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Article

Biases, Beliefs, and Maturity: How Age Shields Women Entrepreneurs From Heuristic Pitfalls in Financial Decision-Making

Yan Li[1], Tahira Iram[2,3,4,*], Muhammad Farrukh Shahzad[3], Ahmad Raza Bilal[4]

[1]Applied Finance, Auckland University of Technology, 1010 Auckland, New Zealand
[2]LaRGE Research Center, University of Strasbourg, 67000 Strasbourg, France
[3]College of Economics and Management, Beijing University of Technology, 100124 Beijing, China
[4]Faculty of Management Sciences, University of Sargodha, 40100 Sargodha, Pakistan
*Correspondence: mini_sayal1@yahoo.com; iram@unistra.fr (Tahira Iram)

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Abstract

This study examines the influence of age on the investment decisions of women entrepreneurs, particularly in contexts where societal norms assign them primary responsibility for household responsibilities. The objective is to clarify the moderating role of age in the relationship between investment decision-making and behavioral biases. Data were collected from 260 women entrepreneurs operating small and medium-scale enterprises in Punjab, Pakistan, using a stratified sampling approach. Partial Least Square-Structural Equational Modeling(PLS-SEM) was used to analyze the data. The results show significant associations between overconfidence, anchoring, and availability biases and investment decision-making. However, the effect of representativeness bias depends on age as a moderator. The findings highlight the importance of age dynamics in understanding how behavioral biases shape investment decisions among female entrepreneurs in Pakistan. These insights can help policymakers design targeted interventions, such as specialized lending schemes and tax incentives, to support entrepreneurs across different age groups.

Keywords: age; women entrepreneur; heuristic theory; cognitive biases; PLS-SEM
JEL: D91, D81, L26, G41,C91

1. Introduction

In recent decades, the financial decisions of women entrepreneurs have become increasingly complex due to the propagation of irrational financial behavior (Poggesi et al., 2024; Schreiber et al., 2024). The pressure to make rational investment decisions has increased considerably as every investor strives to maximize profits, often obscured by cognitive biases (Chávez-Rivera et al., 2024). Although prudent investment decisions typically yield substantial advantages, they require more than financial acumen; they also demand development and experience. In this setting, age is a crucial factor that not only contributes to strategic foresight, cognitive control, and management of risk, but also serves as an indicator of life experience (Zhang et al., 2025a). It is imperative to comprehend the way in which age amends the relationship between investment decisions and behavioral biases, particularly in Pakistan, where women entrepreneurs are undoubtedly contributing to economic development (Chávez-Rivera et al., 2024; Zeng, 2025). Moreover, this research underlines the necessity of a more thorough investigation into the ways in which age-related experience can reduce irrationality and improve the financial decision-making capabilities of women entrepreneurs, thereby promoting their economic empowerment and long-term entrepreneurial success. Moreover, while making investment decisions, the entrepreneurs frequently employ heuristic behaviors, or mental shortcuts, as emphasized by Iram et al. (2023a). Such heuristics, which are influenced by societal expectations and cultural conventions, are vital for navigating the intricacies of investment decision-making within the limited environment. Moreover, Sharma (2018) claimed that the decision-making of women entrepreneurs has gained considerable attention regarding economic advancement, employment creation opportunities, and poverty alleviation. The economies of developing countries are significantly influenced by the financial decisions of women entrepreneurs (Shakeel et al., 2020). Moreover, Bouzekraoui and Ferhane (2017) acknowledge the contributions of women entrepreneurs to the consistent development of entrepreneurship. The crisis in economic development highlights the vulnerability of women entrepreneurs and necessitates them to exert significant effort to establish profitable entrepreneurial ventures (Zeb et al., 2020). Women entrepreneurs develop empowerment as a result of financial and moral support during the initial stages of their businesses (Iram et al., 2024).

According to the scholar Syed et al. (2024), in Pakistan, women entrepreneurs are usually undervalued and not encouraged for financial decision-making as compared to men due to the domestic responsibilities of women. Moreover, Iram et al. (2025) took a similar stance, stating that in Asian countries, women entrepreneurs often contend with familial, multifaceted societal, and religious commitments. Furthermore, the financial decisions of women en-

trepreneurs are restricted by unique challenges of cultural norms, limited resources, and unequal access to opportunities (Kibler et al., 2024). The prominent challenges faced by women include social injustice, gender-dominating norms, a lack of family support, and gender discrimination (Hasan, 2020). In contrast, Shah and Saurabh (2015) argued that women investors exhibit imprudent behavior due to inadequate family support, regardless of whether the investment pattern is small, medium, or large. Furthermore, age has a strong influence on investment decisions; similarly, how a woman entrepreneur handles money and makes business decisions is largely determined by her age (Kibler et al., 2024). On the other hand, heuristic shortcuts are also strongly associated with financial decision-making; for example, overconfident and experienced entrepreneurs make better decisions with the gradual increase in age (Syed et al., 2024). Furthermore, the irrational investment and gender inequality highlight the importance of age while making decisions (Syed et al., 2024). So, the age of an entrepreneur has become an important subject to research, particularly in the context of women (Kibler et al., 2024).

Despite the increasing interest in behavioral finance, there has been less empirical investigation into how age impacts the behavioral or cognitive biases and their influence on investment decisions. Although current literature highlights the significance of heuristics in decision-making, it frequently neglects the moderating effects of demographic factors, including age (Chaiken, 1989; Syed et al., 2024). This neglect creates a significant study void in comprehending how age-related experience mitigates vulnerability to cognitive biases and improves financial decision-making (Kibler et al., 2024; Siraji, 2019). In the context of Pakistan, where women frequently encounter economic and social limitations, analyzing these dynamics is pertinent and significant, particularly in light of Pakistan's continued participation in the European Union's Generalized Scheme of Preferences (GSP) (Callao et al., 2020; Sultana and Zehra, 2023). The sustainability of Pakistan's GSP status progressively depends on inclusive economic development, institutional transparency, and the strengthening of women's financial participation. Age surpasses a basic demographic trait; it represents a cumulative repository of experiential knowledge, strategic acumen, and wisdom that evolves with time (Sultana and Zehra, 2023; Verma et al., 2025).

When women grow as entrepreneurs, they usually focus on their heuristic judgment, refine risk perception, and execute more strategic financial decisions (Bose and Mironko, 2023). But with experience, the dependency on cognitive shortcuts gets reduced; therefore, age functions as a noteworthy moderator in mitigating cognitive biases and enhancing the quality of decision-making. The significance of this study resides in its empirical analysis of age as a moderating element influencing the relationship between behavioral biases and investment decisions, a connection infrequently investigated, especially within the socio-economic framework of Pakistani women entrepreneurs. Moreover, the findings of this study will propose valuable insights for policymakers and regulators in designing effective tax compliance frameworks, banking regulations, and financial technology initiatives that are responsive to cognitive heterogeneity among the different age groups of women entrepreneurs (Dvorak and Komarkova, 2023). Additionally, evidence-based regulatory interventions could contribute to improved financial decisions, reduced informal economic activity, enhanced tax transparency, and the development of a resilient fintech ecosystem, thereby strengthening the Pakistan's institutional capacity and compliance with governance and sustainability expectations associated with the European Union's GSP framework (Choudhary, 2024; Malik, 2020; Zhou and Cuyvers, 2012). This study also added its theoretical contribution to the literature of behavioral finance by including age into heuristic theory, providing practical insights to bolster women's financial resilience and engagement. The two main objectives of this study are: (1) to investigate the extent to which behavioral biases impact the investment decisions of women entrepreneurs and (2) to examine the moderating effect of age on the relationship between cognitive biases and investment decisions among women entrepreneurs in Pakistan.

