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## Article

# A conceptual framework on individual investors' learning behavior in the context of stock trading: An integrated perspective

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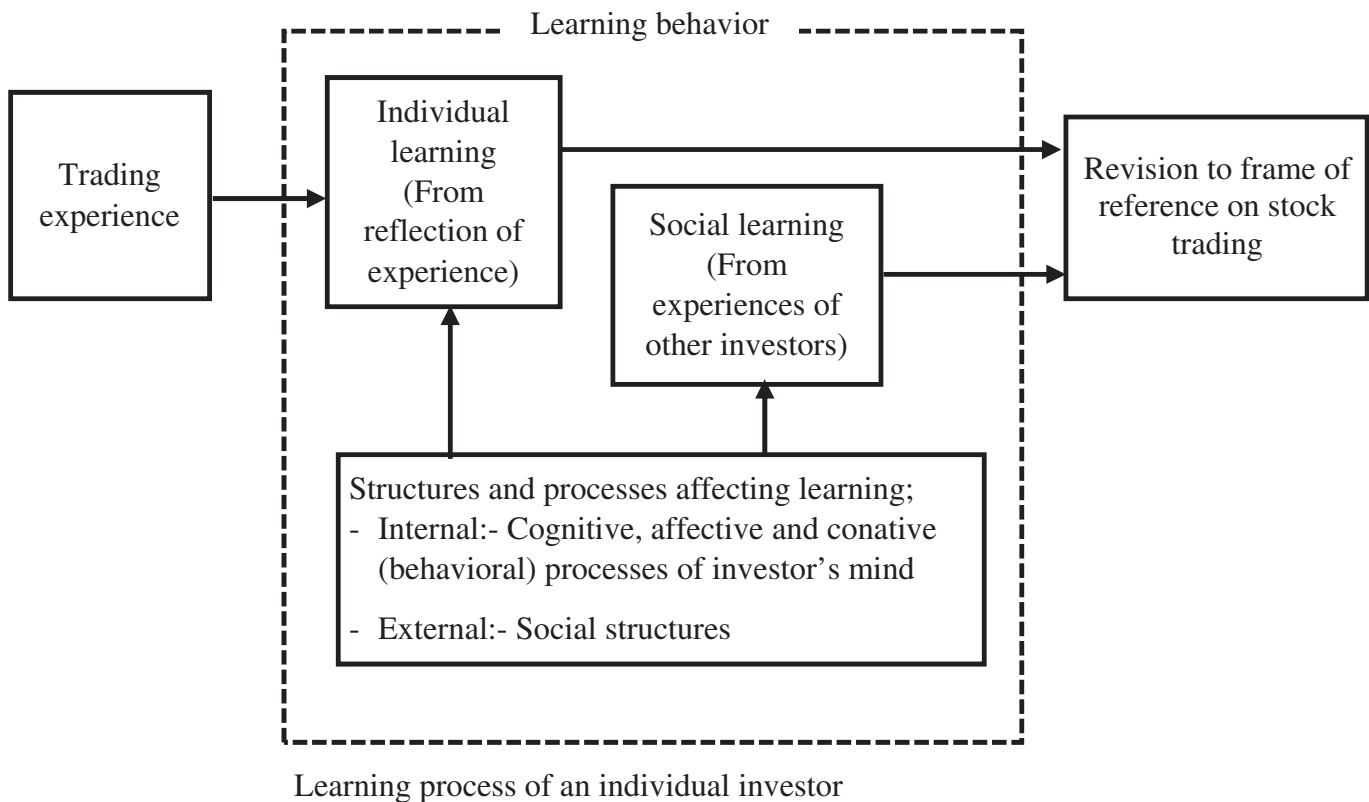
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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# A conceptual framework on individual investors' learning behavior in the context of stock trading: An integrated perspective

Kalugala Vidanalage Aruna Shantha<sup>1\*</sup>, Chen Xiaofang<sup>1</sup> and L.P.S. Gamini<sup>2</sup>

**Abstract:** The objective of the paper is to introduce a conceptual framework for the study of learning behavior of an individual investor in the context of stock trading. It is developed based on the review of behavioral finance literature, and insights from cognitive, behavioral and social learning theories and related empirical evidence. The framework recognizes the investor as an entity that learns consciously and/or unconsciously for continually updating its perspectives underlying stock trading. The intentional or consciousness form of learning occurs as individual learning through reflection of past trading experiences whereas the learning happens unconsciously as social learning through inquiry and imitating the others' behaviors. These learning processes are expected to be affected by interaction of various structures and processes, both internal and external to the investor, such as cognitive, affective, social and behavioral ones. Accordingly, the framework suggests five hypotheses to examine the determinants of these learning behaviors and to assess whether the investors learn over passage of time through the effects of these structures and



Kalugala Vidanalage Aruna Shantha and Chen Xiaofang

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### PUBLIC INTEREST STATEMENT

Education is an important aspect, which, among other factors, affects significantly investors' performance and their participation in stock trading. In addition to the academic education, the knowledge gained through real-life experience helps to achieve a higher investment performance. This paper intends to provide understanding on how individual investors can learn their mistakes in decision-making through the knowledge accumulated from their experiences. Despite mistakes are inherent aspect of the psyche, the model proposed here shows that the investor can learn about them based on his/her own trading experiences (individual learning) and/or trading experiences of other investors (social learning). We expect that such learning attempts will promote efficient and fair functioning of a stock market and minimize possible unfavorable market conditions such as speculative bubbles and crashes, which eventually enhance the investor participation and the market development.

processes. It promotes primary data-based behavioral finance empirical studies to track dynamics involved in learning, which could provide new insights on such behavior predicted by the adaptive market hypothesis.

**Subjects: Economics; Finance; Business, Management and Accounting; Adult Education and Lifelong Learning; Continuing Professional Development**

**Keywords: transformative learning; adaptive market hypothesis; reflection; longitudinal study; social learning; individual learning; trading experience; interpretive research**

**JEL codes: G41**

## 1. Introduction

The standard finance theories and models such as efficient market hypothesis (EMH) of Fama (1970), portfolio theory of Markowitz (1952), capital assets pricing model of Sharpe (1964), Lintner (1965) and Black (1972) assume that investors are rational so that they make decisions to maximize their expected utility. This implies that pricing of securities is fair and unbiased, and financial markets are efficient. However, the behavioral finance theories and the related empirical studies have extensively brought challenges to these hypotheses, showing that the degree of investors' rationality is bounded due their cognitive limitations, psychological factors, information asymmetry, and so forth (Barber & Odean, 2011; Gokhale, Tremblay, & Tremblay, 2015; Shefrin, 2002). These factors cause biases and/or mistakes in investors' decision-making (Filbeck et al., 2017; Kumar & Goyal, 2015). Thus, prices of securities could deviate from their fundamentals and financial markets may become inefficient. To reconcile this debate between the standard finance and the behavioral finance, a new framework called the adaptive market hypothesis (AMH) is emerged, based on some principles of evolutionary biology such as competition, mutation, reproduction, and natural selection (Lo, 2004, 2005). According to the AMH, the efficiency of a financial market is not a static condition, as implied by EMH, however, is dynamic and highly context-dependent, therefore, is predicted to be time-varying.<sup>1</sup> In addition, the AMH predicts that market participants are capable of learning their mistakes for adapting to dynamic market conditions over time. When they are adaptive, stocks are expected to be priced rationally so that the market can be assumed to be approaching to its efficiency status (Lo, 2012; Manahov & Hudson, 2014). Consistent with this prediction, investors' mistake-learning process is empirically recognized as the underlying factor for a stock market to be time-varying efficient (Gu & Finnerty, 2002; Ito, Noda, & Wada, 2016).

