

<https://doi.org/10.70517/ijhsa47204>

The Impacts of the Availability Heuristic, Mental Accounting, Client Stress, and Anchoring on Valuation Variation in Real Estate

Chun-Chang Lee^{1,*}, Pei-Syuan Lin², Wen-Chih Yeh³ and Chun-Chao Chen⁴

¹Professor, Department of Real Estate Management, National Pingtung University, No. 51, Minsheng E. Rd., Pingtung City

²Associate Professor, Department of Land Resources, Chinese Culture University, No. 55, Hwa-Kang Rd., Yang-Ming-Shan, Taipei

³Associate Professor, Department of Real Estate Management, HungKuo Delin University of Technology, No. 1, Lane 380, Qingyun Road, Tucheng District, New Taipei City

⁴Department of Land Economics, National Chengchi University, NO.64, Sec.2, ZhiNan Rd., Wenshan District, Taipei City 11605, Taiwan

Corresponding author: Chun-Chang Lee (e-mail: lcc@mail.nptu.edu.tw).

Abstract The issue of valuation variation in real estate has received increasing attention from researchers in recent years. Valuation variation generally refers to differences in property valuations made by different real estate appraisers, influenced by the appraisers' individual beliefs. These differences arise from each appraiser's subjective values and the different strategies they use in their valuation process. From a behavioral finance perspective, this study examines the effects of mental accounting, heuristics (availability and anchoring), and client stress on real estate appraisers' valuation variation. Because mental accounting, heuristics, and client stress are treated as latent variables, we used structural equation modeling to analyze appraisers' decision-making in their valuations. The empirical results show that mental accounting has a positive and significant effect on valuation variation, while client stress has a negative and significant effect. Additionally, the availability heuristic, mental accounting, and client stress have a positive and significant effect on anchoring; however, anchoring does not have a significant effect on valuation variation.

Index Terms Valuation variation, availability heuristic, mental accounting, anchoring heuristic, client stress

I. Introduction

The discourse on real estate valuation as an art rather than a science is frequently raised. Yet real estate appraisers are often required to perform valuations in a rational, objective, and scientific manner. According to Tversky and Kahneman [1], people are inherently susceptible to errors in decision-making. It is human nature that biases often arise from one's subjective opinions and affect decision-making behaviors. During the decision-making process, certain factors can contribute to deviations. Real estate appraisers are often influenced by their subjective opinions during valuation, so different appraisers may produce different valuation outcomes for the same property. These differing valuations can cause confusion and perplexity among appointers and stakeholders, potentially leading them to question the appraisers' reliability and to be distrustful of valuation tasks in general.

At present, real estate valuation is an important topic in real estate research worldwide [2]. Valuations are commonly used by decision-makers, including individuals, private firms, and government agencies, in financial decision-making, taxation, purchasing, or disposal matters [3]. Valuations are also essential for decisions in real estate investments, sales, taxation, compensation for compulsory purchases, financial institution loans, and real estate securitization. Because valuations largely depend on appraisers, maintaining objectivity is crucial for effective operations at national, social, and economic levels [4].

In recent years, the issue of valuation variation has garnered substantial interest among scholars. Valuation variation refers to differences in judgment between appraisers and is essentially caused by variations in their beliefs, subjective values, and strategies used during valuations. Kucharska-Stasiak [5] argued that when uncertainty exists in real estate valuation, different appraisers valuing the same property often arrive at different outcomes. Bellman [6] concurred, noting that property valuation is essentially an approximation rather than a fixed value and that the valuation process is influenced by various uncertainty-related factors.

With respect to research on valuation variation, early studies focused on market information, valuation approaches, real estate type, regulatory frameworks, valuation environments, appraisers' professional skills, experience and judgment, and client pressure. More recent studies have examined appraisers' cognitive behaviors [5], [7], [8]. Specifically, many past studies have explored the impacts of client influence [9]–[11], overconfidence, task complexity, and anchoring [11], [12]. Indeed, uncertainty in valuation mainly stems from personal perception, and these behavioral studies are largely associated with the field of cognitive psychology.

The anchoring and availability heuristics are often discussed in the literature on real estate valuation (see [13], [14] for

the former and [15], [16] and [17] for the latter). Lee et al. [11] investigated the anchoring heuristic alongside four other dimensions—client influence, overconfidence, confirmatory bias, and task complexity—using a covariance-based structural equation model (SEM). Skidelsky [18] surmised that appraisers often rely on conventions, rules of thumb, habits, and traditions when real estate risk is uncertain. The availability heuristic provides appraisers with a sense of security when facing uncertainty. Pompian [15] cautioned that the availability heuristic can skew information processing and easily cause bias in appraisers' decision-making, rendering valuations inaccurate and less objective. Lee et al. [19] extended the study by Lee et al. [11] on the availability heuristic by examining the causal relationships between the latent variables using both covariance-based SEM and partial least squares SEM.

Mental accounting is often cited as a factor contributing to valuation variation. Grounded in prospect theory, Thaler [20] adopted a value function–based approach to examine irrational psychological behaviors in humans. He developed a mental accounting framework, which proposes that decision-making is rooted in assessing multiple options, and that the simplest way to interpret the mechanisms underlying our intrinsic gains and losses is by dividing outcomes into profits and losses. When individuals make decisions, latent psychological rules—often at odds with operational rules in economics—exist within their mental accounting systems. As a result, decision-making is frequently influenced by unexpected factors, leading individuals to deviate from rational economic principles. Gupta and Kim [21] similarly noted that people do not consider a single factor during decision-making but also take into account their financial capacity, expenditures, and positive and negative influences. We propose that real estate appraisers are influenced by the perceived risks and benefits in their mental accounts during valuations.