This study is compiled into five sections. The 1st section is an introduction, the 2nd is a literature review, and the 3rd section is an explanation of the methodology, results and findings. The 4th section is the discussion, implications, limitations and future recommendations, while the final section argues the conlcusion.

2. Literature Review and Hypotheses Development

Prior studies suggested that the financial behavior of women entrepreneurs significantly influences the rationality of their investment decisions in Pakistan. Understanding their savings habits, risk tolerance, and investment preferences is crucial for promoting informed and effective investment strategies, thereby fostering economic empowerment and growth (Iram et al., 2022; Tibaingana et al., 2024). The literature not only suggests investigating the impact of women entrepreneurs' behavior on financial decisions, but also suggests that there is an utmost need to examine how this relationship would be more rational and prudent via the moderating role of age (Shah et al., 2018). As a result, this study induced a moderating mechanism (age) to add to the existing literature, which part of the age (young adult, adult, older age) of women entrepreneurs can make more rational decision-making. Part of this literature first explains the study's conceptual model using Heuristic behavioral theory and then focuses on hypothesis development.

2.1 Heuristic Behavioral Theory

Shelly Chaiken (1989) developed the heuristic theory to explain how people receive and process persuasive information. The lens of heuristic theory also aids in explaining how individuals' financial decisions are influenced by uncertain conditions due to a lack of information and biased beliefs. Moreover, this theory understands behavioral finance and supports the relationship between an entrepreneur's behavioral biases and financial investment decisions. Additionally, Iram et al. (2023a) discussed the heuristic theory by emphasizing that an investor's behavior is a strong predictor of financial ups and downs. According to the scholars Gitman et al. (2015), age motivates women investors to gain knowledge to allocate funds, determine working capital, and manage financial retirement plans. Furthermore, Kibler et al. (2024) argued that heuristics assist mature individuals in managing their savings by providing knowledge of how to manage the expenses associated with saving. He went on to explain, using the heuristic theory as a lens, that people who have experience with age can manage their finances for emergency funds, especially for investment purposes. A mature age demonstrates the ability to control and manage the financial investments, an investor's ability to make an investment decision depends upon their ability and maturity.

Furthermore, the age of an investor signifies her investment experience and cognitive maturity, hence improving her financial decision capabilities (Kibler et al., 2024; Verma et al., 2025). With maturity, an entrepreneur develops enhanced heuristic skills, enabling them to process information more precisely and mitigate the impulsive biases (Syed et al., 2024). The age of an entrepreneur serves as a crucial moderator in comprehending the impact of cognitive biases on investment decisions, especially within the framework of heuristic theory. Moreover, Chaiken (1989) discussed that investors frequently utilize mental shortcuts, or heuristics, while evaluating irrational financial information, particularly when lacking proper expertise. In this context, age transforms into a significant construct; it transcends mere numerical value to embody cumulative experience, knowledge, and cognitive maturity that profoundly impact financial decisions (Zeng, 2025). Furthermore, Urban and Moetse et al. (2024) and Gitman et al. (2015) also argued that age enhances financial judgment in women, making them able to manage complications such as tax calculation, risk tolerance, fund allocation, and long-term planning. The prior studies presented the age as a moderating variable, signifying that older and experienced women entrepreneurs, owing to their superior heuristic abilities, may exhibit reduced susceptibility to behavioral biases and demonstrate greater proficiency in making rational investment decisions (Verma et al., 2025; Zhang et al., 2025b). This addition of demographics augments behavioral finance research and challenges broad assumptions regarding gender and risk by highlighting the complexity of age-related wisdom in women (See Fig. 1).

2.2 Overconfidence Heuristic and Investment Decision

When an entrepreneur develops an exaggerated perception of their decision-making abilities, they often believe that they have more and superior knowledge, which indicates overconfidence bias (Karki et al., 2024). This cognitive misrepresentation typically results in ambiguous decision-making because investors overestimate their skills and underestimate the potential risks (Iram et al., 2023b). According to the heuristic theory, Chaiken (1989) claimed that entrepreneurs employ mental shortcuts to simplify intricate decisions, particularly in uncertain conditions. This dependence on heuristic shortcuts is more pronounced in women entrepreneurs, particularly in developing economies, due to limited access to formal financial literacy and institutional support (Singh et al., 2024). Furthermore, when heuristics can accelerate decision-making, they may intensify biased judgments when coupled with overconfidence, leading to risky investments (Iram et al., 2023a). However, the aged and experienced women entrepreneurs can critically assess these shortcuts, thus improving and enhancing the quality of their financial decisions (Syed et al., 2024). The mature and experienced women entrepreneurs are more prone towards prudent, rational investment decisions and manage overconfident behavior effectively (Iram et al., 2022). Moreover, maturity not only improves the heuristic judgment but also mitigates overconfidence bias, thereby enabling female entrepreneurs to make more strategic and effective investment decisions. Thus, we proposed this hypothesis:

H1a- Overconfidence bias has a significant impact on the investment decisions of women entrepreneurs.

2.3 Representativeness Heuristic and Investment Decision

Representativeness heuristics means to make decisions on the estimation of the likelihood of events. Making decisions is the most difficult aspect of running a business (Hitaj et al., 2025). The cognitive approach of each individual constantly pushes them to make decisions (Pappas, 2025). Moreover, Einhorn and Hogarth (1981) argued that the psychology of human cognition and the perception of having a kind, judgmental attitude. Psychologists frequently guide heuristics based on their critical skills. Aside from business decisions, heuristic skills provide individuals with shortcuts in their daily lives (Iram et al., 2023b). Moreover, not all research supports the idea that heuristics like representativeness consistently influence decision-making. Some researchers suggest that female investors may rely less on certain heuristics, such as representativeness, in complex or unfamiliar situations (Kahneman and Tversky, 1974). The essence of a shortcut varies from person to person; everyone has their own mental shortcuts. Tversky and Kahneman (1974) argued that the representativeness heuristic is a common cognitive shortcut whereby individuals rely on familiar patterns or outcomes when making decisions. Within the context of heuristic decision-making theory, women entrepreneurs exhibiting this heuristic are