The literature to date includes the study of investors' learning based on computational models such as agent-based financial models, and lab experiments.<sup>2</sup> However, their contribution to the understanding of this phenomenon is limited in the following ways. First, it is unlikely that the agent-based models represent reasonably the complex learning process due to unrealistic assumptions employed (for example, those relating to number of assets traded, number of agents, timing of decisions, information and execution of trade, and speed at which agents update behavioral rules), difficulties in assessing the validity of the models and a large number of parameter configurations, which may cause a simulated market not approximating to a real market<sup>3,4</sup>. In addition, lab experiments may be limited to studying one type of learning and be conducted in controlled environments, therefore may have limited generalizability to the complex learning behavior observed in a real market. Second, the studies based on agent-based models and lab experiments in the literature are mostly concerned on the reinforcement learning (that is, trail-and-error behavior) for learning and adapting to market conditions. Thus, more experienced investors are assumed to possess better investment strategies than less experienced ones. However, as argued in Section 3.3., the literature provides no strong evidence to support for this prediction since it reveals contradictory evidence on the impact of investment experience in minimizing behavioral biases. Third, the literature review of Wang, Ahn, Kim, and Ha (2018) emphasizes certain difficulties in modeling learning processes in agent-based financial models.<sup>5</sup>

Fourth, learning theories suggest that a variety of structures and processes, both internal and external to an investor, such as behavioral, cognitive, affective, and social ones influences the learning process. Nevertheless, according to our knowledge, there is no framework or model in the literature providing such a holistic view of the learning behavior. Consequently, consistent with Jiao (2015), the current knowledge of how the learning takes place in an investor's psyche and underlying determinants of this learning process appear to be limited. Therefore, in this paper, we present a new conceptual framework of the individual investor's learning behavior in the context of stock trading by integrating cognitive, affective, behavioral and social aspects of learning. Since the new framework can be empirically examined in the actual context of stock trading using primary data-based research methods, it would contribute new insights to the limited knowledge generated by the agent-based models and the lab experiments conducted in artificial market settings.

Our study contributes to the growing literature on behavioral finance as follows. The new conceptual framework will help to deliver a deeper understanding of the learning process occurred within the investors since it facilitates in-depth empirical study into a variety of cognitive, affective, social and behavioral aspects that play a significant role in their learning behavior. The framework will also promote empirical research on the AMH to support for its prediction that market participants are capable of learning their irrational behaviors for adapting to market environment. Further, it inspires primary data-based behavioral finance research which is limitedly available, especially in the context of emerging stock markets (Kumar & Goyal, 2015).

The rest of the paper is organized as follows. Section 2 provides a background to the proposed conceptual framework, followed by the discussion on trading experience and learning behavior in Section 3 and 4, respectively. In Section 5, we present hypotheses for predicting the learning process of the investor. Section 6 discusses our suggestions for the empirical test of the conceptual model. Section 7 concludes the paper.

## **2. The new conceptual framework: An overview**

In this section, we present an overview for the understanding of the nature and the extent of learning predicted by our model in the context of stock trading. To begin, we represent an investor as an individual involved in buying and selling (hereafter called as "trading") stocks in an organized stock exchange. An investor typically trades stocks depending on his/her expectations (beliefs) about the outcome of trading, which, in turn, require judgments on series of stock fundamentals and environmental states. Consistent with the rational expectation hypothesis of Muth (1961), the expectations should ideally be arrived rationally by making use of all available information efficiently.

However, the behavioral finance literature regularly reveals that this idealized view is less likely to take place when forming beliefs. For instance, Bordalo, Gennaioli, and Shleifer (2012), presenting the Salience Theory, propose that decision makers do not consider all available information due to their cognitive limitations, but tend to overstate information that their mind get attention and disregard that do not. In addition, models of investor behavior proposed by Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999) show heuristics<sup>6</sup> biases and irrational mental frames occurred within investors when forming their beliefs.<sup>7</sup> According to Barberis et al. (1998)'s model of investor sentiments, investors are biased by representativeness heuristic and conservatism when their beliefs are updated. The former results to a tendency to infer quickly based on too small sample of observations and the latter causes to a slow revision of their beliefs in the face of new information. Similarly, Daniel et al. (1998) show the influences of overconfidence and biased self-attribution of investment outcome when processing information. They posit that an investor's confidence on his private information increases with the receipt of public information which confirms his private signals. Consequently, the investor becomes overconfident about his/her ability to generate information (through the biased self-attribution), resulting an overestimation of his/her private signals relative to public signals when trading stocks. Based on previous empirical evidence, Hong and Stein (1999) also

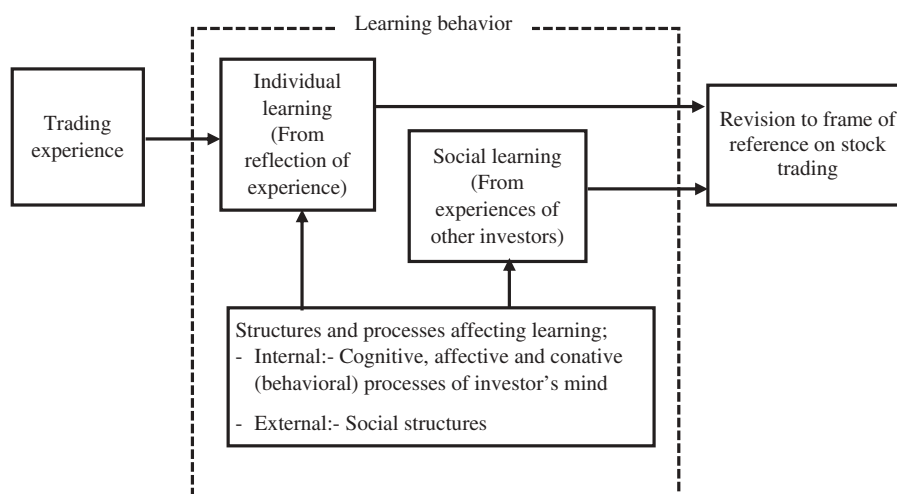
theorize that investors do not use all publically available information and are limited to use simple heuristics, thus information is slowly incorporated into prices of assets. Further, the literature reviews of Filbeck et al. (2017) and Kumar and Goyal (2015) summarize behavioral biases occurred in the decision-making process of investors. Hence, as the Prospect Theory of Kahneman, Slovic, and Tversky (1982) suggests, these theoretical and empirical evidence strongly emphasize the fact that investors are likely to be exposed to biases which cause deviation of their expectations from the rational expectations.