Existing studies on the influence of client pressure on valuation decisions and valuation variation have produced mixed conclusions. Some researchers suggest that, under the influence of trade negotiations and economic hardship, client pressure amplifies bias and variation. Others contend that appraisers may focus more on target prices to minimize variation and prevent customer loss. This study is grounded in behavioral finance and aims to achieve the following objectives: 1. Investigate the effects of the availability and anchoring heuristics, mental accounting, and client pressure on real estate appraisers' valuation variation; and 2. Clarify the paths of influence of these variables and develop an integrated analytical framework.

Most real estate studies rooted in behavioral finance and focusing on individual factors have relied on secondary data rather than primary data. Given that the availability and anchoring heuristics, mental accounting, and client pressure are important psychological factors in behavioral finance that can influence valuation variation, this study collected primary data to examine their effects on valuation variation. The four variables were treated as latent variables in an SEM to analyze real estate valuation decisions. This study enhances our understanding of how appraisers' valuations are influenced and driven by the availability and anchoring heuristics, mental accounting, and client pressure.

Unlike previous studies that have focused on a single bias or path of influence, this study simultaneously examined four variables and collected and analyzed primary data, thereby providing evidence consistent with local standards and contexts and enhancing the interpretability and external validity of the findings. If the results show that certain dimensions, such as mental accounting, play a key role in decision-making, this study can deepen our understanding of valuation tasks and help interpret the risks of valuation variation by providing an empirical basis for regulatory supervision and the standardization of appraisal reports.

II. Literature Review and Study Hypotheses

Babawale and Omirin [22] defined valuation accuracy as the consistency between valuation results and market transaction prices. This differs from valuation variation, which refers to the difference between valuations. According to Havard [23], real estate appraisers use heuristics when making judgments in complex task environments. However, this strategy may lead to decision-making bias in individuals with limited information-processing capacity, as the valuation may not provide a reliable interpretation. The availability heuristic may even introduce greater bias. Diaz and Hansz [12] reported that although heuristics can simplify complex information and help solve problems efficiently, they are subject to the individual bias of the decision-maker. Amidu et al. [24] likewise noted that while heuristics expedite problem solving, decisional bias may surface in the process, and there is sufficient evidence that heuristics can cause valuation bias. Iroham et al. [16] examined the impact of heuristics on asset valuation through a questionnaire survey of property surveying and valuation companies in Nigeria. The results showed that participants were indeed affected by heuristics. Evans et al. [25] emphasized the salience of heuristics in valuation, particularly the availability heuristic, which simplifies complex tasks. We therefore propose the following hypothesis:

H1: The availability heuristic significantly and positively influences valuation variation.

Anchoring refers to setting an initial reference point and making adjustments as more information becomes available. In this process, decision-makers often adopt an initial value or anchor when making decisions in socially ambiguous contexts. They then adjust based on relevant information, with the result that the final decision tends to be biased toward or similar to the initial anchor. Iroham et al. [13] described the availability heuristic as a shortcut or rule of thumb for simplifying complex problems, and it is regarded as one of the most common heuristics. Mwasumbi and Tarimo [26] noted that the availability heuristic can improve information processing systems and increase decision-making efficiency. Their study showed that the availability heuristic is widely employed at various stages of the decision-making process. Furnham and Boo [27] argued that

anchoring is influenced by personal factors such as mood, professional expertise, past experience, motivation, personality, and cognitive ability. Cascão et al. [28] reported that the availability heuristic affects the strength of the anchoring effect. An initial anchor influences judgment by increasing the availability of certain information in memory, which makes relevant features easier to recall and more likely to affect decision-making. The authors also observed that in the housing investment market, investors influenced by the availability heuristic and anchoring were more sensitive to house prices and location. Because of these easily recalled and straightforward factors, investors may overlook other, more important but less accessible information. We posit that setting a reference price is influenced by the availability heuristic and propose the following hypothesis:

H2: The availability heuristic significantly and positively influences anchoring.

Thaler [20], [29] introduced mental accounting theory, which holds that people tend to categorize their assets into different accounts for individual management. Thaler [20] further described mental accounting as the separation of costs and benefits in individual decision-making. In these processes, people rely on mental accounts as a heuristic to organize and monitor their consumption and expenditures. In traditional economics, funds are considered fungible; money of the same amount has equal value and should not affect decision-making differently depending on its source or purpose. In reality, however, mental accounts are prevalent in everyday economics. Under their influence and allocation, people develop decision-making behaviors that diverge from traditional economic theories and lead to unexpected outcomes that contradict the principle of fungibility. In the real estate market, buyers with this bias may make inefficient investments, restrict cash flow, and miss profitable opportunities. For appraisers, the valuation process may also be undermined. Einiö et al. [30] investigated sellers' reluctance to realize losses in the Helsinki real estate market. They found that sellers delayed sales when facing small losses but aggregated sales when the selling price was close to the buying price. As a result, in valuation distribution, sales peaked at the point of zero profit (where profit equals cost) and were scarce in small-loss intervals. Baucells and Hwang [31] stated that through reference prices and loss aversion, mental accounting magnifies valuation variation. Compared to rational consumers—whose valuations are based solely on subtracting cost from profit—consumers with mental accounts show greater fluctuations, as they perceive a transaction to be too costly, wasteful, or unworthy. We therefore propose the following hypothesis:

H3: Mental accounting significantly and positively influences valuation variation.