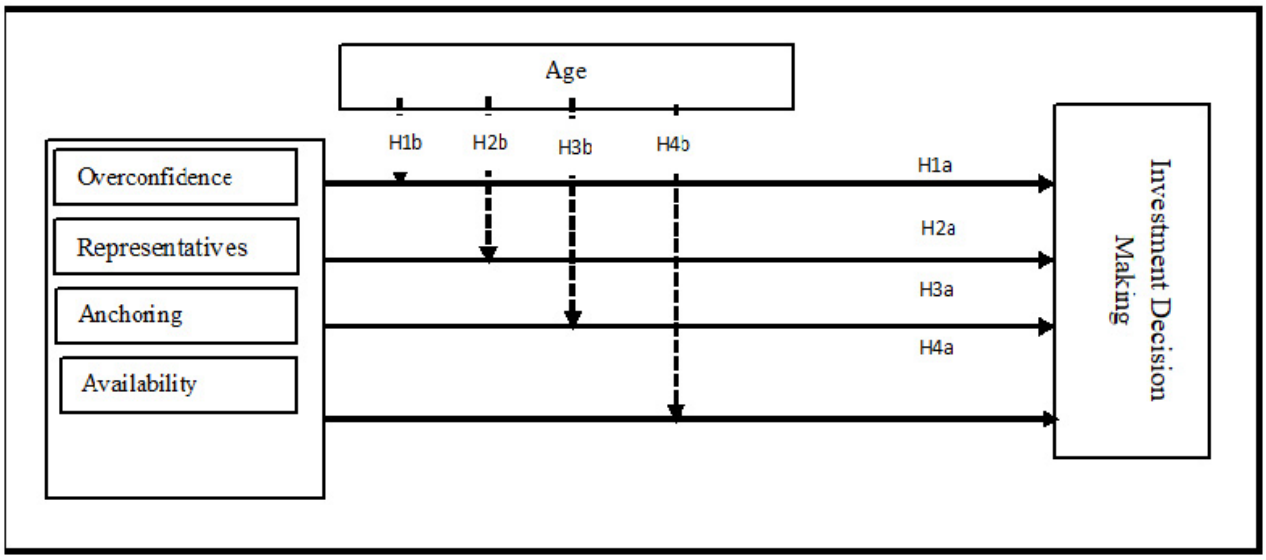

Fig. 1. Conceptual framework. Source: Prepared by Authors.

more likely to base their investment decision-making on perceived similarities to previous outcomes or typical cases, rather than engaging in detailed analytical evaluation (Hitaj et al., 2025; Siraji, 2019). This reliance on heuristics illustrates how cognitive shortcuts influence financial choices, highlighting the role of heuristic-driven decision-making in entrepreneurial behavior. As a result, the proposed hypothesis is:

H2a- Representativeness heuristic has a significant impact on investment decisions of women entrepreneurs.

2.4 Anchoring Heuristic and Investment Decision

Anchoring bias means to rely on the first piece of information while making decisions, and it is a common occurrence that has an impact on all aspects of business Chauhana et al., 2024). Furthermore, Schein (1996) claimed that an entrepreneur's proclivity to put her investment in the stock market based uniquely on available information is anchored. According to Malhotra et al. (2018), women investors usually avoid obtaining rationalized information and instead depend upon their existing knowledge to make investment decisions. Moreover, Karki et al. (2024) discussed that investors' investment decisions are based on the primary piece of information or evidence, which is called an anchor. Similarly, women entrepreneurs may fall victim to anchoring heuristic bias and usually make poor financial decisions while running their businesses (Chauhana et al., 2024; Hitaj et al., 2025). Therefore, it can be concluded that women entrepreneurs' anchoring heuristics may impact their investment decisions. Thus, we proposed this hypothesis:

H3a- Anchoring bias has a significant impact on the investment decisions of women entrepreneurs.

2.5 Availability Heuristic and Investment Decision

Availability means to make decisions based on vivid information (Zhang et al., 2025b). Individuals can use availability heuristics to determine the possibility while evaluating an explicit concept, topic, or method (Pompian, 2012). According to the prior study, availability heuristics are valuable for the dynamic procedure or the ethical advancement (Hayibor and Wasieleski, 2009). Moreover, Kliger and Kudryavtsev (2010) contended that an increase in stock prices within a favorable financial exchange environment may lead to more informed investment decisions. In emerging markets with inadequate financial infrastructure, individuals often rely on the availability heuristic, using readily available stocks for investment opportunities (Salman et al., 2021). Pakistani women entrepreneurs often rely on readily available or recent information when making investment decisions, particularly in contexts where structured financial data is limited (Iram et al., 2024; Komba, 2025). According to heuristic decision-making theory, this reliance reflects the availability heuristic, where judgments are disproportionately influenced by information that is most accessible. Such heuristic-driven decision-making can shape perceptions of risk and opportunity, potentially leading to choices that are not fully objective or analytically grounded (Zhang et al., 2025b). So, the proposed hypothesis is:

H4a- Availability bias has a significant impact on the investment decisions of women entrepreneurs.

2.6 Age as Moderator

Age plays a critical role in determining financial decisions for women entrepreneurs, influencing financial rationality, risk perception, and behavioral tendencies over time (Syed et al., 2024). The moderating impact of age can be estimated through life-stage theory, where individ-

uals progress through stages like accumulation, consolidation, and gifting, which influence the investment priorities (Brown, 2012; Kibler et al., 2024). The age group 36–60 is predominantly noteworthy as it corresponds to the consolidation phase of life-stage theory, where entrepreneurs typically accumulate wealth, reassure the risk tolerance matters, and prioritize stability over growth. This phase usually leads to more cautious and risk-averse decisions (Agarwal et al., 2009). On the other hand, cognitive ability sometimes declines with age, as argued by Agarwal et al. (2009); but the accumulated experience of women entrepreneurs over time contributes more to the human capital, resulting in more rational and prudent investment decisions. The investment decisions also align with the life-stage perspective, which emphasizes how social roles and responsibilities evolve across the lifespan. Specifically, middle-aged women entrepreneurs often associate professional expertise with life experience, allowing them to make more stable and informed financial choices, as decision biases typically diminish with experience (Zeng, 2025).

Similarly, societal norms assign women primary responsibility for household duties, marriage, and child-rearing, which interact with age as a social role to shape financial decision-making (Iram et al., 2023b; Zeng, 2025). Furthermore, women aged 18–35 are often heavily engaged in family and societal responsibilities, which may constrain risk-taking or influence investment behaviors differently as compared to middle-aged women, who may have greater autonomy and resources. Integrating these age-as-life-stage effects into the theoretical framework helps explain how social roles, alongside accumulated human capital, influence how women entrepreneurs navigate financial risks. In contrast, young investors, who are early in both professional and social life stages, usually exhibit overconfidence bias due to limited experience and higher risk tolerance (Frank et al., 2025), highlighting the interplay of age as human capital and life-stage factors in financial decision-making. This overconfidence often impairs decision-making by limiting adaptability and consideration of alternatives (Ezeani et al., 2025).

Additionally, older women entrepreneurs above 60, with more experience, tend to exhibit more caution and reflective thinking, reducing impulsive decisions and mitigating overconfidence bias (Kibler et al., 2024). Thus, age restrains the influence of biases, supporting more stable financial decisions. This perspective is strengthened by heuristic theory, which postulates that age augments the capacity to process mental shortcuts more efficiently, thereby reducing cognitive biases such as overconfidence, while investors rely on them in ambiguous situations (Syed et al., 2024). Furthermore, this perspective is reinforced by heuristic theory, which explains that age enhances the capacity to process mental shortcuts more efficiently, thereby reducing biases such as overconfidence, while individuals rely on them in ambiguous situations (Syed et al., 2024). So, we hypothesized that:

H1b- Age has a moderating impact on overconfidence and investment decisions of women entrepreneurs.