Accordingly, the individual investor being represented in our model is assumed to be a bounded rational individual involved in trading stocks. Thus, on one hand, given the investor's heuristic bias and irrational mental frames, he/she would exhibit irrationality, at least to a certain extent, in decision-making. On the other hand, based on the implications of the AMH, it can also be expected that such biases are evolutionary and tend to minimize when the investor learns and adapts to market conditions. The model presented in this paper intends to capture this learning story. Consistent with the AMH and the learning literature, it predicts that investors learn about their mistakes or irrational mental frames occurred with their previous trades, and produce more adaptive trading strategies subsequently.

The conceptual model of this paper is different from the existing behavioral finance models in the following manner. The behavioral models, discussed above, attempt to recognize possible causes for market anomalies documented in the literature (for example, short-run momentum in prices and long-run reversal) by modeling investor behavior with the associated biases. However, we expect to contribute the literature by proposing a learning model, through which investors learn about their biased behaviors and shift away from them when trading stocks. Further, unlike the existing agent-based models, our model does not limit to conceptualize the reinforcement learning predicted by the AMH since the evidence summarized in Section 3.3 suggests that a higher experience does not merely result to a lower level of behavioral biases in decision-making. This signifies for a learning process to be occurred within the investor, where by, a new knowledge is produced that, in turn, revises biased mental frames to yield more adaptive trading strategies. Therefore, we incorporate in our model cognitive, affective and social aspects of learning, in addition to the behavioral aspects of learning implied in the AMH. As shown in Figure 1, the learning process of an investor involve the individual learning and the social learning behaviors which are expected to be influenced by various structures and processes, both internal and external to the investor.

In sum, in case of individual learning, an investor cognitively evaluates his/her own past trading experiences, the learning outcome of which would result in revising his/her biased frame of

**Figure 1. Learning process of an investor.**



reference<sup>8</sup> on trading stocks. Thus, contrary to the prediction of the AMH, we assume that the past experiences do not merely revise biased mental frames, rather cognitive reflection of such experiences is expected to be functioning as a mediating process when revising them. In addition to this deliberately engaged individual learning, we suggest another form of learning, known as “social learning”, where the investors, without relying on their own experiences, learn from inquiry and imitating the other investors’ behaviors<sup>9</sup> so that there would be an unconscious or incidental changes to their frame of reference. However, we predict that mere imitating others’ behaviors does not result in learning since it causes to exaggerating the behavior, delay in incorporating new information into prices, and deviating significantly behavior from reality (Bossan, Jann, & Hammerstein, 2015). Thus, the social learning is expected to take place when imitated behaviors are inquired for obtaining information about reasons and strategy underlying those behaviors, socially confirmed and yield successful outcome. The following sections further discuss these learning processes by considering appropriate theories and the related empirical findings to provide an adequate understanding and develop the hypotheses of our conceptual framework.

### 3. Trading behavior and experience

The trading behavior comprises all physical and psychological behaviors that an investor engages when trading stocks. As behavioral finance literature suggests, investors’ inner cognitive and affective states, and sociocultural aspects together with market conditions and information structure influence their trading decisions. Given particular market condition and information set, investors would exhibit diverse trading patterns depending on their socio-psychological statuses, thus they experience differently when trading stocks.

#### 3.1. What is experience and how is it conceptualized in the context of stock trading?

The word “experience” means for an occurrence in an individual’s psyche (mentally perceived) or cognition (knowledge or understanding obtained) by practical exposure to an event.<sup>10</sup> Supporting this psychological view, Otto and Ritchie (1996) define experience as “the subjective mental state felt by participants”. An individual obtains experience by being encountered or exposed personally to an event or occurrence (first-hand experience). It could also result from being informed of the first-hand experiences of family members and closely related others (second-hand experience) or being exposed to different views of individuals living in the same environment such as rumors (third-hand experience). Notably, Schmitt (1999), incorporating such societal influences in addition to psychological and cognitive ones, defines experience as the “result of encountering, undergoing, or living through situations. They are triggered stimulations to the senses, the heart, and the mind..., providing sensory, emotional, cognitive, behavioral, and relational values that replace functional values”. Accordingly, the trading experience is meant for a subjective mental state felt by an investor while interacting with the trading environment, which is characterized by cognitive, affective, social and behavioral values perceived in response to the outcome of his/her stock trading.

When different forms of experiences are concerned, the reinforcement learning theory (RLT) implies that the outcomes of events personally experienced have greater impacts on future behavior than those experienced without personal involvement. Supporting this hypothesis, Kaustia and Knüpfer (2008) find that personally experienced returns have greater impacts on future IPO subscription than those merely observed, revealing a tendency to overweight personal experiences in decision-making. Similarly, Chiang, Hirshleifer, Qian, and Sherman (2011) confirm this reinforcement learning, showing that investors are more likely to subscribe for future IPO if they receive a higher return for their previous IPO subscription. Further, Hoffmann and Post (2016) show that risk and return personally experienced by investors, rather their mere apparent (for example, during high-volatile market periods) influence their beliefs about return expectations, risk perceptions and risk tolerance. Andersen, Hanspal, and Nielsen (2016) also reveal significance of the first-hand experiences in shaping future investment behavior since they find that events experienced personally have stronger effects than observed market conditions and those experiences shared by relatives and peers. Therefore, following the RLT and the related empirical



findings, as discussed above, it is evident that the impact of the first-hand experience on future behavior is significantly different from that with the second-hand or the third-hand experience. Accordingly, in order to distinguish these effects in our model, the “trading experience” is represented by the investors’ first-hand experiences, whereas their second-hand and third-hand experiences are considered under the social learning.

The trading experience, representing an investor’s first-hand experience, is conceptualized in our model as follows. In the context of stock trading, investors exhibit trial-and-error behavior (reinforcement learning) since they are more likely to use heuristics when forming beliefs, rather than deeply processing of information, for their decision-making (Barber & Odean, 2011; Kahneman et al., 1982). When market conditions shift, the heuristics previously applied may not perform well under the new conditions, the outcome of which would stimulate them to apply new heuristics for adapting to the new context (Lo, 2005). The outcomes of such trail-and-error behavior affect the investor’s mind, resulting cognitive, affective, social and behavioral values in response to those past stock trades, which we call as “trading experience” in our model. Further, such psychological responses are considered to be subjective since the investor’s interpretation of the trading outcome is not entirely based on objective facts, rather affected by the frame of reference that the investor currently holds when trading stocks. The trading experiences, when accumulated over time, are rooted into the investor’s psyche and may consequently change the current perspectives underlying stock trading.

### **3.2. How is the trading experience of an investor predicted?**

When the psychological process relating to the first-hand experiences to an investor is considered, it is expected to be the result of the post-hoc reason processing (Westaby, 2005), where by reasons are processed subsequent to a stock trading by interpreting its outcome and its attributes (for example, cost incurred in trading and profit realized), which produce cognitive, affective, social and behavioral values in response to the outcome of stock trading. Since these psychological responses represent causal explanations of the behavior to support or alter it, consistent with Westaby (2005), they affect the future stock trading by influencing the investor’s behavioral motives. Accordingly, if past trading strategies get responded favorably leading to a positive mental state, they are expected to be repeated and vice versa.