Tversky and Kahneman [32] asserted that reference point setting is influenced by mental accounting. Paraschiv and Chenavaz [33] reported that reference point adjusting among sellers in the real estate market is not instantaneous but rather influenced by mental accounting. Sellers are more likely to close an old mental account and open a new one after a profit, and to keep the old account after a loss. Waweru et al. [34] explored the behavioral factors influencing investment decisions in the Kenyan property market and found that mental accounting and erroneous reference points influenced investors' anchoring behaviors, causing them to respond differently to price variations. More specifically, investors' sensitivity to anchors differed across accounts. The influence of anchoring was strongest in long-term accounts and weakest in short-term accounts. When making a loss, investors were more likely to anchor an incorrect reference point. We surmise that appraisers' anchoring is influenced by mental accounting during the valuation process, and propose the following hypothesis:

H4: Mental accounting significantly and positively influences anchoring.

In a New Zealand study, Levy and Schuck [35] found that clients were capable of influencing valuation outcomes. Because the valuation process is largely client-controlled, client influence exists not only in the pre-valuation phase but also in specific valuation procedures. Amidu et al. [24] found that Nigerian appraisers often violated ethics and regulations because of client pressure, thereby altering their final valuation outcomes. Wofford et al. [36] stated that some clients constantly attempt to influence appraisers' valuation decisions. Nwuba and Salawu [37] argued that valuation bias occurs when appraisers submit to client pressure and also highlighted the detrimental effects of client stress on valuation practice. Crosby et al. [10] noted that due to the intrinsic uncertainty of property valuation, clients may exert influence that increases valuation variation. Kinnard et al. [38] similarly found that appraisers often adjust valuation outcomes to align with client expectations in order to avoid potential client loss. This suggests that valuation variation may diminish under client pressure. In highly systematized valuation tasks with stringent standard operating procedures, client pressure may skew valuation outcomes toward an acceptable range and lead to variation convergence. On this basis, we propose the following hypothesis:

H5: Client pressure significantly influences valuation variation, either positively or negatively.

Amidu et al. [24] surmised that the valuation process is influenced by pre-transaction prices provided by clients, as appraisers can gain additional benefits when the valuation outcome exceeds the sales price. Gallimore and Wolverson [39] noted that the objective of mortgage loan valuation is to estimate open market prices to reduce default risk. However, under client pressure, appraisers may adjust reasonable market prices toward fictitious sales prices in order to secure a higher loan amount. Nwuba et al. [40] agreed that appraisers are susceptible to client pressure when performing mortgage loan valuations, as they may devise ideal prices for clients to obtain financing. Lee et al. [11] investigated why valuations for the same property vary among appraisers and found that client pressure significantly influenced both anchoring and valuation variation. In summary, client pressure affects appraisers' anchoring during the valuation process. On this basis, we propose the following hypothesis:

H6: Client pressure significantly and positively influences anchoring.

According to Diaz and Hansz [12], appraisers rely on previous valuations when they believe that a current valuation task exceeds their capability due to market uncertainty. In other words, they tend to base their valuations on unverified anchor points. Wong [41] surveyed professional appraisers in Hong Kong with at least two years of valuation experience and found that the valuation process is influenced by anchoring because it simplifies the process and facilitates problem solving, thereby improving task efficiency. Scott and Lizieri [42] examined the presence of anchoring among first-time homebuyers in the United Kingdom. The results showed that due to their inexperience in house selection and purchasing, most consumers’ cognitive price judgments were influenced by anchoring. Pompian [15] noted that appraisers often fail to adjust their anchors adequately during initial anchor selection, thereby increasing the likelihood of valuation bias. Adegoke [43] determined that appraisers’ skills, judgments, and experiences, as well as anchoring, influenced valuation variation and uncertainty. Many studies have attested to the extensive use of heuristics in property valuation, as they effectively simplify the decision-making process. The anchoring and adjustment heuristic is a common approach in valuation and is often cited as a cause of uncertainty. Therefore, anchoring and valuation are closely associated [13], [14], [44]. We propose the following hypothesis:

H7: Anchoring significantly and positively influences valuation variation.

III. Study Design

III. A. Conceptual Framework

Based on the literature review and study hypotheses, this study developed a conceptual framework (shown in Figure 1) and applied an SEM to analyze the influences of four latent behavioral finance variables—the availability heuristic, anchoring, mental accounting, and client pressure—on valuation variation.

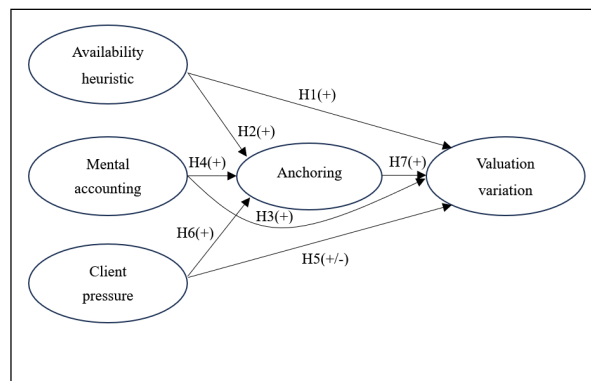


Figure 1: Conceptual framework of the study

III. B. Questionnaire Design

The questionnaire consisted of two sections. The first collected participants’ basic information, including sex, age, marital status, education level, tenure, mean annual income, and firm size. The second section covered items related to the availability heuristic, mental accounting, client pressure, anchoring, and valuation variation. All items were measured on a 5-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree).

Pompian [15] described the availability heuristic as a rule of thumb or mental shortcut in which a decision-maker relies on past experience before making an estimation. Based on Pompian [15] and Lee et al. [11], we designed four items on the availability heuristic across the two sub-dimensions: rule of thumb and mental shortcut.

Furnham and Boo [27] identified factors affecting the anchoring heuristic, including mood, professional expertise, past experience, motivation, personality, and cognitive ability, and noted that the valuation process is influenced by individual differences. Based on Furnham and Boo [27] and Lee et al. [11], we designed four items on anchoring across three sub-dimensions: knowledge and skills, practical experience, and motivational factors.

