Financial literacy and Value orientation on ESG Investing: A Causal analysis with Endogeneity correction

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ABSTRACT,
This study investigates how investor characteristics—financial literacy, altruism, and materialism—influence attitudes toward ESG (Environmental, Social, and Governance) investing, and to what these relationships change when correcting for endogeneity. The research applies both the Knowledge–Attitude–Behavior (KAB) model, extended by the Theory of Planned Behavior (TPB), and the Value–Attitude–Behavior (VAB) model to provide a multidimensional explanation of ESG attitude formation. Data were collected through an online survey of 274 participants. The analysis employed Two-Stage Least Squares (2SLS) regression to address potential endogeneity in financial literacy. Findings indicate that altruism is positively associated with favorable ESG attitudes, while materialism shows a negative association. Financial literacy was initially positively correlated with ESG attitudes but became statistically insignificant after endogeneity correction. Demographic factors such as age, gender, and income had limited explanatory power. These results suggest that value orientations may exert a more stable influence on ESG attitudes than financial knowledge, particularly when accounting for endogenous traits. The joint application of KAB+TPB and VAB frameworks provides theoretical support for including both cognitive and motivational pathways in attitude modeling. Practically, the findings highlight the need for investor engagement strategies that align with underlying value profiles, rather than relying solely on financial education to promote ESG investing.

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ESG Investing, Sustainable Investing, Investment Attitudes, Altruism, Materialism, Financial Literacy, Endogeneity

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1. INTRODUCTION

1.1 Topic Introduction

Over the past decade, ESG (Environmental, Social, and Governance) investing has experienced significant growth and has become a central theme in global financial discourse. According to the US SIF Foundation (2020), the volume of professionally managed assets incorporating ESG criteria in the United States reached $17.1 trillion in 2020, representing one-third of total assets. In the European market, ESG funds attracted net inflows exceeding €120 billion in 2020, reflecting heightened investor interest in sustainable finance (Zeb & Morningstar, 2021). This expansion is not limited to asset volumes; rather, it signifies a broader shift in how financial markets are expected to address long-term environmental and social challenges (OECD, 2020). Research has demonstrated that ESG factors can influence corporate valuation and capital costs by affecting firm-level risk exposure (Giese et al., 2019). Moreover, sustainability-oriented investments are increasingly seen as tools to align financial systems with broader societal goals, including climate mitigation, social inclusion, and responsible governance (Schoenmaker & Schramade, 2019). As ESG integration becomes more embedded in policy and market practices, understanding the determinants of investor participation in this space has become a subject of growing academic and regulatory interest.

Despite the expansion of ESG investment products and increased public attention to sustainability, a notable gap persists between individual investors' stated support for ESG principles and their actual investment behavior. Survey data show that although many individuals express interest in sustainable investing, only a minority allocate funds to ESG-labeled products (OECD, 2020; Eurosif, 2018). Heeb et al. (2023) similarly report that while a large proportion of retail investors value corporate sustainability, relatively few act on these preferences. This discrepancy suggests that favorable attitudes toward ESG do not consistently lead to corresponding investment behavior. Prior research has identified various potential determinants of ESG participation, including financial literacy, perceived efficacy, social influence, and trust in ESG information, yet empirical findings remain mixed across studies and populations (Gutsche et al., 2023; Heeb et al.,2023). In the absence of a cohesive explanatory model, further research is needed to clarify the psychological and cognitive processes that influence individual ESG investment decisions.

A commonly held view in academic and policy discussions is that improving financial literacy will encourage greater participation in sustainable investing. This assumption is based on the notion that financially informed individuals are more capable of assessing ESG-related information and incorporating it into their investment decisions (Lusardi & Mitchell, 2014; van Rooij, Lusardi, & Alessie, 2011). Empirical research has reported positive associations between financial literacy and sustainable investment behavior, particularly in relation to perceived behavioral control and expected outcomes (Gutsche et al., 2023; Jansson & Biel, 2011). However, more recent studies have raised questions about the robustness of this relationship. Findings suggest that the effect of financial literacy may be weak or conditional on other factors, such as social identity or trust in ESG disclosures (Siemroth & Hornuf, 2023; Bianchi & Brière, 2021). Meta-analytic evidence further shows that standalone financial education interventions often produce limited changes in behavior (Fernandes, Lynch, & Netemeyer, 2014). These observations point to the need for broader explanatory models that include non-cognitive determinants.