The theory of planned behavior of Ajzen (1991) recognizes these behavioral motives as “global motives”, classified into attitudes toward behavior, subjective norms and perceived behavioral controls. The outcomes of past trading affect affective and evaluative beliefs about the trading (attitudes toward trading). Further, an investor’s behavior would be influenced by different perspectives of other investors and be exposed to rumors during stock trading, the outcome of which influences his/her perspectives about the importance of such social considerations (subjective norms) in stock trading. The past trading also reveals the extent to which resources and opportunities are available and skills are possessed to trade stocks, thereby an investor could perceive about its easy or difficulty (perceived behavioral controls). It consequently affects the investor’s perspectives about his/her ability to trade stock. Accordingly, these three global motives characterize an investor’s psychological responses to his/her past trading. It can then be expected that favorable global motives resulting from a positive mental state increase the trading frequency, thereby, accumulate more experience to an investor and vice versa. Therefore, these three global motives can be considered as the predictive factors of the trading experience.

### **3.3. Does the trading experience matter for an investor’s learning?**

Learning is known as accumulation of knowledge and skills, which may result from experiences (Kolb, 1984). Consequently, it may continue as a lifelong process driving through everyday practices (Dirkx, 2000). The AMH also assumes such an experienced based learning behavior among market participants. Similar to the RLT, it predicts that investors learn based on positive or negative reinforcements received for their past behaviors, which results in more adaptive trading strategies

to increase their investment performance. Accordingly, the experience is predicted to be the key determinant of the learning of an investor.

In the context of stock trading, despite the evidence to support for this experience-based learning hypothesis,<sup>11</sup> the literature shows some contradictory evidence to this prediction. For example, Chevalier and Ellison (1999) reveal evidence of higher return for less-experienced fund managers than experienced ones. Further, Agarwal, Driscoll, Gabaix, and Laibson (2007) find a reverse U shape relationship between investment experience and performance, which emphasizes the fact that an increase in experience beyond a particular level causes to a decrease in performance. In addition, novice traders are continuously entering stock market, however, they would not do so if experience would lead to a higher investment performance. Certain empirical studies also find that a higher investment experience increases certain behavioral biases such as overconfidence and disposition effect, which consequently decrease investment performance.<sup>12</sup> Therefore, with the consideration of these contradictory evidence, it seems unreasonable to claim that the trading experiences directly produce learning and, thereby, increase investment performance.

Consistent with the learning theories discussed in Section 4, we suggest that the learning should not only be limited to the knowledge and skills accumulated over the past trading, however, also include the transformation of one's perspectives. This transformation would occur when the accumulated knowledge and skills challenge the previous stocks of knowledge and skills, thereby, alter one's perspective to yield new practices (Benner & English, 2004; Engeström, 2018). As stated by Meyer-Drawe (2008), in case of transformation, "a new horizon is opened up to which the old one needs, to a certain degree, to be sacrificed". Accordingly, we argue that the trading experience matters in learning, however, a learning process should occur within an investor to transform the experiences into a knowledge which, in turn, could change his/her perspectives for adapting to dynamic market conditions (Refer Figure 1).

#### 4. Learning behavior

As discussed in Section 3.3., learning should include both the accumulation and the transformation of knowledge and skills. Accordingly, learning is expected to occur within an investor when new knowledge and skills are acquired, based on which his/her biased mental frames are transformed for adapting to the trading environment. We assume that it results from individual learning and/or social learning behaviors. Figure 1 shows these two forms of learning behaviors with their determinants. Accordingly, individual learning is based on an investor's own experiences whereas social learning results from experiences of other investors. Further, these two forms of learning processes are expected to be shaped by interactions of various structures and processes, both internal and external to the investor such as those of cognitive, affective, social and behavioral ones, as explained below. The level of individual learning depends on the extent to which trading experiences are cognitively evaluated by reasoning. The affective states such as emotions experienced, attention to mistakes occurred during past stock trading and interest in learning influence the cognitive functioning of the brain in the learning process. In addition, social structures such as relationships with friends, associates and family members would enable for both individual learning and social learning since such relationships could facilitate for obtaining relevant information, questioning discussion and receiving feedback for past trading. The new understanding would affect how investors trade stocks in the future and the resulting experiences are interpreted, thus assist further learning as a cyclical process.

Consistent with the previous studies,<sup>13</sup> our conceptual model predicts that investors exhibit trial-and-error behavior (reinforcement learning) when trading stocks. In addition, as a novel attempt, the model conceptualizes the learning holistically by incorporating the effects of investors' inner processes such as those of cognitive and affective ones, and influences arising from social structures whereby they interact and live together. Further, the learning outcome would lead to significant and permanent changes to the way an investor experiences, conceptualizes the

experiences and interact in different context, even beyond stock trading, such as investment in other types of securities, other personal financing and investment decisions. Accordingly, consistent with Hoggan (2016), the learning process can be justified to be transformative learning. Therefore, we incorporate the concepts and ideas originated from the RLT of Thorndike (1898),<sup>14</sup> the transformative learning theory (TLT) of Mezirow (1991) and social cognitive theory (SCT)<sup>15</sup> of Bandura (1986) to model the learning process in our conceptual framework.

#### **4.1. Theories for predicting the learning behavior of an investor**

The RLT and the TLT can be used to conceptualize the individual learning behavior of an investor since both of these theories underline an individual's own prior experiences as the starting point for learning. Emphasizing the behavioral perspective of learning, the RLT predicts that individuals tend to repeat a particular behavior based on the rewards/punishments received for the same behavior in the past. If a particular action is rewarded in the past, it is expected to be repeated in the future. However, the repetition of past behaviors under dynamic environmental conditions may cause them to experience disorienting dilemma.<sup>16</sup> The TLT suggests that occurring a disorienting dilemma is the subject matter for changes in one's frame of reference, which encourages to assess the validity of the beliefs, thoughts and assumptions underlying his/her behavior through critical thinking and questioning (critical reflection). The reflection is the justification for what is known, felt, believed and acted upon in relation to one's frame of reference. It helps to transform the frame of reference to a more reflective and dependable one so that future behavior would adapt to new environment conditions. Accordingly, the TLT concerns on the cognitive aspects of the learning process by dealing with how learners give meaning for their experiences to challenge the perspectives on which they behave, influences of social structures in this meaning making process, and dynamics involved in modifying meanings for perspective transformation (Mezirow, 2000).

On the other hand, investors could learn socially since they are thoroughly integrated to the social environment within which they interact with other investors. The SCT provides a holistic view of this social learning process by suggesting that person (a person's cognitive, affective and other personal factors), behavior, and environment are inseparably integrated and act together in a learning attempt. By incorporating social influences to the human learning, the theory predicts that learning takes place by way of observational learning—observing, modeling and imitating others' behaviors. The observational learning leads to understanding of new behaviors, how they are performed and their consequences. Nohl (2015) shows that perspectives could be revised unconsciously or abruptly when new practices are observed, then they are taken into account by experiments, inquiry with others and from their feedback, and added to the existing ones. The SCT theory also predicts that with the integration of learner to environment, the learner develops self-efficacy since social praises and encouragements motivate to exert more efforts for learning.