Representativeness decreased with age in the study performed by Kahneman and Tversky (1974), although the reverse was observed in other cases. An interesting range of findings has emerged in the study of Pappas (2025) on heuristics and perceptions, in which he argues that representativeness remains constant in the teenage years, but this was offset by some developmental changes. Moreover, Hitaj et al. (2025) argued that the significant decrease in responses was due to a wide range of tasks; this phenomenon suggests a change in heuristic reasoning among teenagers. The relationship between representativeness and age has reduced in the assessments of outcomes and decisions (Hitaj et al., 2025).

Building on this, the moderating role of age on representativeness bias may be explained by age-related changes in cognitive processing and social identity (Ahmad et al., 2025). As individuals grow older, accumulated experience and enhanced analytical reasoning may reduce reliance on representativeness, whereas social roles and responsibilities may influence which heuristics are more salient at different life stages (Zeng, 2025). This differential effect usually accounts for the unique impact of representativeness moderated by age, while other biases, such as availability or anchoring, may be less sensitive to these age-related cognitive and social changes (Hitaj et al., 2025).

H2b- Age has a moderating impact on representativeness and investment decision of women entrepreneurs.

Various studies have investigated the anchoring bias among adults; however, it remained unaddressed when it pertained to age (Jetter and Walker, 2017). An ongoing discussion on heuristics (e.g., anchoring) exists when we discuss age. One of the previous research projects argued that youngsters have a greater tendency to enter into financial decisions (Jetter and Walker, 2017; Syed et al., 2024). Moreover, three experiments have been conducted to explore the age at which the anchoring heuristic develops, and age has been shown to significantly influence anchoring heuristics. As age increases, the effectiveness of anchoring in investment decision-making appears to decrease. Moreover, Chauhana et al. (2024) conducted experiments examining how consumers' evaluation of goods is impacted by anchoring. Young adults, in particular, tend to rely on external anchors to guide their decisions (Geurten and Meulemans, 2017). Thus, we can hypothesize that:

H3b- Age has a moderating impact on anchoring and investment decisions of women entrepreneurs.

Previous studies reveal that heuristic ability (e.g., availability) among youngsters has a logical association between age and mind (Klaczynski and Felmban, 2014; Zhang et al., 2025a). Availability style of decision-making can also be associated with different levels of age in investment analysis and business variation. Younger people have better cognitive or heuristic abilities than older people (Komba, 2025). Additionally, we predicted that cognitive capacity

would be a more powerful predictor of heuristic processing. Thus, it can be hypothesized that:

H4b- Age has a moderating impact between availability and investment decision of women entrepreneurs.

3. Methodology

The participants in this study are women entrepreneurs who own small and medium-sized firms (SMEs) in Punjab, which is Pakistan's most populated province. This study examines how they make short- and long-term investment decisions while managing their company's affairs. We focused on the women business owners who are members of the Women's Chamber of Commerce (WCC). We used WhatsApp to collect the primary data from the aforementioned women entrepreneurs. Their contact details were attained from WCC. Google Forms were utilized to create the survey. The respondent's privacy and data security were strictly preserved through ethical consideration.

The data were collected by using the proportionate stratified sampling technique because research is conducted on a specific population that shows similar characteristics but resides in different geographical regions of Pakistan. Furthermore, the population for data collection is categorized into four strata based on four women's chambers of commerce operating in four districts of Punjab, Pakistan. These are named as: Lahore Women's Chamber of Commerce, Bahawalpur Women's Chamber of Commerce, Multan Women's Chamber of Commerce, and the Faisalabad Women's Chamber of Commerce. The sample size was determined using the formula from Ruane (2005), which suggests that for populations greater than 1000, 30% of the total population provides an adequate sample size. To enhance validity, Stevens' (2002) formula for sample size selection was also applied, requiring a minimum of 90 participants (15 × 6 predictors).

In addition to Ruane (2005) and Stevens (2002), we further validated the adequacy of the sample size via post-hoc statistical power analysis, which was conducted by using a G*Power 3.1 (Düsseldorf, North Rhine-Westphalia, Germany) developed by Faul et al. (2009) for linear multiple regression. The results indicated that the final sample size (N = 260) provides adequate statistical power (≥0.80) to detect the hypothesized moderation effects, particularly for the overconfidence × age, anchoring × age, and availability × age interactions (see Fig. 2). These results confirmed that the sample size was sufficient for testing the proposed moderated model.

As the sample size was validated using multiple statistical approaches, the final sample size based on Ruane's (2005) recommendation was adopted to ensure accurate representation of the population (see Table 1). There are two sections to the questionnaire. The first part of the poll deals with the demographics of women entrepreneurs, including their age. The second portion discusses overconfidence, anchoring, representativeness, availability, and investment decisions.

260 surveys were received in the three months after being sent via WhatsApp to the 343 registered women entrepreneurs. The response rate was approximately 76% once the data were examined. Table 1 shows the percentage of the four WCC Punjab's total population from which samples were taken.

3.1 Measurement of Scale

The questionnaire for this study was adapted from published, highly cited studies that use well-calibrated items relevant to the four heuristic aspects of overconfidence, anchoring, representativeness, and availability. Overconfidence, representativeness, anchoring, and availability were among the measured variables whose scale items were adopted from Babajide and Adetiloye's (2012) study. One of the overconfidence scale items is "*I am an experienced entrepreneur*". An item from the representativeness heuristic is "*I prefer such transactions that represent desirable qualities*". Moreover, an item from anchoring is "*I rely on my previous experiences in the market for my next investment decision*". Availability scale item is "*I consider the information from my close friends and relatives as a reliable reference for my investment decisions*". These studies were later validated by ul Abdin et al. (2017). Additionally, the Waweru et al. (2008) study was used to modify the scale items for investment choice; Rasheed et al. (2018) validated this modified scale. One of the items to measure the investment decision is "*My investment as an entrepreneur has a safety*". As advised by Gujarati (2021), the short adaptation procedure was performed to make the necessary changes to the scale items and make it feasible according to the current study on women entrepreneurs, as some of the questions are mentioned above. Age is measured as a categorical variable in this research and split into three categories, from 18–35 were considered as young, those aged 36–60 were considered as adult and 60-above was considered as older women (Brown, 2012)

3.2 Data Analysis, Interpretation, and Results

For instance, Partial Least Square-Structural Equational Modeling (PLS-SEM) technique is selected for data analysis because this technique is notably effective in the management of missing data by employing estimating algorithms and mean replacement (Hair et al., 2019; Ramayah et al., 2018). These methods enable the precise imputation of missing values using the available data, thereby preserving the integrity of the results and minimizing bias (Bagozzi et al., 1981; Hair et al., 1998). This technique was chosen for its capacity to analyze intricate relationships between latent (unobserved) and observable variables, as well as its capability to handle the missing data efficiently (Hair et al., 2019; Iram et al., 2025). Moreover, Hair et al. (2010) preferred PLS-SEM over covariance-based SEM for its capacity to handle sophisticated models, non-normal data distributions, and smaller sample sizes.