In response to the limitations of cognition-based explanations, recent research has turned attention to individual value orientations as important determinants of ESG investment attitudes. Altruism and materialism, in particular, have been identified as influential predictors. Nilsson (2008) found that individuals with stronger prosocial values were more likely to express preferences for socially responsible investment products, independent of financial return considerations. Similarly, Bauer and Smeets (2015) reported that social identification and concern for others were positively associated with investment in ethical and environmental funds. Conversely, materialistic orientations—defined by a focus on personal gain and status—have been negatively linked to sustainable consumption and investment behavior (Hurst et al., 2013; Pepper, Jackson, & Uzzell, 2009). These results suggest that investment behavior may be shaped by underlying motivational structures beyond financial or informational factors. Supporting this view, prior studies indicate that informational interventions tend to be more effective when they align with individual value systems (Bénabou & Tirole, 2010; Fernandes, Lynch, & Netemeyer, 2014).

Although prior studies have examined financial literacy and personal values as predictors of sustainable investment behavior, few have assessed their relative and combined effects within a single analytical model. Existing literature tends to isolate these constructs, focusing either on cognitive factors such as financial knowledge (Lusardi & Mitchell, 2014; van Rooij, Lusardi, & Alessie, 2011) or on value orientations such as altruism and materialism (Nilsson, 2008; Hurst et al., 2013). As a result, limited empirical evidence exists on how these factors perform when evaluated simultaneously and how their relative contributions to ESG investing attitudes compare when considered in the same model. Moreover, the treatment of financial literacy as an exogenous predictor has recently been questioned. Research indicates that financial knowledge is often endogenous, shaped by unobserved traits such as cognitive ability, prior investment experience, and motivation—factors that also influence ESG attitudes (Behrman et al., 2012; Allgood & Walstad, 2016). Failure to account for this endogeneity can lead to biased estimates and misleading inferences (Angrist & Pischke, 2009). Addressing these gaps, this study systematically examines the relative and combined effects of financial literacy and value orientations on ESG investment attitudes, accounting for endogeneity, to clarify the value-oriented and cognitive foundations of sustainable investment participation.

1.2 Research Question

The purpose of this study is to answer the research question, "How do investor characteristics influence attitudes toward ESG investing, and to what extent does correcting for endogeneity alter these relationships?". To find an answer to the central question, four sub-questions were identified:

1. How does financial literacy affect individual attitudes toward ESG investing?
2. How does altruism affect individual attitudes toward ESG investing?
3. How does materialism affect individual attitudes toward ESG investing?
4. To what extent does correcting for endogeneity alter the estimated relationship between financial literacy and ESG investment attitudes?

1.3 Contributions

This study contributes to the theoretical literature on sustainable investing by addressing limitations in cognition-centered explanations that emphasize financial literacy as the primary determinant of ESG investment attitudes

(Lusardi & Mitchell, 2014; Gutsche et al., 2023). By empirically testing the influence of altruism and materialism, it expands the focus beyond cognitive predictors to include value-based determinants. Prior studies have shown that prosocial and self-enhancement values are associated with sustainability preferences (Nilsson, 2008; Hurst et al., 2013), yet their comparative role relative to financial literacy remains underexamined. To provide a more comprehensive understanding, the study integrates the Knowledge–Attitude–Behavior (KAB) and Value–Attitude–Behavior (VAB) frameworks (Schrader & Lawless, 2004; Homer & Kahle, 1988). This dual-theoretical approach allows for a multidimensional analysis of ESG attitude formation, recognizing the roles of both informational and motivational factors.

Additionally, this study offers a methodological contribution by addressing the endogeneity of financial literacy in models of attitude formation through the use of a Two-Stage Least Squares (2SLS) estimation approach. Previous research has shown that financial literacy is potentially endogenous, shaped by unobserved factors such as cognitive ability, prior investment experience, and motivation—factors that may also influence ESG investment attitudes (Behrman et al., 2012; Allgood & Walstad, 2016). When such endogeneity is not accounted for, treating financial literacy as an exogenous predictor may result in biased estimates and incorrect causal interpretations (Angrist & Pischke, 2009). By employing 2SLS with theoretically informed instruments, this study controls for omitted variable bias and addresses potential reverse causality. This contributes to improving causal identification in behavioral finance models, where attitudinal determinants are often subject to endogeneity concerns.

