Reference-Point Framing and Future Savings: How Anchoring Bias influences Saving Intentions among Students

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BRIEF. This study carries out an empirical analysis on a randomized experiment carried out on high school students to investigate the role of anchoring bias on decision making and how other mediators (such as financial literacy) can mitigate this effect.

ABSTRACT. This study investigates the impact of cognitive biases, namely anchoring bias, on saving intentions, by testing variables such as financial literacy and socioeconomic status acting as moderators to this effect. Given that little is known about anchoring effects on youth specifically, we conduct a city-wide randomized experiment to assess the relationships between different variables and anchoring levels, through an online single-blind survey. Then, we formulate an empirical analysis using an OLS regression model, based on numerous questions asked to high school students to estimate magnitudes of different variables. From our analysis, we established that there exists a strong presence of anchoring effects, and the key variables of socioeconomic status and financial literacy do act as partial moderators. However, contrary to our expectations, we discover that, sometimes, a greater presence of these moderators lead to a greater anchoring among youth. As a result, our study bridges a major research gap in youth financial decision making, evidencing a high sensitivity of adolescents to reference point values, while also challenging assumptions through our experimental analysis. Overall, we suggest the need for more focused bias-awareness training courses integrated in financial literacy programs and recognizing individuals from lower-income households, which are more susceptible to cognitive biases, allowing for a more targeted and early intervention, which helps to balance humanitarian goals with enhanced, effective decision-making. Given that adolescents are increasingly vulnerable to risky decision making with a lack of financial experience, we believe that these policies can help to reduce the lack of informed judgement due to anchoring bias.

INTRODUCTION.

Adolescents, globally, are increasingly making financial decisions that shape their personal finance habits for the future. In order to achieve long-term financial success, these personal financial habits are crucial [1]; however, with the growing use of anchoring bias (which relates to how individuals rely upon the very first instance of information that they see) and various framing mechanisms across platforms, it is of even greater importance to prioritize and analyze the different patterns of how youth are influenced, making this branch of behavioral economics crucial to help form more optimal financial decisions.

In this paper, we examine a cognitive heuristic bias, where individuals are heavily dependent/reliant on the first source of information that they see, even if these sources are chosen arbitrarily. As seen in the previous literature [2], anchoring bias has been found to impact individuals in a plethora of financial events, especially in setting savings/budgeting goals, investment predictions, alongside expectations about future market trends. We specifically focus on high school students as part of our methodology in this paper, given that they are currently developing their financial identity/habits but are also extremely vulnerable to cognitive bias [3], due to their limited financial experience, arising from a deficiency in real-world exposure. As a result of the growing use of social media, AI, and online news outlets [4], anchoring bias becomes even more common, as also shown by Carter and Liu [5]. By taking a representative sample size of high school students across schools in Dubai, we aim to better understand the variance across these biases and how financial literacy and other programs can counter this bias – helping to develop solutions that can enhance critical thinking skills and improve bias awareness.

In addition to this, it is also important to note that there exists a somewhat large research gap, where the existing literature has mainly focused on adult consumers and/or investors, such as Benartzi and Thaler [6], Zahera and Bansal [7], and Mittal [8]. As a result, there are only a few studies that specifically focus on the impacts of anchoring and whether financial literacy solutions can help to mediate this effect. Moreover, different variables have also not been researched thoroughly, such as socioeconomic backgrounds, which may further enhance this effect of financial literacy solutions mediating the effect of anchoring.

Overall, this study investigates how different levels of anchoring (reference point framing) can impact saving intentions among high school students and whether financial literacy initiatives can moderate this effect. We have three key hypotheses:

1. A higher income household status can act as a moderator, to lower levels of anchoring, with students from higher income backgrounds being less susceptible to this cognitive bias.

2. A lower level of financial literacy will lead to a greater level of anchoring to the original reference point.

3. Higher savings are usually a result of high anchoring.

By examining these hypotheses through a series of experiments, we link cognitive bias theories in psychology to effectively improve financial decision-making skills in the branch of economics. This paper focuses on a branch of behavioral economics where we develop potential policies and interventions that can correct a bias-influenced thinking heuristic.