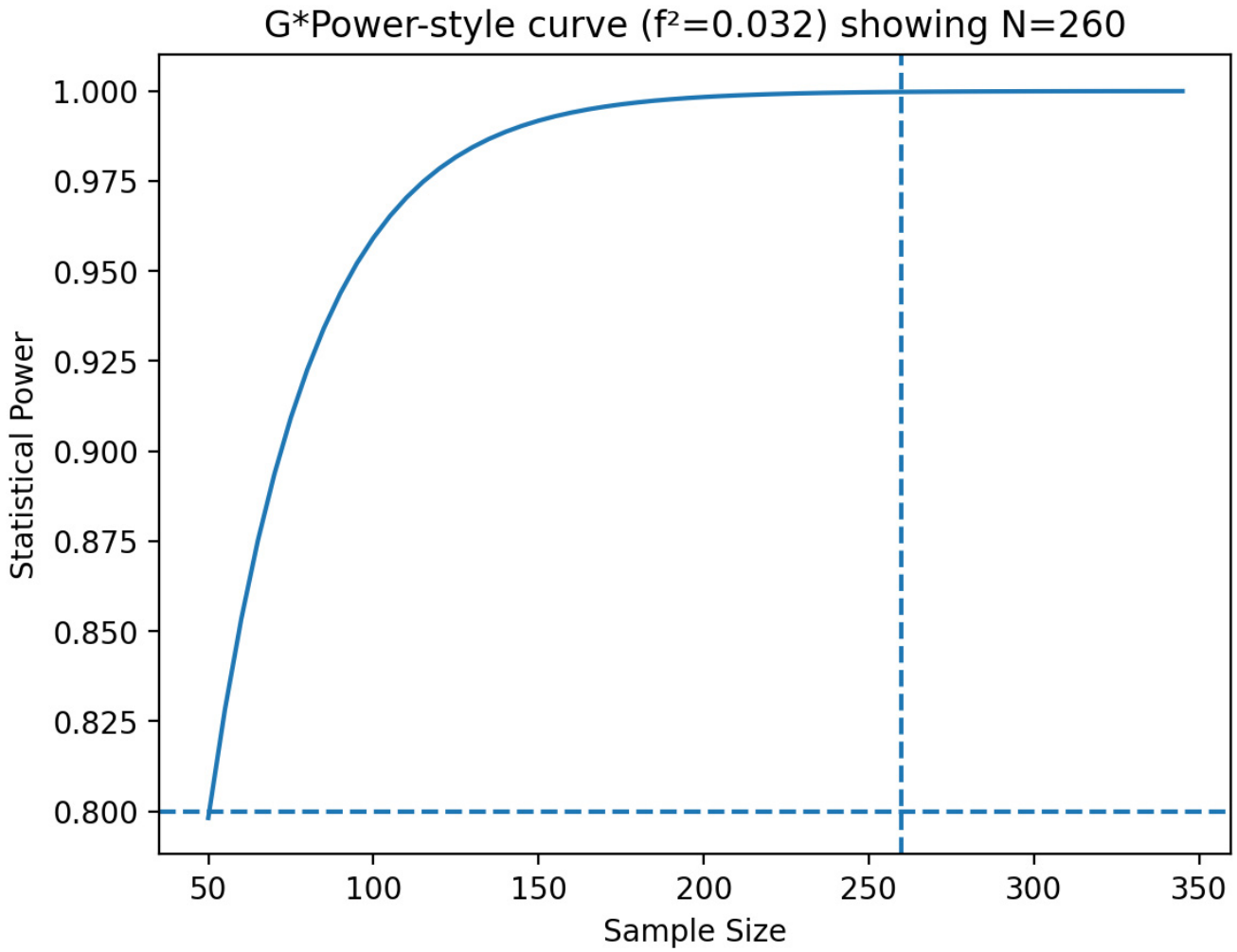

Fig. 2. G*Power. Source: Prepared by Author.

Table 1. Proportionate stratified sampling.

Punjab Stratum	Women entrepreneurs		
	Number of registered women entrepreneurs	%	Number of registered women entrepreneurs
Lahore Women Chamber of Commerce (CC)	516	30%	155
Faisalabad Women Chamber of Commerce (CC)	103	30%	31
Multan Women Chamber of Commerce (CC)	283	30%	85
Bahawalpur Women Chamber of Commerce (CC)	240	30%	72
Total	1142	30%	343

(Source:Ruane, 2005).

PLS-SEM is the best choice for exploratory research because it does not necessitate large sample sizes or strict distributional assumptions, unlike covariance-based SEM (Ramayah et al., 2018). Its ability to effectively evaluate both structural and measurement models and estimate complex relationships further justifies its selection. Moreover, SmartPLS 4.0, SmartPLS GmbH (Oststeinbek, Schleswig-Holstein, Germany), was chosen for its exceptional analytical capabilities, including its capacity to model complex relationships, its ability to evaluate both reliability and validity, and its proficiency in managing missing data (Hair et al., 2010). Consequently, it is a highly effective tool for this study.

3.2.1 Common Method Variance (CMV) and Non-Response Bias

The diagnostic tests of Hair et al. (2019) were followed to detect common method variance; statistical and procedural measures were implemented to reduce the extent of common method variance. According to previous researchers, variance inflation factor(VIFs) technique is used to check CMV, which determined that the value must be be-

low 3.3(Kock, 2017; Kock and Lynn, 2012). In this study, the value of VIF is 2.7, which is below the threshold limit, and the model is considered as accepted. The respondents' confidentiality and secrecy were maintained throughout the entire procedure. Our 60 questionnaires went unanswered, and 23 were incorrectly completed, resulting in no responsive bias. We used wave analysis to address potential issues with non-response bias. The responses were divided into two categories for this purpose: "early respondents" and "late respondents", and a *t*-test revealed that there is no significant difference between the two groups in terms of their survey responses.

3.2.2 Measurement Model

The measurement model was also tested for internal reliability as well as convergent and discriminant validity of the given constructs (see Table 2). Internal reliability resembles the extent to which the given items of a specific construct are representative of the given latent variable (Ramayah et al., 2018). Cronbach's alpha and composite reliability (CR) were used to calculate internal reliability (Hair et al., 2019). The CR threshold value is 0.7 (Richter et al., 2016). The evaluation of the measurement model revealed that all of the above-mentioned constructs had a CR value greater than the cut-off value (0.70). Overconfidence (0.94), Representativeness (0.94)Anchoring (0.87), Availability (0.91), and Investment decision (0.94) imply that the current study's measures have internal consistency (see Table 3).

Table 2. Fornell larcker criterion.

Constructs	ANC	AVA	ID	OC	REP
ANC	0.832				
AVA	0.605	0.885			
ID	0.415	0.588	0.882		
OC	0.627	0.566	0.549	0.876	
REP	0.585	0.525	0.517	0.596	0.897

Note: OC, overconfidence; REP, representativeness; ANC, anchoring; AVA, availability; ID, investment decision.

Source: Author's own calculation.