The empirical findings of this study contribute to clarifying the relative importance of cognitive and value-based predictors of ESG investment attitudes. Bivariate analyses initially indicated a positive association between financial literacy and ESG attitudes, consistent with earlier findings (Lusardi & Mitchell, 2014; Jansson & Biel, 2011). However, this effect became statistically insignificant once endogeneity was addressed using instrumental variable techniques, aligning with more recent studies that question the robustness of cognition-based models (Siemroth & Hornuf, 2023). In contrast, altruism and materialism emerged as significant and consistent predictors, corroborating prior evidence on the role of value orientations in ethical and sustainable decision-making (Nilsson, 2008; Hurst et al., 2013). Furthermore, the analysis showed that socio-demographic variables—such as age, gender, and income—exhibited limited explanatory power, echoing results from Gutsche et al. (2023) and suggesting that ESG attitudes are better explained by psychological and motivational factors than by structural demographics.

The findings of this study offer practical implications for financial education and ESG investment promotion. Given that value orientations—specifically altruism and materialism—were stronger predictors of ESG attitudes than financial literacy, the results suggest that educational and outreach strategies should extend beyond cognitive training to address underlying motivational factors. Prior studies have shown that value-congruent communication enhances engagement with sustainability-related choices (Bénabou & Tirole, 2010; Pepper et al., 2009). Accordingly, this study supports the design of value-based, segmented interventions such as tailored financial education programs, targeted ESG marketing strategies, and differentiated investor communication. Furthermore, the limited role of socio-demographics in predicting ESG attitudes indicates that universal policy approaches may be less effective than psychographic segmentation (Gutsche et al., 2023). These insights can inform policy development aimed at fostering broader participation in sustainable finance by aligning educational content and policy tools with investors' values and motivations.

2. LITERATURE REVIEW

2.1 ESG Investing

Sustainable investing refers to investment strategies that integrate environmental, social, and governance (ESG) factors alongside financial considerations to support long-term economic, environmental, and social well-being (Brundtland Commission, 1987; Eccles & Klimenko, 2019). ESG investing is a subset of sustainable investing, focusing on the evaluation of non-financial risks and opportunities across ESG domains (OECD, 2020).

Although originally led by institutional investors such as pension funds and sovereign wealth funds, ESG investing is increasingly accessible to individual or retail investors through mutual funds, ETFs, and green bonds (OECD, 2020; Amel-Zadeh & Serafeim, 2018). Individual investors engage in ESG investing through various channels, including indirect investments in ESG-labeled funds, direct stock selection based on ESG ratings, automated ESG portfolios via robo-advisors, retirement plan allocations, and crowdfunding for impact projects (Heeb et al., 2023). Moreover, motivations differ across individuals: some prioritize value alignment, others seek long-term risk mitigation, and many adopt ESG for both ethical and financial reasons (Gutsche et al., 2023). These heterogeneous interpretations of ESG contribute to differing levels of engagement and attitudes toward ESG investing.

2.2 Financial Literacy and ESG Investing

Financial literacy is often conceptualized in two distinct forms: subjective financial knowledge (SFK), which reflects individuals' self-assessed confidence in their financial understanding, and objective financial knowledge (OFK), which captures actual financial competence measured through standardized questions (Lusardi & Mitchell, 2014; Allgood & Walstad, 2016). Prior studies have explored the relationship between these two constructs and suggest a theoretically plausible link in both directions. On the one hand, individuals with higher levels of SFK may be more likely to engage in financial learning activities or decision-making processes, thereby accumulating greater objective knowledge over time (Tang & Baker, 2016; Allgood & Walstad, 2016). On the other hand, empirical evidence indicates that acquiring objective financial knowledge can enhance individuals' perceived competence, reinforcing self-evaluations of financial ability (van Rooij, Lusardi, & Alessie, 2011). This reciprocal association implies that SFK and OFK are not fully independent but may co-evolve as part of a broader learning and self-assessment process. Based on these findings, existing literature supports the assumption that the two constructs are significantly correlated, and potentially causally related, depending on context and measurement. Building on this relationship, financial literacy has also been examined as a predictor of sustainable investment behavior.