LITERATURE REVIEW.

Since the 21st century began, behavioral economics has become a pivotal area of interest for both potential and experienced investors. Following the early 2000s, recession and stock market crises, each investor aims to be rational and logical in their decision-making and, therefore, participate in reflexivity.

More often, this serves in reflecting on and studying their personal biases, relating to how this may impact their judgment when investing and, therefore, the success of their investments. The majority of the literature used to be oriented toward the older demographic. This is evident in Benartzi and Thaler [6] research, where the paper investigated the behavior behind employees deciding a retirement plan in America, specifically looking at how cognitive heuristics and biases influence the employee's choice on picking a "defined benefit" plan or a "defined contribution" plan. Researchers found that employees with limited prior financial knowledge and low financial literacy, as

well as those given poor advice, were more likely to pick a plan that is unfavorable to them in the long term. Similarly, in a later published paper, Hayat and Anwar [9] used a questionnaire to check the influence of behavioral biases in investment decision making while moderating the role of financial literacy, and discovered that investors who show overconfidence bias about picking a stop are more likely to make the wrong decision. Additionally, financial literacy also has a statistically insignificant relation with investment decisions, with the results across Hayat and Anwar's statistical and empirical models demonstrating this relationship. This research further demonstrates the need for courses to increase financial literacy skills, given that it plays a hand in decreasing biases.

As discussed previously in the introduction, teenagers are an interesting demographic to investigate due to their more vulnerable nature. Nakurma [3], demonstrated that high school students were less susceptible to framing effects (a cognitive bias where individuals react differently to the same information depending on how it is presented, or "framed," as either a gain or a loss) compared to the college-age students on the classic Asian disease problem and its modifications. This entails that high -school students are not consistently more biased that adults when it comes to decision making, hence leading to the literature needing more specific research on adolescents and their financial habits. Since 2016, the rise of interest in behavioral biases has grown, as shown by Zahera and Bansal [7] and Mittal [8]. These literature reviews illustrate the need for psychological research into cognitive processes during decision-making, as there is a relationship between the success of investors and their clarity when pursuing a decision.

Furthermore, there is a clear gap in the literature concerning the impact of cognitive biases on teenagers' financial decisions, as previous literature is usually concerned with employees and experienced stock market investors. However, recently, teenagers have become more involved in the economic side of the world due to easy access to the internet and finance.

Moreover, Manwani [1] explored the influence of different institutions, such as family and schools, on adolescents' wealth management skills and attitudes. This can certainly explain how certain biases develop, but it does not exactly demonstrate the relationship between cognitive biases and teenagers' financial decisions.

It is important to note that, though, this literature contrasts with Qi [2], where the research was linked to how cognitive biases impact people from an economic standpoint, specifically anchoring bias. The paper concluded that initial information disproportionately influences decisions, affecting various domains, including consumer behavior, investment choices, and macroeconomic forecasting. Likewise, to the previous literature mentioned, the paper illustrated how bias can lead to irrational purchasing decisions, suboptimal investment strategies, and skewed macroeconomic predictions.

In conclusion, the literature mentioned conveys that understanding the psychology of behavioral economics can lead to wiser financial decisions and higher financial literacy rates, which in turn can help teenagers develop financial habits that are rational and beneficial towards their personal financial decisions.

MATERIALS AND METHODS.

In order to conduct our empirical analysis, we utilise key insights from existing literature by Nakamura [3], as discussed in the literature review, alongside others such as Yasseri and Reher [10], and Zong and Guo [11]. As part of our methodology and results analysis, we use a regression model to test our three hypotheses, that is computed by the following Eq. 1.

$$IS = \beta_0 + \beta_1 AC + \beta_2 FL + \beta_3 SEB + \beta_4 (AC \times FL) + \beta_5 (AC \times SEB) + \varepsilon \quad (1)$$

Here, we have different variables for our three different hypotheses, where IS is equal to the total intended savings for a person, influenced by AC, which is our dummy anchoring coefficient, where high anchoring is represented by 1, low anchoring is represented by 0, and the baseline will be acting as a control. Our next variable, FL will be for financial literacy, and we will use the standardised z score, which is calculated by the z score tables and respective equations.