Moreover, the predictive power of this study model was assessed by evaluating the path coefficient values and R^2 values. The R^2 analysis is used to check the total variance of the dependent variable and the variation ratio of the independent constructs to determine the coefficient of determination (Zhang et al., 2025b). The value of R^2 in this model is 55.9% for the investment decision, which means this model explains 56% of the variance, with the remaining 44% attributed to other factors. In social sciences, this variance is considered moderate explanatory power, which specifies that unmeasured factors may also influence the dependent variable (Richter et al., 2016). According to the guidelines of Hair et al. (2019), overall model fit was evaluated using multiple goodness-of-fit indicators. Moreover, the standardized root-mean square residual (SRMR) and the global goodness-of-fit (GoF) index were computed to evaluate the discrepancy between the observed and model-implied correlations. The SRMR value of 0.136 suggests a low level of model fit in the context of a complex PLS-SEM model. In addition, further fit diagnostics were examined, including d_ULS (13.171), d_G (3.992), Chi-square (6373.457), and the normed fit index (NFI = 0.470), which provide complementary information about the degree of correspondence between the estimated model and the empirical data (Hair et al., 2019). Although the SRMR and NFI values do not meet recommended thresholds, such results are common in complex PLS-SEM models (Ramayah et al., 2018). As PLS-SEM is primarily prediction-oriented, global fit measures are not decisive. Importantly, Cronbach's alpha, CR, and average variance extracted (AVE) exceed acceptable levels (Richter et al., 2016). Thus, the model demonstrates adequate reliability and validity and is considered acceptable for analysis (see Table 4).

3.2.3 Structural Model

To compute the significance of our proposed hypothetical model, we used the Bootstrapping technique with "5000" resamples (Hair et al., 2023). Table 5 shows the results of the direct cause and effect relationship between the constructs, which are also validated in Fig. 3. Anchoring and investment decision have a significant negative relationship (H3a: $\beta = -0.182$, $p = 0.000$), which means an increase in anchoring bias reduced the rational decision making. So H3a is Accepted. Similarly, there is a significant relationship between Availability and investment decision (H4a: $\beta = 0.307$, $p = 0.000$). As a result, the H4a accepted our proposal. Furthermore, overconfidence with investment decisions shows a significant relationship (H1a: $\beta = 0.195$, $p = 0.000$), supporting our hypothesis. As a result, the H1a is accepted. In contrast, the relationship between representativeness and investment decision is insignificant (H2a: $\beta = 0.045$, $p = 0.070$), contradicting our hypothesis. As a result, the H2a was also rejected.

3.2.4 Moderation Analysis

Advancements in quantitative methodologies consider that the direct effects and total effects have the least importance while analyzing moderation models (Hayes et al., 2017). We investigated the moderating impact of age (see Fig. 3) on the relationship between investment decision and heuristic behavioral biases (overconfidence, availability, anchoring, and representativeness). Age was treated as a continuous variable to better capture the gradual shifts in decision-making as individuals age. Furthermore, the age significantly moderates the relationship between the Anchoring and investment decision (H1b: $\beta = -0.298$, $p = 0.000$). Thus, it supports the hypothesis H1b. Similarly, age also moderates the negative relationship of Availability bias and investment decision (H2b: $\beta = -0.138$, $p =$

Table 3. Reliability and validity of constructs.

Constructs	Cronbach's alpha(α)	Composite reliability (CR)	Average variance extracted (AVE)
ANC	0.782	0.871	0.692
AVA	0.858	0.915	0.784
ID	0.927	0.946	0.779
OC	0.924	0.943	0.767
REP	0.919	0.943	0.804

Note: OC, overconfidence; REP, representative; ANC, anchoring; AVA, availability; ID, investment decision. .

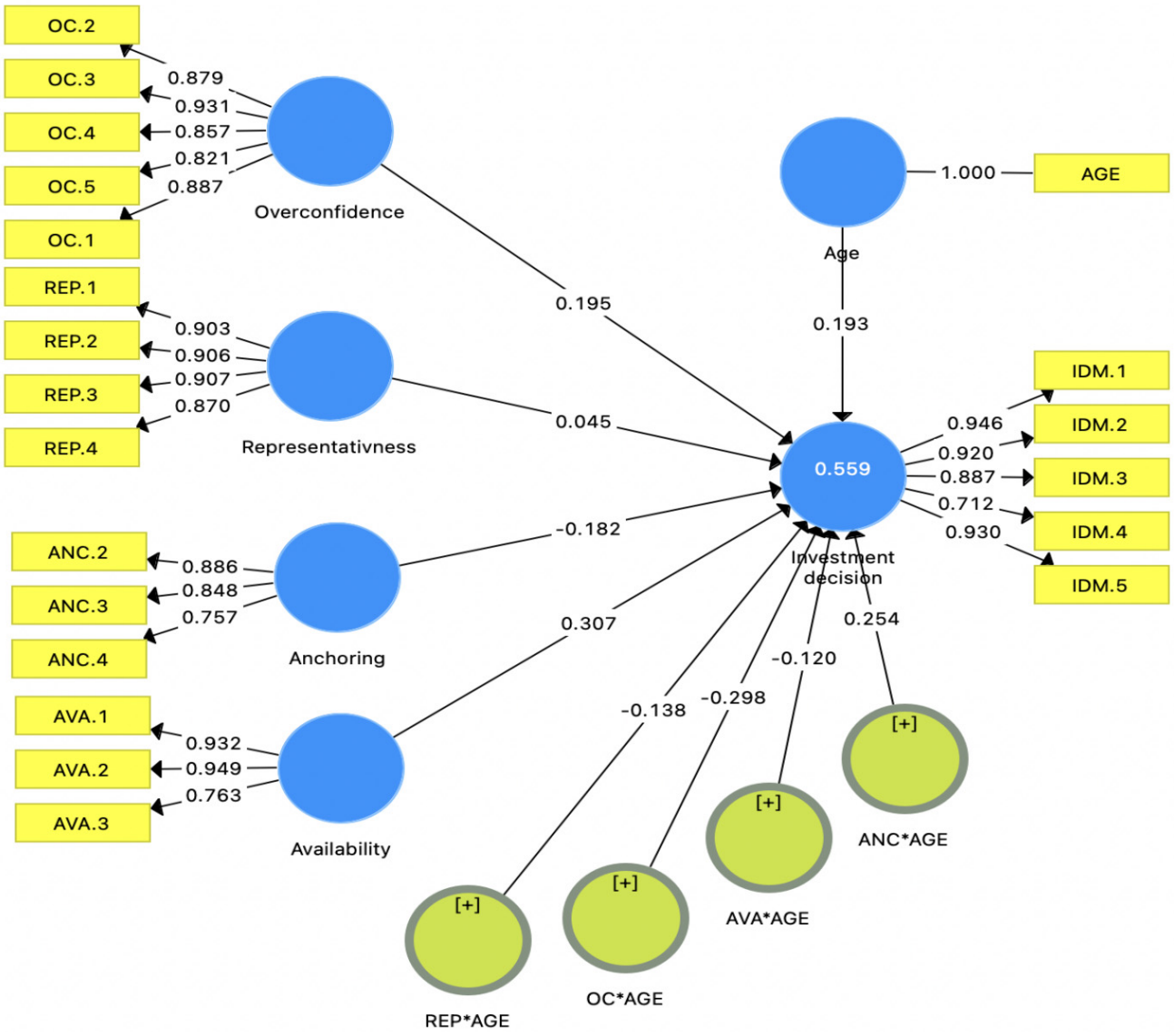

Fig. 3. Structural equation model (PLS Algorithm).