Financial literacy is generally associated with more favorable attitudes toward ESG investing. In a framed field experiment, Gutsche et al. (2023) found that individuals with higher financial literacy were significantly more likely to choose sustainable investment products. Heeb et al. (2023) similarly reported that financially knowledgeable participants demonstrated greater ESG awareness and integrated sustainability considerations into investment decisions. Jansson and Biel (2011) also observed a positive relationship between

financial competence and support for ethical investing principles, suggesting that financial knowledge may facilitate the evaluation of non-financial risks and values.

However, some findings are less consistent. Siemroth and Hornuf (2023), using a lab-in-the-field approach, reported weak correlations between financial literacy and green investment preferences, indicating that contextual variables such as platform trust or social identity may influence this relationship. Additionally, several studies note that financial literacy may be shaped by experiential or psychological factors—such as prior investment experience (Yoong, 2011), self-efficacy (Tang & Baker, 2016), and peer learning (Bursztyn et al., 2014)—which may also affect ESG attitudes. These patterns suggest a potential endogeneity problem, where financial knowledge both influences and is influenced by investment-related attitudes and behaviors.

2.3 Value Orientations and ESG Investing

ESG investing increasingly reflects not just financial motives but also the expression of personal values such as moral identity and social responsibility, highlighting the importance of value orientations like altruism and materialism as key psychological drivers.

First, altruism is generally associated with more favorable attitudes toward ESG investing. Nilsson (2008) found that prosocial value orientations, including altruism, significantly predicted socially responsible investment preferences. Cheah et al. (2011) reported that altruistic motivations differentiated socially responsible investors from conventional ones. Jansson and Biel (2011) similarly observed that ethical concern was a strong predictor of positive ESG attitudes. However, Siemroth and Hornuf (2023) suggested that altruistic values did not always translate into ESG fund selection, suggesting that factors such as perceived effectiveness or trust in ESG labels may moderate this link.

Materialism, in contrast, is generally negatively associated with ESG-related attitudes. Hurst et al. (2013) found that materialism was negatively correlated with environmental concern and sustainability-related behavior. Kilbourne and Pickett (2008) reported that materialistic individuals expressed lower concern for environmental degradation. Pepper et al. (2009) showed similar findings in consumer behavior. Yet, Strizhakova and Coulter (2013) found that materialism was positively related to green consumption in emerging markets, where eco-products symbolize status. This suggests that cultural context and identity signalling may moderate the relationship.

2.4 Determinants of Attitudes toward ESG Investing

Attitudes toward ESG investing are shaped by a combination of cognitive, affective, and value-based components. In the Theory of Planned Behavior, attitude is defined as an individual's overall evaluation of performing a specific behavior. This evaluative disposition is primarily shaped by behavioral beliefs about the likely consequences of the behavior, alongside perceived social pressures (subjective norms) and the perceived ease or difficulty of performing the behavior (perceived behavioral control) (Ajzen, 1991). In ESG contexts, these beliefs relate to expected environmental or ethical impacts and the perceived feasibility of sustainable investing. Behavioral economics emphasizes bounded rationality and heuristic processing, suggesting that individuals form ESG attitudes based on simplified mental models shaped by prior knowledge and values—for example, assuming that a high ESG score automatically indicates ethical corporate behavior (Loewenstein et al., 2001). From a consumer psychology perspective, ESG investing shares similarities with high-involvement product decisions that require active information processing and personal value congruence (Richins & Bloch, 1986). Cognitive factors such as financial literacy influence the ability to evaluate ESG criteria (Lusardi & Mitchell, 2014), while value orientations like altruism and materialism guide moral framing and trade-off decisions (Schwartz, 1992; Homer & Kahle, 1988). Socio-demographic factors—such as age, gender, education, and income—have also been found to moderate ESG attitudes (Riedl & Smeets, 2017), highlighting the multidimensional nature of attitudinal formation in sustainable finance contexts.