Thaler [20], [29] introduced mental accounting theory, which posits that people tend to categorize and individually manage their assets in different accounts. Mental accounting involves the division of costs and benefits related to individual decision-making, in which people follow mental accounts as a heuristic for organizing and monitoring their consumption and expenditures. Based on Thaler [20], [29], we designed four items on mental accounting.

Achu [45] noted that due to client influence, appraisers often need to provide preliminary estimates before being formally appointed and organize draft valuation meetings during valuation tasks. To measure the influence of client pressure on valuation independence, Liao et al. [46] suggested that client pressure reflects appraisers’ willingness to adjust their estimates. Based on

Achu [45], Liao et al. [46], and Lee et al. [11], we designed six items on client pressure across three sub-dimensions: valuation forecasting, draft valuation meetings, and estimate adjustments.

Adegoke [43] identified four factors contributing to valuation variation: the characteristics, appropriateness, and sufficiency of collected data; the valuation approaches used; assumptions and judgments influenced by skills, experience, and clients; and appraisers' behavioral cognition. Based on Ayedun et al. [47] and Lee et al. [11], we designed four items on valuation variation across four sub-dimensions: data selection, valuation approach, assumptions and judgments, and behavioral cognition.

IV. Data Sources and Descriptive Statistics of the Sample

The participants in this study were real estate appraisers who had passed the Taiwan Real Estate Appraiser Certification Examination, were members of their respective city or county real estate appraiser associations, and were licensed to conduct valuation tasks legally. As of January 10, 2023, total membership was 459. We also targeted real estate valuation firms. The online questionnaire was distributed via the Real Estate Appraisers Association's group e-mail and the e-mails of the respective valuation firms. The survey period ran from January 14 to March 30, 2023. A total of 170 responses were received, and after removing seven invalid responses, 163 valid responses remained.

Table 1: Descriptive Statistics of Participants

Variable	Item	N	Percentage (%)
Sex	Male	140	85.9
	Female	23	14.1
Age	Mean = 51.2		
	Maximum = 74		
	Minimum = 24		
Education	Junior college	8	4.9
	Bachelor's degree	75	46.0
	Master's degree	78	47.9
	Doctorate	2	1.2
Marital status	Single	39	23.9
	Married	123	75.5
	No response	1	0.6
Occupation	Appraiser	149	91.4
	Appraiser assistant	14	8.5
Tenure	5 years or less	21	12.9
	6 to 10 years	27	16.6
	11 to 15 years	23	14.1
	16 to 20 years	40	24.5
	21 to 25 years	26	16.0
	26 to 30 years	11	6.7
	31 years or above	15	9.2
Work location	Northern region	82	50.3
	Central region	26	16.0
	Southern region	53	32.5
	Eastern region	2	1.2
Mean annual income	Less than NT\$300,000	2	1.2
	NT\$300,000–NT\$600,000	20	12.3
	NT\$600,000–NT\$900,000	28	17.2
	NT\$900,000–NT\$1.2 million	27	16.6
	NT\$1.2 million and above	84	51.5
	No response	2	1.2

As shown in Table 1, among the 163 participants, 140 (85.9%) were men and 23 (14.1%) were women. The oldest participant was 74 years old, and the youngest was 24 years old, with a mean age of 51.2 years. Regarding education, 2 (1.2%) held a doctorate, 78 (47.9%) held a master's degree, 75 (46.0%) held a bachelor's degree, and 8 (4.9%) held a junior college diploma. The majority of participants held a master's degree, followed by those with a bachelor's degree. In terms of marital status, 39 (23.9%) were single and 123 (75.5%) were married. Regarding occupation, 149 (91.4%) were appraisers and 14 (8.5%) were appraiser assistants.

Regarding tenure, most participants had 16–20 years of experience (40, 24.5%), followed by those with 6–10 years of experience (27, 16.5%). In terms of work location, 82 (50.3%) were in the northern region, 26 (16.0%) in the central region, 53 (32.5%) in the southern region, and 2 (1.2%) in the eastern region. The majority of participants had a mean annual income of NT\$1.2 million and above (84, 51.5%), followed by NT\$600,000–NT\$900,000 (28, 17.2%), NT\$900,000–NT\$1.2 million (27, 16.6%), and NT\$300,000–NT\$600,000 (20, 12.3%).

V. Empirical Findings

V. A. Reliability and Validity Analysis

A reliability analysis assesses the consistency and dependability of the test instruments and measured attributes. This study evaluated reliability using Cronbach’s α . According to Nunnally [48], a Cronbach’s $\alpha \geq 0.7$ indicates high and acceptable reliability; a Cronbach’s α between 0.35 and 0.7 indicates moderate and acceptable reliability; and a Cronbach’s $\alpha < 0.35$ indicates low and unacceptable reliability, requiring scale revision or the addition or removal of items. As shown in Table 2, the Cronbach’s α values for the availability heuristic, anchoring, mental accounting, client pressure, and valuation variation in this study were 0.725, 0.772, 0.727, 0.751, and 0.758, respectively. Since all values were above 0.7, the scale demonstrates high reliability.

Table 2: Reliability Analysis of Each Construct

Dimension	Number of Items	Cronbach’s α
Availability heuristic	4	0.725
Anchoring	4	0.772
Mental accounting	4	0.727
Client pressure	6	0.751
Valuation variation	4	0.758

In this study, validity was assessed in terms of content validity, convergent validity, and discriminant validity. For content validity, the items in the framework needed to reflect the distribution, representativeness, and appropriateness of the study topic; the scale had to avoid high overlap between items; and the items had to be generally representative of the model. The latent variables in this study were developed based on Taiwanese and international research on valuation variation among appraisers. The questionnaire development process was rigorous: we consulted professional appraisers to review the phrasing and sentence structure of the items. Necessary revisions were made to ensure the questionnaire achieved an acceptable level of content validity.