#### **4.2. Conceptualizing the learning process occurred within an investor**

Barber and Odean (2011) state that many studies suggest the reinforcement learning behavior among individual investors. Notwithstanding, as a novel attempt, we intend to provide a holistic view of the learning process, incorporating the investor's cognitive, affective and social aspects, in addition to the behavioral aspects of learning proposed by the RLT. The concepts of the TLT have been originally applied for the researches in the field of education and formal learning setting such as workshops and training sessions (Christie, Carey, Robertson, & Grainger, 2015). However, Taylor (2007) notes, through reviewing previous literature, the validity of the theory has been proven in other disciplines, for example environmental assessments, cooperative extensions and business communication, and suggests it to apply to the settings where learning is more informal and vulnerable to environmental influences. Further, Nohl (2015) proposes a practice-based model of transformative learning for applying to informal learning contexts. Since an investor's learning is more likely to be self-directed, occurred in informal ways such as through observation, imitation and social relationships, and be susceptible to environmental influences, we expect that the RLT, the TLT and the SCT provide adequate insights and a rational basis for conceptualizing the learning process.

The RLT, the TLT and the SCT can be integrated to hypothesize the individual and social learning behaviors of an investor as follows. As the RLT predicts, an investor tends to repeat the trading strategies that are rewarding in the past. When the environment changes, the past strategies may not perform well under the new conditions, experiencing a situation of disorienting dilemma. Then, consistent with the TLT, the individual learning would enable for evaluating cognitively the validity of beliefs, thoughts and assumptions underlying those past strategies through reflecting the associated experiences. As a result, the investor could appropriately revise his/her frame of reference to yield more productive strategies in order to adapt to new market conditions. Thus, the “self-reflection” is predicted to be the mechanism through which the individual learning occurs within the investor. Further, due to self-directed and informal nature of this individual learning, affective states (for example, interest and emotions) and social relationships would influence the learning process, and there would exist some variations of the reflective capacity among investors in relation to their demography (Taylor, 2007). We discuss in Section 5 these psycho and socio-cultural dynamics, and demographic factors for predicting the individual learning in our framework. An investor would also involve in social learning where behaviors of others are imitated, experimented, inquired upon and socially confirmed, resulting to an unconscious or incidental changes to his/her frame of reference underlying stock trading. Accordingly, our model suggests that individual learning and/or social learning would facilitate investors to appropriately revise their perspectives to produce more adaptive strategies for dynamic market conditions. Section 5 further discusses these two forms of learning with their related hypotheses for predicting the learning behavior.

It is noted that the frame of reference referred in our model is not meant to the totality of one’s self and world-reference, as described in the TLT. Our model does not predict such a comprehensive form of learning, but a fragment of it, which is identified specifically as an investor’s frame of reference relating to stock trading. Nohl (2017) distinguishes between these comprehensive and partial forms of transformations. As fragmentary, the perspectives underlying specific subject matter or skills are transformed whereas the transformation of the totality of the self and world-reference deals with one’s being in the world, which includes not only transformation of perspectives, but also purposes, values, feelings, and meanings. Accordingly, we refer the transformation of an investor’s frame of reference to changes in his/her perspectives such as beliefs, thoughts and assumptions underlying stock trading for adapting to dynamic market conditions.

## **5. Hypotheses for predicting the learning behavior**

Based on the SCT, the TLT and its practical realities explored by Taylor (2000, 2007) and Nohl (2015), and considering other related learning literature, we identify the following hypotheses as significant for predicting the individual and social learning behaviors of an investor. Figure 2 demonstrates the proposed conceptual framework with these hypotheses.

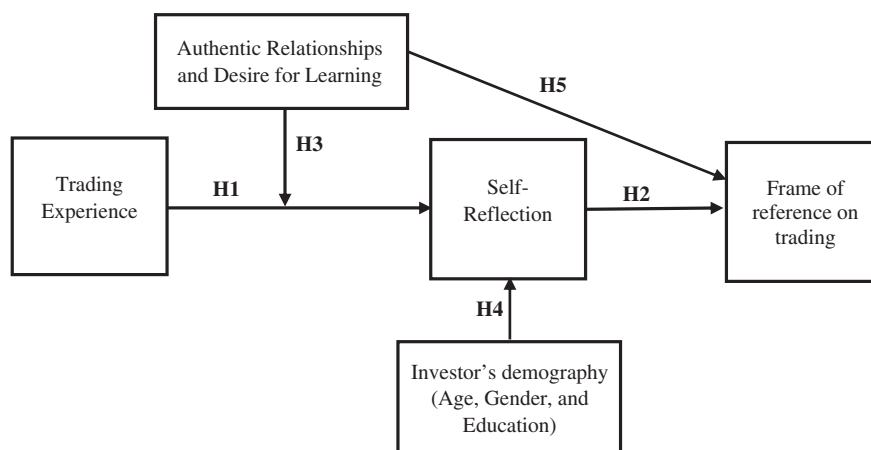
### **5.1. Individual learning behavior**

Figure 2 shows that as a response to trading experience, self-reflection activates within an investor to revise his/her frame of reference. Meanwhile, the investor’s authentic relationships and desire for learning moderate the relationship between the trading experience and the self-reflection. The following sections provide further discussion of this individual learning behavior for the purpose of developing the related hypotheses.

#### **5.1.1. Trading experience and self-reflection**

Our model assumes that the individual learning behavior takes place within an investor when he/she cognitively evaluates his/her perspectives by reflecting on the own past trading experiences. Thus, the trading experience, representing the investor’s cognitive, affective, social and behavioral responses to the outcome of past trading, is expected to be the antecedent of his/her self-reflection in a learning attempt. This prediction is consistent with the learning theories and related empirical findings as discussed below. The TLT predicts that a disorienting dilemma experienced in

**Figure 2. Proposed conceptual framework of an investor's learning behavior.**



the past behavior is the starting point and the subject matter for learning to occur at the individual level. Supporting this prediction, Taylor (2007) finds, through review of previous studies,<sup>17</sup> learners are more likely to engage in an affective process for reflection, in which feelings and emotions experienced during past behaviors prompt them to initiate the learning. Further, Herbers (1998) finds that practical experiences lead adult learners to aware of perceptual biases which, through critical reflection, result in more complete and dependable perspective. Accordingly, it can be anticipated that when an investor trades more frequently, a higher level of trading experience results, which, in turn, produces a better self-reflection, as given in the hypothesis 1.

**Hypothesis 1: Trading experience is positively related to the extent of self-reflection occurred within an investor in the learning process.**

### 5.1.2. Self-reflection and revision of frame of reference

The concept of reflection has been originated in the context of education. Dewey (1933), the founder of this concept, describes reflective thought as “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends”. Following the work of Dewey, this concept has mostly been defined as a mental process involving both emotional and communication components<sup>18</sup> for transforming a particular knowledge into a learning output. Further, it has been recognized as an essential tool for experiential learning (Boud, Keogh, & Walker, 2013; Gibbs, 1988; Killeavy & Moloney, 2010) and for supporting personal development (Shoffner, 2009). Accordingly, the reflection can be regarded as the psychological mechanism through which an individual learns for improving future practices.