2.5 Theoretical Background and Hypothesis Development

This study adopts two conceptually distinct frameworks to examine the formation of attitudes toward ESG investing: a cognition-based perspective grounded in the Knowledge–Attitude–Behavior (KAB) model and a value-based perspective based on the Value–Attitude–Behavior (VAB) model. The KAB model posits that individuals acquire knowledge, which subsequently shapes attitudes and behaviors (Schrader & Lawless, 2004). However, direct measurement of actual behavior is often limited in empirical studies due to methodological, ethical, or logistical constraints (Fishbein & Ajzen, 2010). In such contexts, attitude is commonly used as a proxy for behavioral intentions or likely future behaviors, especially when attitude is theorized to be the primary antecedent of action. The Theory of Planned Behavior (Ajzen, 1991) strengthens this approach by positing that attitudes toward a behavior, together with subjective norms and perceived behavioral control, predict behavioral intentions, which in turn are the best available predictors of actual behavior. Accordingly, the current study focuses on attitudes toward ESG investing as the main outcome variable, based on both the practical limitation of behavioral measurement and the robust theoretical support provided by TPB.

The cognition-based perspective adopted in this study draws on the Knowledge–Attitude–Behavior (KAB) model, which posits a sequential relationship wherein knowledge acquisition shapes evaluative attitudes, which subsequently influence behavior (Schrader & Lawless, 2004). This progression is particularly relevant in high-involvement decision contexts, where individuals are expected to engage in deliberate cognitive processing before forming affective responses or acting. Ray's (1973) Learn–Feel–Do model reflects this sequence, emphasizing that rational evaluation typically precedes emotional and behavioral stages in thoughtful decision-making. The FCB Grid (Vaughn, 1980) similarly classifies such behaviors—like sustainable investing—as "high-involvement/thinking" actions that are primarily driven by cognitive engagement. Financial literacy, often defined as the ability to understand and apply financial information (Lusardi & Mitchell, 2014), serves as a form of human capital that enhances rational decision-making capacity (Becker, 1962). Within this framework, financial literacy provides the cognitive foundation upon which individuals can assess ESG-related information and develop attitudes accordingly. Moreover, the Theory of Planned Behavior suggests that perceived behavioral control and beliefs about outcomes—both influenced by one's level of knowledge—contribute directly to the formation of attitudes (Ajzen, 1991). Taken together, these theories suggest that financial literacy facilitates the development of more informed and structured attitudes toward ESG investing. Based on these theoretical considerations, the following hypothesis is proposed:

H1. Financial literacy will be positively related to attitudes toward ESG investing.

Within this cognition-based framework, financial knowledge is defined as the ability to understand, evaluate, and apply financial information to investment decisions (Lusardi & Mitchell, 2014). It is theorized to enable individuals to process complex ESG-related information, assess non-financial risks and opportunities, and make more rational and informed choices regarding sustainable investments. However, recent research suggests that the effect of financial knowledge on ESG attitudes may be contingent on individual experiences, motivations, or value orientations, highlighting the need to consider both cognitive and value-based factors in understanding ESG investment behavior.

The value-based perspective employed in this study is grounded in the Value–Attitude–Behavior (VAB) model, which posits that stable personal values influence domain-specific attitudes, which in turn shape behavioral intentions (Homer & Kahle, 1988). This framework conceptualizes a hierarchical structure where abstract value orientations act as foundational inputs in the formation of attitudinal responses. Within this model, altruism is defined as a self-transcendence value that emphasizes concern for the welfare of others and the broader society (Schwartz, 1992). It reflects a prosocial orientation wherein individuals prioritize collective outcomes over personal gain (Andreoni, 1990). The VAB model asserts that such deeply held values serve as cognitive-affective filters through which individuals evaluate social and environmental issues, including those related to sustainable investing. The Theory of Planned Behavior similarly suggests that altruistic dispositions shape behavioral beliefs and moral evaluations, thereby influencing attitudes toward ethically relevant choices (Ajzen, 1991). Furthermore, the Value–Belief–Norm (VBN) theory positions altruism as a precursor to personal norms, which guide behavior when individuals internalize social responsibility (Stern et al., 1999). These theoretical models collectively suggest that altruism, as a self-transcendence value, contributes to more favorable attitudes toward ESG investing by reinforcing moral relevance and concern for societal outcomes. Based on these theoretical considerations, the following hypothesis is proposed: **H2. Altruism will be positively related to attitudes toward ESG investing.**