Alongside this, we have also used the variable SEB, which controls for the Socio-Economic Background/Status of the individual, acting as a proxy. Our variable of $\beta_4(AC \times FL)$ tests for whether financial literacy and the anchoring bias coefficient have a negative/inverse relationship or a positive/direct one, since a negative value would mean that high financial literacy will lead to a reduced anchoring bias, while a positive value would be indicative of the opposite phenomenon.

Furthermore, our $\beta_5(AC \times SEB)$ variable checks for whether there exists a relationship between the Socio-Economic status and anchoring bias, where the same conclusions can be formed as the β_4 variable. As a result, this means that our variable of $\beta_1 AC$ will be controlled by from our financial literacy and socioeconomic background variables, depending on whether we different levels of anchoring – helping to test each of our different hypotheses. Finally, we also include an error coefficient (represented by epsilon), at the end of our regression model.

In order to gather data for this regression model, we utilise a randomised survey-experiment in an online format, given out to high-school students from grades 10 to 12. Each participant will be allocated to a high anchor, low anchor, or a control condition randomly, where we use a standardised procedure with a random number generator to group participants, with each participant first being assigned their own number as a key identifier. Specifically, 'high' anchor levels refer to a very high reference point value of "college students typically spend USD50,000 annually on…" while a 'low' anchor level refers to a lower reference point value of "USD5000", with the control/baseline group having no reference point value as part of the financial saving case study/scenario given.

In this study, we use our primary dependent variable as IS (amount or percentage of allowance to save), and our moderators of FL and SEB. Our criteria for participant inclusion will be from ages 15 to 18, currently enrolled in a high school program, with an overall estimated sample size of 250 to 400 participants.

We use a sample size of at least 30 people per anchor coefficient group to simplify confidence interval tests, hypothesis tests, and other z-score calculations assuming a normal distribution (according to the central limit theorem). In addition to this, we have also ensured to keep our total sample size below 10% of the actual population, since we sample without replacement and should assume independence of observations. From distributing these forms, we have collected data and the regression results will be calculated and attached below.

We will employ a single-blind experiment, where participants will not know about the study hypotheses, and this will also be done through a neutral/minimal study description in the consent. We will assign different survey questions that give different scenarios as context and values, in order to effectively adjust and control the different levels of anchor (low, high, or no anchor), thus helping to control for the reference point framing across each group to gather meaningful results.

Through this, we then use our data to create the regression model, as demonstrated by Table 1.

RESULTS AND DISCUSSION.

In Table 1 (below), we have recorded our Ordinary Least Squares (OLS) regression model results, where we estimate the effect of anchoring bias on saving intentions (which we measure as a percentage of the income values given in the forms). We have a total of 3 models which introduce newer explanatory (independent) variables, in order to test whether financial literacy or socioeconomic backgrounds impact this value.

Table 1. These are the results of our OLS Regression models based on our survey data collected.

Variable	Model 1	Model 2	Model 3
High anchor (vs Control)	5.48*** (1.18)	3.28** (1.14)	0.74 (2.45)
Low anchor (vs Control)	–2.23* (1.24)	–3.14** (1.30)	–6.59** (2.92)
FL (financial literacy)		1.92*** (0.47)	1.58* (0.77)
SEB (socioeconomic background)		0.60* (0.35)	0.72 (0.53)
High×FL			2.21* (1.24)
Low×FL			0.52 (1.16)
High×SEB			2.00** (0.86)
Low×SEB			0.99 (0.82)
Age			
Numeracy (self-rated)			
Risk tolerance			
Constant	9.82*** (0.80)	8.54*** (1.20)	10.85*** (2.11)
Observations (Sample size) (To the nearest 100)	400	400	400
R-squared	0.062	0.099	0.244