Different theories and models discuss the stages and essential elements of the reflection process. According to TLT, as a consequence of a disorienting dilemma experienced, a learner is trying to aware of biased beliefs, thoughts and assumptions in his/her frame of reference. It includes questioning the reliability of them by examining based on prior experiences. This reflection process transforms one's frames of reference to a more dependable one “that is more inclusive, differentiating, permeable (open to other viewpoints), emotionally capable of change and integrative of experience” (Mezirow, 2000). Further, Koole et al. (2011) recognize common elements in the reflection process discussed in various theories and models<sup>19</sup> and incorporate them into a cyclical process consisting of three phases, namely reviewing the experience, critical analysis, and reflective outcome. Each phase includes two items for its execution. The first phase, “reviewing the experience” comprises of description of the

experience as a whole, and awareness of essential aspects based on the consideration of personal thoughts, feelings, and important contextual factors. The second phase is the “critical analysis”. It is the analysis of the experience by reflective inquiry (pose questions about an experience and search for answers while remaining aware of the frame of reference within which the inquiry is being conducted). This critical analysis phase leads to the third phase, “reflective outcome” (new perspective). The future behavior is shaped by this new perspective, which generates new experiences to start a new reflection cycle. Bandura (1986) also notes self-reflection as a unique human capability, through which individuals evaluate and change their perspectives.

The reflection has three levels as content, process and premise (Mezirow, 1991). The content reflection refers to what a person perceives, thinks, feels, or acts when performing a task, while the process reflection focuses on how one perceives, thinks, feels, or acts. The deepest level of reflection is the premise reflection which concerns on why a person perceives, thinks, feels, or acts. The awareness of experiences (content reflection) is not simply enough for learning because the interpretation of experiences is subjectively affected by one’s frame of reference (Koole et al., 2011). The premise reflection is the most important for transformative learning since it results from adults’ mature cognitive development, possesses with those who have greater experience and helps to identify psychological and cultural limitations in one’s established frame of reference (Taylor, 2007). Accordingly, the reflection is the tool to learn from the experiences and the level of reflection that an investor engages determines the extent of his/her learning. Therefore, we predict that a higher level of reflection in the learning process leads to an investor being able to revise his/her frame of reference to a more dependable one so that he/she has lower level of biased beliefs, thoughts and assumptions when trading stocks, as shown in the hypothesis 2.

**Hypothesis 2: Investor’s self-reflection positively impact on the revision of his/her frame of reference on trading so that he/she has a lower level of biased perspectives when trading stocks.**

#### *5.1.3. Factors moderating the relationship between trading experience and self-reflection*

Since the learning of an investor is likely to be informal, self-controlled process with minimal or no intervention of instructors and more vulnerable to external influences, psycho and sociocultural factors of the investor may impact on the extent of the learning. Based on our literature review, we summarize these psycho and sociocultural factors under two categories—authentic relationships and desire for learning.

##### a.) Authentic relationships and learning behavior

It often happens that investors spend time with investment advisors, friends, relatives and peers discussing about investments, their successes and failures, and gossiping others’ successes and failures. These social interactions allow learners to share emotions and feelings with their friends and associates, and have questioning discussions with them to obtain relevant information for examining the validity of deeply held beliefs, thoughts and assumptions underlying their behavior (Nohl, 2015). Festinger (1957) shows importance of group influence in reconciling cognitive dissonance. Koole et al. (2011) and Nohl (2015) also note that social interactions improve the reflection process as it creates a stimulating environment in which learners can understand meanings of their experiences and receive feedback for their new practices. The external feedback provides information to confirm or conflict with the learner’s interpretation of experiences and the new practices for directing towards a better learning path. Thus, for individual learners, social relationships would facilitate for obtaining necessary information and practical knowledge in perspective transformation. Particularly, when the relationships are trustworthy, learners feel

a higher self-confidence on knowledge and information received, thus the greater is the tendency to engage in self-reflection with the increased self-efficacy in learning (Taylor, 2007).

b.) Desire for learning and learning behavior

Due to the self-regulated nature of the investors' learning process, affective phenomena such as emotions, interest, attention, boredom and frustration would influence their desire for learning. These affects are integrated with the cognitive functioning of the human brain, influencing the flexibility, creativity and efficiency in learning (Estrada, Isen, & Young, 1994; Isen, 2000). For example, a positive mood could result to a greater creativity and flexibility in learning. The interest and attention are also likely to stimulate active exploration of information for learning (Bransford, Brown, & Cocking, 1999; Lovric, Kaymak, & Spronk, 2008; Picard et al., 2004). Conversely, those who are frustrated, depressed, do not have interest or do not pay attention to their faults, cannot be expected to participate in an efficient learning effort. Therefore, as Taylor (2000, 2007) finds, the desire for learning can be considered as an important determinant since it strengthens the cognitive functioning of the human brain in the reflection process.

Accordingly, the authentic relationships and the desire for learning are expected to strengthen the cognitive reflection process of the investor, therefore, considered to have a moderating effect on the relationship between the trading experience and the self-reflection, as shown by the hypothesis 3.

**Hypothesis 3: Investor's authentic relationships and the desire for learning have a moderating effect on the relationship between the trading experience and the self-reflection.**

*5.1.4. Diversity of learning among investors with respect to their demography*

Since the critical reflective capacity is a result of "mature cognitive development" of an individual (Merriam, 2004), the self-reflection could vary among investors depending on their demography. Gervais and Odean (2001) show that gender, experience and age affect the assessment of investors' own abilities. Further, Taylor (2007) highlights the diversity of learning in terms of maturity, age, gender, education, class, and ethnicity since the critical reflection varies widely among learners with respect to these factors. Accordingly, we expect that an investor's reflective capability varies with respect to age, gender, and education level. Therefore, these demographic factors are predicted to be the control variables of the self-reflection, as given in the hypothesis 4.

**Hypothesis 4: There are significant differences in investors' self-reflection level between male and female, among different age categories and education levels.**

**5.2. Social learning behavior**

The social learning involves copying a particular behavior of another individual for adapting to a novel environment. Bandura (1977), introducing the social learning theory, proposes that many human behaviors are learnt by observing, selecting models and imitating their behaviors. According to Laland (2004), an individual could rely upon social learning when the nature of the environment is uncertain, individual learning is costly, and established behavior is unproductive. However, when the rate of social learners increase, the proportion of individual learners producing reliable information declines, resulting lower value of learning by copying others' behaviors. His theoretical analysis further shows the value of selecting the individuals from whom to copy the behaviors. Such specific social learning motives include adopting the behavior of the majority or "conformity" (Boyd & Richerson, 1985; Henrich & Gil-White, 2001), and adopting the behaviors of more successful individuals, or "payoff bias" (Boyd & Richerson, 1985; McElreath et al., 2008).