Convergent validity refers to the degree of positive correlation between the dimensions and is often assessed using factor loadings, composite reliability (CR), and average variance extracted (AVE). Factor loading, also known as indicator reliability, reflects the reliability of each item. Hair et al. [49] noted that good convergent validity is indicated by a factor loading with a statistically significant absolute value greater than 0.5. The item "Mental accounting 3" was omitted because it did not meet this criterion, while the remaining items were retained. As shown in Table 3, all standardized factor loadings of the measured variables were greater than 0.5 and statistically significant, except for one variable, which had a value slightly below 0.5.

CR measures the consistency among a dimension’s indicators. Higher reliability indicates higher internal consistency. In confirmatory research, a CR between 0.6 and 0.7 is considered acceptable. Fornell and Larcker [50] suggested that CR should exceed 0.6. As shown in Table 3, all CR values of the measured variables were greater than 0.7, indicating consistency among the indicators.

The AVE represents the average of the squared factor loadings of all indicators within a dimension. Fornell and Larcker [50] suggested that an AVE greater than 0.5 indicates good convergent validity, as it means the dimension explains over half of the variance in its indicators (measured variables). As shown in Table 3, the convergent validity of each dimension was satisfactory.

Discriminant validity compares the square root of a dimension’s AVE with its correlation coefficients with other dimensions. It is assessed by checking whether the square root of the AVE is greater than the off-diagonal correlation coefficients. As shown in Table 4, the square root of the AVE for each dimension was greater than its correlations with the other dimensions. Therefore, the variables are distinct, and the questionnaire demonstrates good discriminant validity.

V. B. Empirical Findings and Discussion

This section is presented in two parts: the model’s goodness-of-fit indicators and the analysis results. We employed three types of fit measures—absolute fit measures, incremental fit measures, and parsimony-adjusted measures—to assess the fit between the conceptual model and the data. The results are shown in Table 5.

Absolute fit measures test the fit of a single model. The chi-square (χ^2) statistic assesses the degree of similarity between the probability distribution of the questionnaire items and the population. A larger χ^2 indicates a weaker fit between the model and the observed data. In this study, χ^2 was 136.791 and significant at the 1% level. Jöreskog and Sörbom [51] noted that χ^2 is sensitive to sample size. To reduce this influence, we used the ratio of χ^2 to the degrees of freedom (χ^2/df); the smaller the ratio, the better the model fit. Kline [52] suggested that an acceptable value should be less than 3.0. The χ^2/df in this study was 1.849, indicating a good fit between the theoretical model and the observed data. The goodness-of-fit index (GFI) was 0.902, meeting Huang’s [53] recommended threshold of > 0.9 . Jöreskog and Sörbom [51] stated that an ideal root mean square residual (RMR) should be small, preferably less than 0.5. The RMR in this study was 0.056, close to the recommended value. The root mean square error of approximation (RMSEA) was 0.072, slightly above Schumacker and Lomax’s [54] recommended value of < 0.05 .

Table 3: Analysis of the Questionnaire’s Reliability, Factor Loadings, AVE, and SEM Assessment

Variable	Factor loading		Error variance	Reliability	CR	AVE	R ²
	(unstd.)	(std.)					
Availability heuristic					0.937	0.889	
Rule of thumb	2.223	0.966	0.023	0.933			
Mental shortcut	1.000	0.571	0.135	0.327			
Anchoring					0.817	0.605	0.591
Knowledge and skills	1.000	0.712	0.378	0.507			
Practical experience	1.070	0.877	0.134	0.768			
Motivational factors	0.790	0.561	0.526	0.315			
Mental accounting					0.811	0.589	
Mental accounting 1	0.986	0.776	0.328	0.602			
Mental accounting 2	1.061	0.783	0.364	0.613			
Mental accounting 4	1.000	0.708	0.508	0.502			
Client pressure					0.797	0.581	
Valuation forecasting	0.784	0.751	0.257	0.564			
Draft valuation meetings	1.000	0.801	0.442	0.641			
Estimate adjustments	0.432	0.432	0.303	0.186			
Valuation variation					0.800	0.506	0.152
Data selection	1.000	0.639	0.602	0.409			
Valuation approach	0.977	0.727	0.356	0.528			
Assumptions and judgments	1.143	0.782	0.346	0.611			
Behavioral cognition	0.602	0.500	0.453	0.250			

Note: * p < 0.05, ** p < 0.01

Table 4: Correlational Matrix of the Latent Variables

	Availability heuristic	Anchoring	Mental accounting	Client pressure	Valuation variation
Availability heuristic	0.943				
Anchoring	0.524	0.778			
Mental accounting	0.314	0.699	0.767		
Client pressure	0.432	0.414	0.452	0.763	
Valuation variation	0.178	0.242	0.296	-0.037	0.711

Note: Diagonals represent square root of AVE; non-diagonals represent correlation coefficients.

Incremental fit measures compare the difference (improvement) in fit between the conceptual model and an independent model, assuming that all variables are uncorrelated. Huang [53] recommended that the adjusted goodness-of-fit index (AGFI) should range from 0 to 1, with higher values preferred; a value > 0.9 indicates an excellent fit. The AGFI in this study was 0.841, within the acceptable range. The NFI in this study was 0.853, within the acceptance range. Huang [53] recommended that the comparative fit index (CFI) should be > 0.9, which was the case in our study, with a value of 0.924.

Regarding the parsimony-adjusted measures, Breivik and Olsson [55] suggested that the parsimony normed fit index (PNFI) should be > 0.5, which was the case in our study, with a value of 0.601. Mulaik et al. [56] recommended that the parsimony-adjusted comprehensive fit index (PCFI) should be > 0.5, which was also the case in our study, with a value of 0.651. These fit measures confirm the excellent fit of our model.

