include setting a risk tolerance level and identifying a loss threshold below which investors should sell their losers to avoid the disposition effect.

In addition, the irrational behavior of some investors due to the disposition effect might generate arbitrage opportunities that could be exploited by rational investors. For instance, several studies found that the disposition effect can explain positive autocorrelation of returns, and thereby momentum profits (Hur & Singh, 2019; O'Brien & Best 2017; Sadhwani & Bhayo, 2021). Indeed, the disposition effect induces an under reaction to news and therefore slows the incorporation of news into market prices, creating a spread between the fundamental value of a stock and its actual price. Investors can use momentum strategies to exploit this spread and obtain abnormal returns. However, it was observed that the market moves from periods of inefficiency to periods of efficiency, depending on the adaptive behavior of investors (Bosnjak, 2023; Charfeddine & Khediri, 2016; El Oubani, 2022a, b; Ito et al., 2014; Lekhal & El Oubani, 2020; Okorie & Lin, 2021). Consequently, sticking permanently to momentum strategies can lead to poor performance. Lekhal and El oubani (2020) found that momentum profits are related to the degree of market efficiency. Therefore, portfolio managers need to identify the timing of momentum strategies to exploit market mispricing, and switch strategies when the market becomes efficient again. Investment opportunities appear but disappear once they have been exploited by arbitrageurs (Lekhal & El Oubani, 2020).

As for regulators, our results make them more aware of actual investor behavior, so they can take appropriate regulatory measures to prevent the market from being inefficient and unstable. Financial education programs, focusing on the negative impact of psychological biases (disposition effect, overconfidence, among others), might improve investor behaviour in their financial investment decisions (West, 2012) and thus improve market efficiency. Capital Market Authority can organize workshops to train investors to manage their investment decisions, particularly in times of distress events, focusing on the best possible use of both irrational and rational decision-making, based on the AMH theory (Parveen et al., 2021). Moreover, communication by regulators would play a key role in providing clear information and reducing psychological effects.

CONCLUSION

This paper proposed a new hypothetical model to study the AMH theory in the Moroccan financial market by examining the coexistence of rational and irrational investor behavior, as well as the tendency of investors to adapt to market dynamics. This is the first study in the Moroccan context to use primary data to examine the AMH theory from the perspective of adaptive investor behavior, and the first to provide empirical evidence for this hypothesis at both the individual and institutional levels, and the first to employ the PLS-SEM approach to examine the AMH theory. Accordingly, the study performed a cross-section analysis via PLS-SEM to test the relationships between the stages of the rational decision-making process, and between each stage of this process and the two behavioral biases, namely the disposition effect and the overconfidence bias. The empirical results were consistent with the hypothetical model and therefore with the AMH theory. Indeed, the results revealed that each stage of the rational decision procedure predicts the subsequent stage, suggesting that Moroccan investors attempt to make a rational decision. However, some behavioral biases might appear during some phases of the rational decision-making process, such as the disposition bias. Specifically, during the "searching information" stage, Moroccan investors take excessive risks while being affected by disposition bias, but when

they suffer losses, their overconfidence disappears, their perception of risk changes, and they become rational again. As a result, Moroccan investors adapt to market dynamics.

To inspect whether the magnitude of behavioral biases is related to investor type (individual vs. institutional), the hypothesized model included investor type as moderating variable between each stage of the rational decision-making process and the behavioral biases examined. The results showed that the moderating effect was not significant, suggesting that individual and institutional investors suffer equally from behavioral biases.

Limitations and future directions for research

First, this study considered two behavioral biases that systematically influence investor decisions. Future studies might add other cognitive biases. Second, the survey in this study was conducted during distress events (Covid19 epidemic, Russia-Ukraine conflict, global inflation) which might have influenced the magnitude of some behavioral biases. Therefore, testing the hypothesized model of this study in different market situations and comparing the results, to see whether some behavioral biases are related to specific market conditions, could be an interesting avenue of future research. Third, this study examined the AMH theory based on adaptive investor behavior as an alternative to time-varying predictability of returns. It will be of great interest to combine these two approaches to draw robust conclusions on the implications of the AMH theory.

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