The empirical studies in the context of stock trading (for example, Bossan et al., 2015; Yamamoto, 2005) suggest that social learning practices are more popular among investors since they would be better off by imitating others' behaviors than relying on their own ideas due to low cost of acquiring information and reduced informational uncertainty. Yamamoto (2005) finds that wealth level of investors determines the level of learning, where wealthy investors follow individual learning whereas others tend to be social learners by imitating the behaviors of wealthy investors while constraining the use of their own information and beliefs. Further, Bossan et al. (2015), by studying different forms of social learning,<sup>20</sup> show that payoff-biased social learning and learning by imitating the wealthiest produce better results than individual learning, thus, they are more popular in stock trading. On the contrary, as revealed by herding literature, when imitating others' behaviors becomes market-wide tendency (thus, information producers are rare), the social learning would turn out to be an irrational behavior, resulting unfavorable consequences to a financial market such as speculative bubble and crashes, and information cascade.<sup>21</sup> Considering these evidence, we stress that observation of others' behavior does not merely result in learning, rather it provides only the information on how behaviors are performed and their possible consequences.

We believe that for learning to take place socially, it is essential to aware reasons for the behavior and its underlying strategy, which would be known if the learner has opportunity to interact with those from whom the new behavior is expected to be imitated. Supporting this view, Nohl (2015) states that there would be unconscious or incidental changes to one's frame of reference when new behaviors are inquired upon, socially confirmed and yield successful outcome. Accordingly, social interactions, through which information about reasons and strategies underlying behaviors are transmitted and interpreted, would enable learning to occur at social level. Nevertheless, the communication may not take place, be biased or not be truthful. Behavioral biases could arise if investors are not fully informed or manipulate the way information shared and interpreted to their peer investors (Heimer, 2014; Wu & Gau, 2017). Consequently, the characteristics of the demonstrator and observer (such as age, gender and social status) and nature of relationship between them determine the extent and the trustworthiness of the information communicated, which are important in mitigating such biases (Coussi-Korbel & Fragaszy, 1995; Li, Massa, & Zhang, 2016). Further, Taylor (2009) finds that the authentic relationships facilitate for questioning discussions and openly sharing information, resulting to a greater mutual and consensual understanding of reasons underlying new behaviors. Therefore, given the desire for learning, we predict that the authentic relationships enable unbiased and truthful communication so that investors would learn from others through inquiry and imitating of their successful behaviors, thereby, revise their biased perspectives relating to the stock trading. Accordingly, we expect that, in case of social learning, the authentic relationships and desire for learning have direct and positive effects on the investors' frame of reference so that they are less prone to behavioral biases when trading stocks, as given in the hypothesis 5.

**Hypothesis 5: Investor's authentic relationships and desire for learning have positive effects on the revision of his/her frame of reference on trading so that he/she has a lower level of biased perspectives when trading stocks.**

## **6. Empirical application of the proposed conceptual framework**

Figure 2 demonstrates the proposed entire model for the study of the investors' learning behavior with the related hypotheses. Since our intention is to provide holistic understanding of the learning behavior occurred within the investor, we believe that the empirical test of the model should be pursued within both positivist functionalist and interpretive research paradigms of social sciences, the justifications of which and the suggested methodology under each paradigm are discussed in the following sections.



### **6.1. Positioning the model in the positivist and the interpretive paradigms**

On one hand, we believe that our model can be positioned in the positivist functionalist research paradigm based on the justification for its realist ontology and objectivist epistemology, as follows. First, since the framework is developed based on a sound body of literature, the hypothesized relationships are expected to exist in the context of stock trading. Thus, the learning behavior conceptualized here appears to be a truth that occurs when trading stocks, reflecting the realist ontology of the positivist paradigm. Second, due to this apparent reality, we believe that objective evidence is possible to obtain to measure the theoretical constructs and test the hypothesized relationships of the model. Hence, the explanations for the cause-and-effect relationships and predictions can be based on measurable outcome, which support for the objectivist epistemology of the positivist paradigm.

On the other hand, the learning of investors depends on how they give meanings or interpretations to their experiences. Since the experience is an idiosyncratic and socially constructed occurrence in the mind of investors, its interpretation would be subjective and conditional on factors such as relationships with other investors, perceived controls, way of learning and demography. This subjective and context-specific nature of learning would give rise to multiple truths of the learning phenomenon existing among investors, which limit the validity of single reality (realist ontology) assumed in the positivist paradigm. As a consequence, the results of the studies conducted in the positivist paradigm may have limited generalizability. Further, due to the fact that the model is new and has not yet been empirically examined, there would be some other factors, not identified in the model, affecting the learning behavior, which could narrow the internal validity of the studies conducted in the positivist paradigm (Burns, 2000). Therefore, it appears that positioning the study of our model solely in the positivist paradigm would generate a limited knowledge about this learning phenomenon.

In addition to the subjective and context-specific nature of learning, its causes and effects are mutually interdependent, for example, when an investor's perspectives get revised and become more reflective upon past experiences, he/she is more likely to experience a higher investment performance which would motivate him to trade more frequently, accumulating further learning over time. Accordingly, the learning effects appear to be neither uniform across investors nor value-neutral phenomena. Thus, we believe that the objective evidence and deductive logic cannot provide a comprehensive understanding of the learning behavior. Given this nature of learning, it can best be studied by directly interacting with the investors, and evaluating and interpreting their perspectives, rather than researcher being external to the research context. Hence, we are in the opinion that conducting studies within the interpretive paradigm is also equally important to gain in-depth knowledge on the nature and extent of learning occurred within the investor.

Accordingly, following the suggestions of Lagoarde-Segot (2015), we expect to extend the study of our model to the interpretive paradigm, without limiting solely to the positivist paradigm. We believe that such diversification would enhance the knowledge of investors' learning behavior as follows. First, given the idiosyncratic and context specific nature of the learning, the objective evidence obtained from deductive methods may be inadequate and/or biased to provide inferences. However, the interpretive researches provide value judgments by directly interacting with the investors for understanding, describing and interpreting their perspectives. Such value judgments can be used to further support and/or argue the objective evidence. Second, the studies under the interpretive paradigm would facilitate to explore hidden patterns behind complex and interrelated cognitive, affective, social and behavioral aspects of the learning process. Third, with the considerations of both objective evidence and value judgments, the future studies could improve our model or develop new learning models, and discover interesting issues for further research.