Table 5: Goodness-of-Fit Results

Test statistic	Ideal fit criterion	Our value
<i>Absolute fit measures</i>		
χ^2 (p-value)		136.791 (0.001)
χ^2/df	< 3	1.849
GFI	> 0.90	0.902
RMR	Ideally smaller	0.056
RMSEA	< 0.05	0.072
<i>Incremental fit measures</i>		
AGFI	> 0.90	0.841
NFI	> 0.90	0.853
CFI	> 0.90	0.924
<i>Parsimony-adjusted measures</i>		
PNFI	> 0.50	0.601
PCFI	> 0.50	0.651

The estimation results are shown in Table 6. The estimated coefficient of the availability heuristic on valuation variation was 0.179, but it was not significant. The empirical findings did not support H1 and were inconsistent with the studies by

Iroham et al. [16] and Evans et al. [25]. We surmise that the appraisers strictly adhered to a set of valuation norms developed through leadership mechanisms, which minimized valuation bias arising from the availability heuristic. Tidwell and Gallimore [17] suggested that using decision-making support tools can reduce the valuation bias caused by the availability heuristic. Our findings did not show a significant positive influence of the availability heuristic on valuation variation and did not support the notion that Taiwanese appraisers' subjective perceptions of the availability heuristic contribute to valuation variation.

The estimated coefficient of the availability heuristic on anchoring was 0.337, significant at the 5% level. The empirical findings supported H2. Iroham et al. [13] described the availability heuristic as a rule of thumb or mental shortcut for solving complex problems and reported that it is one of the most commonly used heuristics. Mwasumbi and Tarimo [26] agreed that the availability heuristic can improve information processing systems and enhance decision-making efficiency, and showed that it is extensively used in various stages of the assessment process. Our empirical results demonstrated that price anchoring was influenced by the availability heuristic.

The estimated coefficient of mental accounting on valuation variation was 0.356, significant at the 10% level. The empirical findings supported H3. Thaler [20] described mental accounting as the division between the costs and benefits related to individual decision-making, during which people adhere to individual mental accounts as a heuristic for organizing and preserving their consumption and expenditures. In reality, mental accounting is prevalent in daily economic behavior. Under its influence, people develop decision-making behaviors that deviate from traditional economic theories, resulting in unexpected outcomes that violate the concept of fungibility. In the real estate market, buyers with this bias may engage in inefficient investments, experience poor investment flows, and limit their profits from other opportunities. For appraisers, the valuation process may be rendered inefficient.

The estimated coefficient of mental accounting on anchoring was 0.593, significant at the 5% level. The empirical findings supported H4. Paraschiv and Chenavaz [33] found that in the real estate market, sellers do not adjust their reference points instantaneously, but rather in accordance with mental accounting. Waweru et al. [34] showed that mental accounting and incorrect reference points influence investors' anchoring behaviors, causing them to respond differently to price variations. More specifically, investors in different mental accounts exhibit different sensitivities to anchoring. Our empirical findings were consistent with those of previous studies.

The estimated coefficient of client pressure on valuation variation was -0.282 , significant at the 5% level. The empirical findings supported H5, indicating a negative influence of client pressure on valuation variation. Kinnard et al. [38] reported that appraisers often adjust final valuation outcomes to meet clients' expectations and prevent client loss. Therefore, client pressure has a constraining effect on valuation variation. In highly systematized valuation tasks with stringent standard operating procedures, client pressure may skew outcomes toward an acceptable range, resulting in variation convergence. Our empirical findings support this assumption but differ from previous studies [40], in which client pressure had a positive effect on valuation variation.

The estimated coefficient of client pressure on anchoring was 0.001, not significant. The empirical findings did not support H6. This study suggests that appraisers may discreetly establish anchoring points before being officially appointed by providing a target price in advance. Based on their preconceptions and reliance on early information, they could devise outcomes that favor the client. However, our empirical findings did not support this notion, consistent with the findings of Kinnard et al. [38] and Nwuba et al. [40].

The estimated coefficient of anchoring on valuation variation was 0.016, not significant. The empirical findings did not support H7. This contrasts with previous studies, such as Scott and Lizieri [42] and Adegoke [43]. Although anchoring can influence decision-making and judgment, appraisers may mitigate its effect by gathering market information and conducting on-site surveys and analyses. In Taiwan, the examination standard for real estate appraisers is considerably high, and only those with sufficient proficiency, experience, and skills are competent to handle valuation tasks and adapt to different valuation models. Appraisers also employ assistants to compile information and survey the real estate market. These assistants provide objective market reports as references, helping to minimize the influence of anchoring. This may explain why H7 was not supported in this study.

Regarding the mediation effects, anchoring was set as a mediator between the availability heuristic, mental accounting, client pressure, and valuation variation. The empirical results showed that the path coefficient of anchoring on the dependent variable, valuation variation, was not significant; therefore, no mediation effect was observed.

VI. Conclusions and Recommendations

This study adopted a behavioral economics perspective to construct a conceptual model of real estate valuation decision-making rooted in psychological biases. The availability heuristic, mental accounting, client pressure, and anchoring were set as latent variables in an SEM model. The results demonstrated that the availability heuristic and mental accounting influenced anchoring, but anchoring did not influence valuation variation, implying that anchoring was not the primary path of influence. The effect of behavioral bias on valuation variation may arise from the systematic constraints of direct paths and work contexts.