0.040), thus supporting the hypothesis H2b. Furthermore, age also significantly moderates the negative relationship between Overconfidence and investment decision (H3b: β = 0.254, p = 0.000), which again supports H3b. Similarly, the age moderates the negative significant relationship between representativeness bias and investment decision (H4b: β = –0.120, p = 0.007), thus H4b is accepted. Whereas the direct relationship between representativeness and investment decision was insignificant and moderating impact of age makes it significant (see Table 6).

3.2.5 Multigroup Analysis of Age

The multigroup analysis (Table 7) shows that younger women entrepreneurs (18–35) are more influenced by overconfidence and availability biases, reflecting prudent and information-based decision-making. The decision-making

Table 4. Discriminant validity.

Constructs	ANC	AVA	ID	OC	REP
ANC					
AVA	0.733				
ID	0.451	0.642			
OC	0.723	0.629	0.580		
REP	0.681	0.585	0.548	0.648	

Note: OC, overconfidence; REP, representative; ANC, anchoring; AVA, availability; ID, investment decision.

Source: Author's own calculations.

is significant but weakened in the age group of 36–60, indicating greater control of cognitive and more rational investment behavior due to their experience. But anchoring bias is stronger among women investors aged 60+, suggesting increased dependency on past experiences. Overall, an increase in age reduces irrational heuristics while increasing dependence on experiential reference points in investment decisions. Age also reduces impulsive heuristics (overconfidence, availability) but strengthens the anchoring, indicating experience-driven yet reference-dependent decision-making among older women entrepreneurs.

4. Discussion

Our primary objective was to investigate the extent to which behavioral (cognitive) biases significantly affect the investment decisions of women entrepreneurs. This study's findings affirm that behavioral biases, such as overconfidence, anchoring, and availability biases, significantly positively impact the investment decisions of women entrepreneurs. The findings correspond with existing literature indicating that women entrepreneurs frequently depend on heuristic decision-making due to limitations in information, time, and resources (Iram et al., 2025; Sharma, 2018). Heuristics are the cognitive shortcuts that support entrepreneurs in managing uncertainty; yet, they may also result in biased investment judgments (Nouri et al., 2019).

Furthermore, overconfidence bias significantly impacts younger women entrepreneurs, leading them to overrate their financial skills and undervalue dangers, resulting in daring yet occasionally imprudent investment decisions (Zeng, 2025). Anchoring bias plays a key role, as women entrepreneurs usually depend largely on initial information when making financial decisions. The availability bias demonstrates that easily retrievable information disproportionately affects investment behavior (Iram et al., 2022; Pappas, 2025). These findings highlight the enduring influence of cognitive biases on decision-making, especially within the volatile and uncertain commercial landscape of developing economies. Nonetheless, representativeness bias did not exhibit a substantial impact on investing decisions. This may result from the bias being more consistent across age demographics, or sometimes, younger women entrepreneurs might not depend on stereotypical decision-making in novel or intricate situations (Pappas, 2025).

Age serves as a substantial moderating role between cognitive biases and investing decisions, as outlined in our second objective. The findings indicate that age mitigates the impact of some of the biases, like overconfidence and representativeness biases, on investment decision-making. Moreover, the age was originally categorized into three age slots (18–35, 36–60, and 60+), and to distinguish the impact of the three age slots, the multigroup analysis was done. This analysis showed that younger women entrepreneurs (18–35) are more influenced by overconfidence and availability biases, reflecting imprudent and information-driven decision-making. Furthermore, these impacts weaken in the 36–60 age group, indicating greater cognitive control and more rational investment behavior due to experience (Stirzaker and Sitko, 2019). The findings indicate that anchoring bias becomes stronger among women aged 60+, suggesting increased reliance on past experiences. Overall, age reduces irrational heuristics while increasing dependence on experiential reference points in investment decisions (Kibler et al., 2024). This age categorization aligns with verdicts that suggest age impacts biases like overconfidence, representativeness, and anchoring affect decision-making (Vuori et al., 2024).

Furthermore, young women entrepreneurs (18–35) often display significant overconfidence; nevertheless, as they age, their decision-making evolves to become more prudent, evidence-based, and contemplative (Iram et al., 2021; Zeng, 2025). Older women (60 plus) entrepreneurs have superior evaluative abilities and diminished impulsivity, hence mitigating the detrimental impacts of overconfidence and representativeness biases (Kibler et al., 2024). Conversely, age positively influences the link between anchoring bias and investing decisions. As entrepreneurs mature, they increasingly depend on early knowledge (anchors), likely due to their acquired expertise and established heuristics, which may not consistently correspond with the contemporary market setting (Vuori et al., 2024). This dependence may render mature entrepreneurs more vulnerable to anchoring effects than their younger counterparts, who proactively follow current knowledge. In this study, the age adversely influences the effect of availability bias. It is predicted that younger women entrepreneurs tend to base their decisions on accessible or striking information, but older women are more inclined to reflect on and contrast past experiences before making financial decisions (Komba, 2025; Stirzaker and Sitko, 2019). This improved analytical depth results in more reasonable and stable investment behavior among older age demographics. Additionally, both the continuous moderation model and the categorical multigroup analysis consistently demonstrate that age reduces irrational heuristics while increasing experience-based decision-making, thereby strengthening the robustness and interpretability of the findings (Kibler et al., 2024; Vuori et al., 2024; Zeng, 2025).

Table 5. Bootstrapping.

Hypothesis	Relationship	Coefficient	Std.Dev	*t*-value	*p*-value	Supported
H1a	OC → ID	0.195	0.041	4.717	0.000	Yes
H2a	REP → ID	0.045	0.032	1.411	0.070	No
H3a	ANC → ID	–0.182	0.044	4.186	0.000	Yes
H4a	AVA → ID	0.307	0.037	8.343	0.000	Yes

Note: OC, overconfidence; REP, representative; ANC, anchoring; AVA, availability; ID, investment decision; Std.Dev, Standard deviation.

Source: Author's own calculation.

Table 6. Bootstrapping-moderating effect.

Hypothesis	Relationship	Coefficient	Std.Dev	*t*-value	f^2	Supported
H1b	OC×AGE →ID	–0.298	0.052	5.741	0.032	Yes
H2b	REP×AGE →ID	–0.138	0.046	2.963	0.002	Yes
H3b	ANC×AGE→ID	0.254	0.062	4.083	0.034	Yes
H4b	AVA×AGE →ID	–0.120	0.063	1.989	0.099	Yes

Note: OC, overconfidence; REP, representative; ANC, anchoring; AVA, availability; ID, investment decision; AGE, age.

Source: Author's own calculation.

Table 7. Multigroup analysis by age.

Relationship	18–35	36–60	60+	Results
OC → ID	Strong and significant	Weak and Significant	Insignificant	This impact declines with age
REP → ID	Insignificant	Significant	Weak	Age mitigates this bias
ANC → ID	Insignificant	Significant	Stronger	Anchoring bias increases with age
AVA → ID	Strong and significant	Moderate	Insignificant	Younger investors rely on vivid information

Note: OC, overconfidence; REP, representative; ANC, anchoring; AVA, availability; ID, investment decision.

Source: Author's own calculation. Age groups operationalized as: 18–35, 36–60, 60+ (Brown, 2012).

These findings authenticate the heuristic theory by demonstrating how age influences susceptibility to particular behavioral biases. As individuals grow, their capacity to understand heuristic cues gets increasingly sophisticated, supporting the assertion that older women entrepreneurs engage in more rational and informed investment choices.