### **6.2. Proposed research methodology**

We suggest to pursue the case study approach since our model is examined in both positivist functionalist and interpretive research paradigms. Accordingly, the following procedures are

**Table 1. Measurement of constructs of the proposed conceptual framework**

| Latent construct        | Measurement variables   | Source of the scale                    |
|-------------------------|---|--|
| Trading experience      | Attitudes to trade<br>Subjective norms<br>Perceived behavioral controls | Rhodes, Blanchard, and Matheson (2006) |
| Self-reflection         | Reflection<br>Critical reflection                                       | Kember et al. (2000)                   |
| Desire for learning     | Single dimension  | Fisher and King (2010)                 |
| Authentic relationships | Single dimension  | Kale, Singh, and Perlmutter (2000)     |
| Frame of reference      | Heuristic, prospect factors, herding                                    | Waweru, Munyoki, and Uliana (2008)     |

recommended to test our learning model using survey and phenomenology research methods. The surveys and phenomenology studies should initially be focused on validating the predictive factors of the learning, as given in Figure 2, under different market settings such as developed, emerging and frontier stock markets, and under different market conditions such as market bubble and crashes. In this process, new predictive factors could be added and some factors may be dropped conditional on the market setting and status. Once the validity is proven, the model can be used to assess how the learning takes place within the investor and the extent to which its predictive factors affect the learning process. Since the learning is a slow and incremental process progressing throughout the investors' lives, the surveys and phenomenology studies should be conducted in the longitudinal form to track changes in their perspectives over time. Further, nature and extent of the learning process could vary depending on the market setting and conditions. Thus, such longitudinal studies should be repeated in different market settings and conditions, as given above, to gain more insights of the learning behavior. In relating to the data collection, we propose the questionnaire method (self-administrated or interviewer-administrated) for survey research, and the interview method (semi-structured or focus group) for the phenomenology research. Since the constructs of our model are unobservable, the variables to measure them can be identified based on previously validated scales, as illustrated in Table 1, or using an exploratory study for a group of investors. The structural equation modeling is recommended for survey data analysis as it allows to identify which variables are better indicative of these unobservable constructs and relationships between them to test the model hypotheses.

## 7. Conclusion

This paper proposes a conceptual framework to improve the understanding of the learning behavior of a retail investor in the context of stock trading. Consistent with the literature, it predicts that an investor learns by individually (by his/her own), socially or both of these conscious and unconscious ways for adapting to dynamic market conditions. As a novel attempt, our model conceptualizes learning holistically by incorporating it influences arising from the investor's inner processes such as those of cognitive and affective ones and social structures, in addition to the behavioral processes considered in most of the existing studies. It recognizes the investor's own trading experience as the main contributor to the individual learning, the reflection of which would facilitate to identify biased trading perspectives so that they are expected to be revised to suit with changing environmental conditions. Apart from the experience, the investor's authentic relationships and the desire for learning, and demographic factors such as age, gender and education level are identified as determinants of the individual learning behavior. In relation to social learning, the model predicts that the authentic relationships and the desire for learning enable investors to inquire of the reasons and underlying strategies of others' behaviors, resulting unconscious or incidental revisions to their biased perspectives relating to stock trading.

When the empirical test of the model is concerned, we expect to position the study of our model in both the positivist functionalist and interpretive research paradigms. The survey methodology is suggested for the former and the phenomenology methodology for the latter. Using these

methodologies, the validity of the proposed hypotheses are firstly ensured under different market settings and trading conditions. Once the validity is established, we propose the model to apply in longitudinal studies to investigate the hypothesized learning effect. Accordingly, we expect that while minimizing the weaknesses of the existing learning models, the new framework provides new insights into the learning behavior predicted by the AMH.

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#### Notes

- Empirical studies have found evidence to support the time-varying nature of the market efficiency. See, for example, Ito, Noda, and Wada (2014, 2016); Ito and Sugiyama (2009); Kim, Shamsuddin, and Lim (2011); Noda (2016); Urquhart and Hudson (2013). The literature documented by Lim and Brooks (2011) on evolving nature of return predictability provides further support for this time-varying market efficiency postulated in the AMH.
- See, for example, Chan, LeBaron, Lo, and Poggio (1999), Yamamoto (2005), Hommes (2006), LeBaron (2006), LeBaron (2011), LeBaron (2012), Bossan et al. (2015), and Pastore, Esposito, and Vasilaki (2015) for the agent-based models, and Jiao (2015) for lab experiments on the learning behavior of investors.
- See, for example, LeBaron (2001), LeBaron (2006) and Helbing (2012) for discussion on the limitations of agent-based financial models.
- Studies have revealed that such unrealistic assumptions and parameter configurations can lead to issues in the financial models. For example, Ponta, Pastore, and Cincotti (2018) reveal that agents' interaction is highly sensitive to the statistical properties of the model, and Wang et al. (2018) find that small changes in parameter values cause relatively large fluctuations in the modeled markets, making them more complex and/or deranged systems. Thus, the results of the studies based on the agent-based modeling appear to be highly sensitive to the assumptions and parameter configurations of their models.
- According to their review, Genetic Algorithm is much complex to apply to model the learn behavior of agents. Furthermore, they find that incorporating learning processes such as active learning into agent-based models are difficult and give rise to noise in financial time series, leading to instabilities in the modeled markets.
- The heuristics are rule of thumbs or mental shortcuts used for effort reduction (Shah & Oppenheimer, 2008). According to Gigerenzer and Gaissmaier (2011), "a heuristic is a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex methods".
- The empirical studies have found evidence to support for these behavioral finance models. See, for example, Kariofyllas, Philippas, and Siriopoulos (2017).
- The term "frame of reference" is referred to an investor's perspectives (mental frames such as beliefs, thoughts, assumptions and ideas) underlying stock trading. See Section 4. 2 for a detailed discussion.
- Many empirical studies in both developed and emerging stock markets reveal that imitation of other investors' behaviors (also known as "herd behavior") significantly exists among individual investors. See, for example, literature reviews conducted by Spyrou (2013) and Kumar and Goyal (2015).
- This explanation has been arrived by comparing different meanings given for the term "experience" in the Oxford English Dictionary.
- See, for example, Barber and Odean (2011); Bradbury, Hens, and Zeisberger (2014); Dhar and Zhu (2006); Feng and Seasholes (2005); Gervais and Odean (2001); Itzkowitz and Itzkowitz (2017); List (2011); Nicolosi, Peng, and Zhu (2009); Seru, Shumway, and Stoffman (2009).
- See, for example, Bhandari and Deaves (2006), Xiao (2015), Bodnaruk and Simonov (2015), Wulfmeyer (2016) and Chang (2017).
- See, for example, Barber and Odean (2011); Bossan et al. (2015); Jiao (2015); and Pastore et al. (2015).
- Thorndike was first to use reinforcement theory which was later applied to models in economics, mostly with game theory (for example, Camerer and Hua Ho (1999)).
- The SCT is first developed as the social learning theory by Bandura (1977) and later evolved into the SCT.
- It is an inconsistency between what is assumed to be true and what has just been experienced.
- For example, Eisen (2001), Baumgartner (2001), Carter (2002), Baumgartner (2002) and Brown (2006).
- For example, Scanlan and Chernomas (1997), Aukes, Geertsma, Cohen-Schotanus, Zwierstra, and Slaets (2007), Boud et al. (2013) and Moon (2013).

19. Such as those of Boud, Keogh, and Walker (1985), Schön (1987), Atkins and Murphy (1993), Mezirow (1993), Stockhausen (1994), Moon (1999), Bourner (2003), Mamede and Schmidt (2004), and Korthagen and Vasalos (2005).
  20. These forms of social learning include “imitating the wealthiest”, “conformism”, behaviors containing mix both individual and social learning —“opportunistic individual learning”, “opportunistic conformists” and “in doubt, conform”, and four forms of payoff-biased social learning behaviors.
  21. See literature reviews on herd behavior, for example, Spyrou (2013) and Kumar and Goyal (2015).
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