Table 6: Estimation Results Derived from SEM

	Path	Coefficient	Standard error	t-ratio	p-value
H1	Availability heuristic → Valuation variation	0.179	0.317	1.426	0.154
H2	Availability heuristic → Anchoring	0.337	0.222	3.691	0.001**
H3	Mental accounting → Valuation variation	0.356	0.166	1.933	0.053*
H4	Mental accounting → Anchoring	0.593	0.100	5.165	0.001**
H5	Client pressure → Valuation variation	-0.282	0.116	-2.127	0.033**
H6	Client pressure → Anchoring	0.001	0.087	0.006	0.995
H7	Anchoring → Valuation variation	0.016	0.191	0.089	0.929

Note: Path coefficients are standardized; * p < 0.10, ** p < 0.05

Mental accounting concurrently influenced anchoring and valuation variation, while client pressure significantly and negatively influenced valuation variation.

As this advanced-level cognitive framework may include risk perception, motivation, and task assignment, additional higher-level theories could be integrated in future studies. Research on behavioral economics in real estate, focusing on individual factors, has mostly analyzed secondary data rather than primary data. Given that the availability heuristic, anchoring, mental accounting, and client pressure are important psychological factors in behavioral economics, we collected primary data to investigate the influence of these four factors on valuation variation, distinguishing our study from the existing literature. The findings can facilitate our understanding of how appraisers' valuation variation is influenced by the availability heuristic, anchoring, mental accounting, and client pressure.

In practice, standardized valuation operating procedures can be implemented when taking orders and during the initial valuation. This prevents appraisers from setting anchors based on early information, such as clients' target prices. Decision support systems and verification checklists can also help mitigate bias. Compared to case selection, rate adjustment, and weighting, standardization reduces the influence of the availability heuristic.

Furthermore, mental accounting debiasing training—such as context reconstruction, control group calibration, and anti-anchoring exercises—can help appraisers maintain valuation consistency in large-scale cases or in unfamiliar contexts. Real estate appraisal firms in Taiwan vary by size; larger firms handle large-scale developments, commercial projects, and urban renewal. Future studies could consider company size as a factor influencing appraisers' decision-making. Analyses could also use hierarchical linear modeling, with company size as a second-level variable and appraiser-related attributes as first-level variables. Further in-depth investigations on asset type and condition, as well as appraiser attributes, could be conducted to analyze the influence of bias on appraiser behavior.

References

- [1] Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 5(2), 207-232.
- [2] Cheloti, I., & Mooya, M. (2021). Valuation problems in developing countries: A new perspective. *Land*, 10(12), 1352.
- [3] Baum, A., Crosby, N., Gallimore, P., McAllister, P., & Gray, A. (2000). *The influence of valuers and valuations on the workings of the commercial property investment market*. London, England: Royal Institution of Chartered Surveyors/Investment Property Forum.
- [4] Wilkinson, S. J., Antoniadis, H., & Halvitiğala, D. (2017). *The future of the valuation profession*. Sydney, NSW: The Australian Property Institute.
- [5] Kucharska-Stasiak, E. (2013). Uncertainty of property valuation as a subject of academic research. *Real Estate Management and Valuation*, 21(4), 17-25.
- [6] Bellman, L. (2018). High-impact information types on market value: Property appraisers' information sources and assessment confidence. *Journal of Property Research*, 35(2), 139-163.
- [7] Babawale, G. K. (2011). Valuers' and valuation firms' characteristics as causes of inaccuracy in valuation in Nigeria. *Mediterranean Journal of Social Sciences*, 2(3), 12-23.
- [8] Klamer, P., Bakker, C., & Gruis, V. (2017). Research bias in judgement bias studies – A systematic review of valuation judgement literature. *Journal of Property Research*, 34(4), 285-304.
- [9] Gwin, C. R., & Maxam, C. L. (2002). Why do real estate appraisals nearly always equal offer price? A theoretical justification. *Journal of Property Investment & Finance*, 20(3), 242-253.
- [10] Crosby, N., Devaney, S., Lizieri, C., & McAllister, P. (2018). Can institutional investors bias real estate portfolio appraisals? Evidence from the market downturn. *Journal of Business Ethics*, 147(3), 651-667.
- [11] Lee, C. C., Lee, H. Y., Yeh, W. H., & Yu, Z. (2022). The impacts of task complexity, overconfidence, confirmation bias, customer influence, and anchoring on variations in real estate valuations. *International Journal of Strategic Property Management*, 26(2), 141-155.
- [12] Diaz, J., & Hansz, A. (1997). How valuers use the value opinions of others. *Journal of Property Valuation & Investment*, 15(3), 256-260.
- [13] Iroham, C. O., Ogunba, O. A., & Oloyede, S. A. (2013). Relative level of occurrence of the principal heuristics in Nigeria property valuation. *International Journal of Development and Sustainability*, 2(2), 493-504.
- [14] Gitau, G. G., Kiragu, D. N., & Kamau, R. (2018). Effect of heuristic factors and real estate investment in Embu County, Kenya. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 8(4), 30-38.
- [15] Pompian, M. M. (2012). *Behavioral finance and investor types: Managing behavior to make better investment decisions*. Canada: Wiley.
- [16] Iroham, C. O., Ogunba, O. A., & Oloyede, S. A. (2014). Effect of principal heuristics on accuracy of property valuation in Nigeria. *Journal of Land and Rural Studies*, 2(1), 89-111.
- [17] Tidwell, O., & Gallimore, P. (2014). The influence of a decision support tool on real estate valuations. *Journal of Property Research*, 31(1), 45-63.
- [18] Skidelsky, R. J. A. (2009). *Keynes: The return of the master*. New York: Public Affairs.
- [19] Lee, C. C., Yao, T. W., Chen, C. C., & Yeh, W. C. (2025). The influence of customer influence, overconfidence and availability heuristic on the variation of real estate valuation: Analysis by behavioral economics. *Journal of Architecture & Planning*. In press.
- [20] Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, 4(3), 199-214.