4.1 Theoretical Implication

This study proposed substantial theoretical advances to behavioral finance and entrepreneurship by merging heuristic theory with demographic moderators, specifically age, about the investment decisions among women entrepreneurs in a developing nation. Although previous research has thoroughly explored the influence of cognitive biases such as overconfidence, anchoring, and availability on investment behavior, limited studies have empirically investigated the functioning of these biases within the gendered entrepreneurial context of emerging markets like Pakistan.

This study adds to heuristic theory by illustrating that age influences the cognitive biases and investment decisions, indicating that susceptibility to biases is dynamic and changes over time. The findings highlight that as women entrepreneurs mature, their cumulative experience and exposure to business issues enhance their cognitive filtering capabilities, thus diminishing the impact of adverse biases such as overconfidence and representativeness. Moreover, this study also addresses a significant gap in the behavioral decision-making literature by incorporating age as a dynamic, context-sensitive moderator, thereby enhancing the knowledge of entrepreneurial cognition in women. It establishes the foundation for additional theoretical investigation into the intersection of social, cultural, and psychological factors with heuristic processing in gendered investment behavior.

Additionally, this study also revealed that behavioral biases such as overconfidence, representativeness, anchoring, and availability significantly influenced investment decisions, especially among women entrepreneurs across different ages. The incidence of such biases differs among different age groups: youth, adults, and seniors. The findings further suggest that women entrepreneurs who rely on prior knowledge and exhibit overconfidence tend to make suboptimal decisions. Conversely, the investors who utilize current and pertinent knowledge demonstrate superior and more rational decision-making capabilities.

4.2 Managerial Implications

The findings of this study propose valuable practical insights for financial regulators, policymakers, and en-

trepreneurship support organizations. Given that cognitive biases significantly influence investment decisions, particularly among younger women entrepreneurs, there is a persistent need for specialized financial literacy and behavioral training programs. These training programs should not only enhance technical knowledge but also focus on raising self-awareness about biases.

Policymakers, especially related to regulatory bodies such as the Federal Board of Revenue (FBR), State Bank of Pakistan (SBP), and Securities and Exchange Commission of Pakistan (SECP), should prioritize such initiatives to foster rational decision-making in women entrepreneurs, contributing to the sustainable development of the economy. Additionally, the moderating role of age underscores the importance of age-specific interventions. Younger women entrepreneurs could benefit from mentorship opportunities with older, more experienced women in business, which could refine their risk assessment and decision-making processes. For older women, despite their experience, biases such as anchoring and availability may still persist, indicating a need for refresher training to challenge outdated beliefs and adjust investment strategies according to current market realities.

Moreover, investors and financial institutions can utilize these insights to develop tailored financial products and advisory services that consider age-related cognitive patterns in women entrepreneurs. In terms of corporate strategies, women SME managers and investors should focus on adapting their business models and financial strategies to address both cognitive biases and age-related shifts in decision-making. This would not only expand their investment outcomes but also enhance their long-term business sustainability.

Lastly, policymakers should also keep in mind the measures to maintain and enhance Pakistan's GSP Plus status with the European Union. This is especially pertinent for international readers, as the Free Trade Agreement facilitates access to global markets (Choudhary, 2025). Furthermore, strengthening the entrepreneurial environment for women, particularly through improved financial literacy and tailored support, will contribute to Pakistan's economic growth while ensuring continued benefits from international trade agreements.

4.3 Limitation and Future Research

This study, like other empirical investigations, has several limitations that should be acknowledged. First of all, the sample is geographically restricted to SMEs in four districts of Punjab, Pakistan, which may limit the generalizability of the findings to other regions. In addition, Pakistan's unique socio-cultural, religious, and economic context may have influenced the observed relationships. Moreover, as the cultural values, institutional environments, and technological development vary across countries, future research should conduct cross-cultural comparative studies to enhance external validity. The study also does not explicitly consider the role of international trade policies, such as the European Union's GSP, which may influence SME decision-making in global market settings. From a methodological perspective, although the model demonstrates acceptable explanatory power and statistically significant structural relationships, global fit indices should be interpreted with caution. The values of SRMR and NFI do not meet conventional covariance-based SEM cut-off values. However, in PLS-SEM, particularly for complex models with multiple interaction terms, such indices are only approximate diagnostics and are often inflated or deflated (Hair et al., 2019; Hair et al., 2023). These values are therefore acknowledged as a limitation, and future studies are encouraged to further validate the model using alternative specifications or covariance-based approaches.

The future research could be expanded by incorporating additional psychological and behavioral biases, such as risk aversion, self-serving bias, and confirmation bias. These factors can be analyzed using appropriate mediating and moderating variables to deepen our understanding of decision-making processes among entrepreneurs and managers. Additionally, the study did not explore gender-based differences in responses or behaviors. Analyzing gender differences, particularly in relation to age, could offer valuable insights into how male and female entrepreneurs or employees perceive and react to the examined factors. Therefore, incorporating gender as a demographic variable in future studies could further enrich the understanding of behavioral patterns in SMEs. Furthermore, the longitudinal study could help examine how these biases and behaviors evolve, providing a more comprehensive view of decision-making processes.

5. Conclusion

We encapsulate that behavioral biases among women entrepreneurs significantly influence their decision-making capabilities, which in turn may lead to either suboptimal or improved decision making, as supported by prior research. The findings further indicate that younger adult women entrepreneurs are more likely to rely on readily available examples, overestimate their abilities, and experience greater cognitive confusion in the early stages of decision-making. These tendencies collectively exert a stronger influence on their investment decisions compared to older women entrepreneurs, as also noted by Stirzaker and Sitko (2019), Römer-Paakkanen and Takanen-Körperich (2022), Iram et al. (2024).

Moreover, according to this research findings, , younger women entrepreneurs do not consistently depend on the first available piece of information, particularly in situations where reliable information sources are limited. In contrast, older women entrepreneurs are more inclined to rely on initial reference information and demonstrate more stable and rational decision-making patterns, as supported by Stirzaker and Sitko (2019), Römer-Paakkanen and Takanen-Körperich (2022), and Iram et al. (2024).

Overall, these findings highlight meaningful age-related differences in the influence of cognitive biases on entrepreneurial decision-making, emphasizing the role of experience and information processing in shaping investment decisions (Weber and Schaper, 2004). The heuristics behavioral factors have a significant mark on a woman entrepreneur's investment decision, but the age-wise pattern priorities are changed. Age has a strong moderating effect. Women are more heuristic and possess more qualities of heuristic behavior patterns in mid-age, while at a young age and old age, their priorities are limited.

Availability of Data and Materials

Data can be provided on reasonable demand.

Author Contributions

YL contributed to conceptualization, data curation, methodology, formal analysis, funding acquisition, and manuscript review and editing. TI contributed to conceptualization, investigation, project administration, data curation, validation, and writing of the original draft, as well as manuscript review and editing. MFS contributed to methodology, formal analysis, software, data curation, visualization, and manuscript review and editing. ARB contributed to supervision, design of the work, validation, statistical analysis, and manuscript review and editing. All authors made substantial contributions to the study, participated in manuscript preparation and revision, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

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Conflicts of Interest

The authors declare no conflicts of interest.

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