For our first model, we only include two different anchor conditions against the control group, and from Table 1, we see that a high anchor coefficient (5.48***) shows how students who have a high reference point of AED50000 are willing to save ~5.5% more than the control group, which contrasts with the low anchor coefficient (-2.23*), which shows the opposite, where the exposure to a lower reference point of AED5000 will reduce saving intentions among students relative to our control value – by students willing to save ~2.2% less than the control group. From this model, we see how anchoring bias exists, given that providing a reference point can strongly influence the shifts in intended savings amounts, as seen by Qi [2], Colby and Chapman [12], and Masiero and Hensher [13]. In our second model, we add in the standardized financial literacy and socioeconomic background coefficients, which we use from the background/screening questions done at the start of the survey. From this, the decrease in the values of both the high and low anchors demonstrates how financial literacy and socioeconomic backgrounds can become moderators of the anchoring effect, but the effect still remains another significant factor in influencing intended savings amounts.

Moreover, the positive coefficients for (1.92***) and (0.60*) also show how there is a positive correlation between the variables and overall saving intentions, with a greater financial literacy or socioeconomic status correlating with an increased savings amount. This hypothesis became even more emphasized in the third model, which evidenced how including interactions between and with the anchoring coefficients makes the overall anchor effects drop in magnitude, as seen in Table 1. As a result, this explains how interactions between these factors and anchoring effects become less significant, and financial literacy and socioeconomic backgrounds become even more important factors, which links with the studies by Negara and Rahyuda [14] alongside Agarwal et al. [15]. From this, we also see that despite anchoring still influencing the intended savings amount, other moderators can also influence decision-making, which does not make the anchoring effect uniform.

Overall, from these models, we learn that instead of leading to lower levels of anchoring, a higher income level/status and a greater level of financial literacy leads to an opposite effect, meaning that instead of lowering anchoring, a decrease in financial literacy or income levels will strongly correlate to a positive increase in the anchoring response. However, from our empirical analysis and results, we are, indeed, able to confirm that higher savings are usually a result of high anchoring, given that anchoring is a key factor that influences this variable. As a result of this, some of our initial expectations did, in fact, match the results, but some were surprising to see when tested in reality.

CONCLUSION.

To recapitulate, from our empirical analysis, we curated multiple models with varying levels of dependent variables. From our results, we demonstrated that anchoring bias can significantly influence saving intentions among high school students, where the presence of reference point framing can have a measurable behavioral impact on adolescents. However, contrary to our initial hypotheses, higher financial literacy or socioeconomic status coefficients did not reduce the cognitive sensitivities to anchoring bias, but rather increased the strength to the effect in certain models. As a result, some education programs may be necessary to equip students with basic financial literacy skills, but as a whole, education alone may not mitigate this bias-dependent approach to decision making, as discussed in some previous literature [3]. In addition to this, policymakers should also focus on not only factual knowledge but rather psychological bias-awareness training courses (to help students better understand their own personal reflexivity). As for improving reference-point framing bias across lower-income households, they remain a concern at humanitarian grounds but will not be sufficient alone to reduce the sensitivity of people towards anchoring bias, as demonstrated by the small change in the magnitudes of values in our OLS regression table. Overall, we believe that policies aimed to be more specific into the field of behavioral economics and decision-making practices also mirror our empirical analysis results.

However, our findings could carry some limitations that were difficult to control, given that our sample size is only taken from Dubai, which does not account for larger variations in socioeconomic backgrounds and cultural diversity than in other cities. Furthermore, the mode of conducting the survey in an online format did not allow us to have control over the behavior of our sample size, which reduces our internal validity, alongside the nature of the self-reported survey format - which could introduce other extraneous biases, namely social desirability bias. Expanding on this, future research projects could aim to incorporate a more diverse group of participants in a more controlled experimental environment, if they do not encounter the limitations that we faced with our resources and time, and potentially include monetary incentives to further improve the accuracy, validity, and generalizability of their findings.

Despite these constraints, we believe that our research provided a notable contribution by investigating behavioral biases, specifically in adolescents - filling in the research gap where we suggest policy implications for a demographic that is sparsely researched upon. Hence,

we believe that our findings not only act as a bridge to assimilate empirical data into psychological theories, but also recognize and challenge previous conventional hypotheses about the nature of moderator variables such as financial literacy, suggesting how youth decision making is more multifaceted and complex to understand than just investigating a few variables.

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