- [21] Gupta, S., & Kim, H. W. (2010). Value-driven Internet shopping: The mental accounting theory perspective. *Psychology & Marketing*, 27(1), 13–35.
- [22] Babawale, G. K., & Omirin, M. (2012). An assessment of the relative impact of factors influencing inaccuracy in valuation. *International Journal of Housing Markets and Analysis*, 5(2), 145–160.
- [23] Havarad, T. M. (2001). Valuation reliability and valuers behaviour. *RICS Foundation Research*, 4(1).
- [24] Amidu, A. R., Aluko, B. T., & Hansz, J. A. (2008). Client feedback pressure and the role of estate surveyors and valuers. *Journal of Property Research*, 25(2), 89–106.
- [25] Evans, K., Lausberg, C., & How, J. S. S. (2019). Reducing property appraisal bias with decision support systems: An experimental investigation in the South African property market. *Journal of African Real Estate Research*, 4(1), 108–138.
- [26] Mwasumbi, A. N., & Tarimo, D. I. (2019). The use of less relevant heuristics in mortgage valuations in Tanzania. *Journal of African Real Estate Research*, 4(1), 1–22.
- [27] Furnham, A., & Boo, H. C. (2011). A literature review of the anchoring effect. *The Journal of Socio-Economics*, 40(1), 35–42.
- [28] Cascão, A., Quelhas, A. P., & Cunha, A. M. (2023). Heuristics and cognitive biases in the housing investment market. *International Journal of Housing Markets and Analysis*, 16(5), 991–1006.
- [29] Thaler, R. H. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, 1, 39–60.
- [30] Einiö, M., Kaustia, M., & Puttonen, V. (2008). Price setting and the reluctance to realize losses in apartment markets. *Journal of Economic Psychology*, 29(1), 19–34.
- [31] Baucells, M., & Hwang, W. (2017). A model of mental accounting and reference price adaptation. *Management Science*, 63(12), 4201–4218.
- [32] Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, 211(4481), 453–458.
- [33] Paraschiv, C., & Chenavaz, R. (2011). Sellers' and buyers' reference point dynamics in the housing market. *Housing Studies*, 26(3), 329–352.
- [34] Waweru, N. M., Mwangi, G. G., & Parkinson, J. M. (2014). Behavioural factors influencing investment decisions in the Kenyan property market. *Afro-Asian Journal of Finance and Accounting*, 4(1), 26–49.
- [35] Levy, D., & Schuck, E. (2005). The influence of clients on valuations: The clients' perspective. *Journal of Property Investment & Finance*, 23(2), 182–201.
- [36] Wofford, L., Troilo, M., & Dorchester, A. (2011). Real estate valuation, cognitive risk, and translational research. *Journal of Property Investment & Finance*, 29(4), 372–383.
- [37] Nwuba, C. C., & Salawu, B. M. (2017). Valuers' perception of the effect of client influence on valuation practice. *ATBU Journal of Environmental Technology*, 10(2), CDR.
- [38] Kinnard, W. N. Jr., Lenk, M. M., & Worzala, E. M. (1997). Client pressure in the commercial appraisal industry: How prevalent is it? *Journal of Property Valuation & Investment*, 15(3), 233–244.
- [39] Gallimore, P., & Wolverton, M. (2000). The objective in valuation: A study of the influence of client feedback. *Journal of Property Research*, 17(1), 47–57.
- [40] Nwuba, C. C., Egwuatu, U. S., & Salawu, B. M. (2015). Client influence on valuation: Valuers' motives to succumb. *Journal of Property Research*, 32(2), 147–172.
- [41] Wong, C. K. (2006). An exploratory study of behavioral characteristics in Hong Kong property valuation practice (University of Hong Kong). Retrieved from <http://hub.hku.hk/handle/10722/48910>
- [42] Scott, P. J., & Lizieri, C. (2012). Consumer house price judgements: New evidence of anchoring and arbitrary coherence. *Journal of Property Research*, 29(1), 49–68.
- [43] Adegoke, O. J. (2016). Effects of valuation variance and inaccuracy on Nigerian commercial property market. *Journal of Property Investment & Finance*, 34(3), 276–292.
- [44] Osmond, I. C., Adebayo, O. O., Adesiyun, O. S., & Moronke, O. M. (2013). Factors affecting the usage of major heuristics in Nigeria property investment valuation. *Journal of Sustainable Development Studies*, 4(2), 114–133.
- [45] Achu, K. (2013). Client influence on property valuation: A literature review. *International Journal of Real Estate Studies*, 8(2), 24–47.
- [46] Liao, H. F., Chu, N. Y., & Peng, C. W. (2018). Awareness of independence of real estate appraisers: An empirical analysis. *International Real Estate Review*, 21(3), 295–316.
- [47] Ayedun, C. A., Durodola, D. O., Oloyede, S. A., Akinjare, O. A., & Oni, A. S. (2018). An empirical evaluation of the factors militating against valuation accuracy in Nigeria. *International Journal of Civil Engineering and Technology (IJCIET)*, 9(8), 752–776.
- [48] Nunnally, J. C. (1978). An overview of psychological measurement. *Clinical diagnosis of mental disorders: A handbook*, 97–146.
- [49] Hair, J. F., Jr., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis* (6th ed.). Upper Saddle River, NJ: Pearson-Prentice Hall.
- [50] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- [51] Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. USA: Science Software International.
- [52] Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.
- [53] Huang, F. M. (2002). *Structural equation modeling: Theory and application*. Taipei: Wunan Books.
- [54] Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. Psychology Press.
- [55] Breivik, E., & Olsson, U. H. (2001). Adding variables to improve fit: The effect of model size on fit assessment in LISREL. In *Structural equation modeling: Present and future* (pp. 169–194).
- [56] Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*, 105, 430–445.

...