The value-based approach builds on the Value–Attitude–Behavior (VAB) framework, which posits that enduring personal values shape attitudinal dispositions, which in turn guide behavioral choices (Homer & Kahle, 1988). Within this model, materialism is defined as a core value orientation that emphasizes the acquisition, possession, and display of material goods as central to personal achievement and social recognition (Richins & Dawson, 1992). According to Schwartz's (1992) value theory, materialism aligns with self-enhancement values, which prioritize individual success, power, and achievement. These values contrast with self-transcendence orientations, such as altruism, that emphasize collective welfare and environmental concern. Theoretical accounts suggest that individuals with strong materialistic values are less likely to form favorable attitudes toward ethically motivated behaviors, as their evaluative judgments are guided by instrumental utility and personal gain (Doran, 2009; Nilsson et al., 2004). The Theory of Planned Behavior further supports this view, proposing that materialistic individuals may form behavioral beliefs that emphasize financial outcomes over moral or environmental considerations (Ajzen, 1991). Likewise, the Value–Belief–Norm (VBN) theory suggests that materialism may inhibit the development of personal norms associated with environmental responsibility due to weak associations with biospheric values (Stern et al., 1999). Based on this theoretical reasoning, the following hypothesis is proposed: **H3. Materialism will be negatively related to attitudes toward ESG investing.**

Financial literacy is commonly defined as the capacity to understand, evaluate, and apply financial information in personal decision-making (Lusardi & Mitchell, 2014). Theoretical models such as the Knowledge–Attitude–Behavior (KAB) framework typically position financial knowledge as an exogenous and stable precursor to attitudes and behaviors (Schrader & Lawless, 2004). However, recent theoretical discussions emphasize that financial literacy is not a fixed input but a dynamic construct shaped by latent factors such as cognitive ability, motivational orientation, and prior investment experience (Becker, 1962; van Rooij, Lusardi, & Alessie, 2011). Furthermore, the directionality of influence between knowledge and attitude is not always consistent with the Knowledge–Attitude–Behavior (KAB) model. Studies in behavioral economics and consumer finance have documented reverse pathways, where individuals develop financial knowledge through investment experience or post-hoc rationalization of prior choices (Bucher-Koenen & Ziegelmeyer, 2014; Sekita, 2011). These antecedents also influence financial attitudes, indicating potential omitted variable bias when financial literacy is treated as strictly exogenous. The Behavior–Attitude–Knowledge (BAK) model proposes that individuals may first act, then form attitudes, and only later acquire knowledge to rationalize past decisions (Petty & Cacioppo, 1986). This reversed pathway is supported by Kolb's (1984) experiential learning theory, which posits that knowledge formation begins with concrete experience, followed by reflection and conceptualization. In the context of ESG investing, where behavioral engagement may be initiated through social influence or automatic enrollment, individuals may later develop financial literacy through post-decision learning. These theoretical perspectives collectively suggest that financial literacy may function not only as a cause but also as a consequence of attitudinal development, depending on the learning context. Therefore, its estimated effect on ESG investment attitudes may differ once endogeneity is appropriately addressed. Based on this theoretical reasoning, the following hypothesis is proposed: **H4. The effect of financial literacy on attitudes toward ESG investing will significantly differ after correcting for endogeneity.**

2.6 Conceptual Framework

Consequently, the following conceptual framework has been designed:

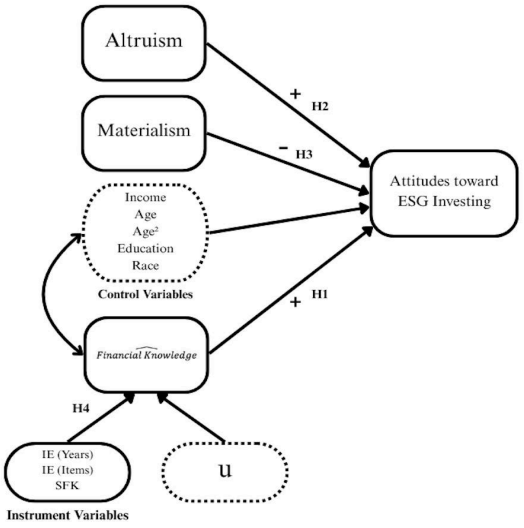

Figure 1 – Conceptual Framework

3. METHODOLOGY AND DATA

3.1 Sample

Prior to data collection, this study was reviewed and approved by the Ethics Committee of the University of Twente. Data were collected via an online questionnaire developed and distributed using Qualtrics. The survey was administered in English and distributed through personal networks as well as three main social media platforms: LinkedIn, Instagram, and WhatsApp. To ensure respondent confidentiality and data integrity, several measures were implemented. First, the survey was fully anonymous, and participants were informed that they could withdraw at any point without penalty. Second, the "Allow respondents to finish later" function in Qualtrics was enabled, allowing participants to pause and resume the survey at their convenience. Third, to prevent duplicate participation and maintain response validity, the "Prevent multiple submissions" feature was activated.

A total of 274 individuals initially accessed the survey. Of these, participants who did not provide informed consent (i.e., declined the terms and conditions) or failed the attention check items were excluded, resulting in a remaining sample of 205 respondents. Subsequently, participants who did not complete the questionnaire in full were removed, resulting in a final sample of 150 fully completed and valid responses for analysis. Table 1 presents the sample's descriptive statistics.

3.2 Variables and Method

The dependent variable for this study is attitude toward ESG investing, which, in line with the Theory of Planned Behavior (Ajzen, 1991), is defined as an individual's overall evaluation of investing in financial products that incorporate environmental, social, and governance (ESG) considerations. It reflects the extent to which the individual perceives such investment behavior as favorable or unfavorable, based on underlying beliefs about its ethical value, societal impact, and financial implications. As detailed in Table 2, this construct was operationalized using five items adapted from prior TPB-based models developed by Taylor and Todd (1995) and subsequently applied in the ESG investment context by Adam and Shauki (2014). The items capture evaluative, normative, and affective dimensions of ESG investment attitudes. Respondents rated their agreement with each item on a 7-point Likert scale, where higher values indicate more favorable attitudes. A confirmatory factor analysis (CFA) was conducted to assess the construct's validity, and the results are presented in the Results section.

As shown in Table 2 in the Appendix, the main independent variables were altruism, materialism, and objective financial knowledge. Altruism was measured using nine items (ALT1 to ALT9) from the 9-item Self-Reported Altruism (SRA) Scale developed by Manzur and Olavarrieta (2021), which is a shortened version of the original scale by Rushton, Chrisjohn, and Fekken (1981). The items represent three types of altruistic attitudes: helping or donating to others (prosocial behavior), feeling concern for others (empathy), and a sense of duty (moral obligation). Each item was rated on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). All items were coded in the same direction, and higher values indicate stronger altruistic beliefs. Materialism was measured using nine items (MAT1 to MAT9) from the short version of the Material Values Scale (MVS) developed by Richins (2004), originally based on the full scale by Richins and Dawson (1992). The items cover three dimensions: the idea that owning things shows success (success), the importance of possessions in everyday life (centrality), and the belief that buying things leads to happiness (happiness). Among the items, MAT4 was reverse-coded to account for its opposite wording direction. The remaining items were coded such that higher values indicate stronger support for materialistic beliefs. Objective financial knowledge was measured using three quiz items (OFK1 to OFK3) originally developed by Lusardi and Mitchell (2007) as part of the "Big Three" financial literacy questions. These items assess knowledge of compound interest (OFK1), inflation (OFK2), and risk diversification (OFK3). Each correct answer was scored as 1, and incorrect or "don't know" responses were scored as 0. The total score (ranging from 0 to 3) was used as the indicator of objective financial knowledge, where a higher score reflects a higher level of financial literacy. A confirmatory factor analysis (CFA) was conducted to assess the construct's validity, and the results are presented in the Results section.

To address potential endogeneity in the relationship between objective financial knowledge and ESG investment attitudes, three instrumental variables were included: subjective financial knowledge (SFK), investment experience years (IEY), and investment experience items (IE_1 to IE_8). Subjective financial knowledge was measured using a single self-assessment item adapted from the National Financial Capability Study (FINRA Investor Education Foundation, 2021), which asked respondents to rate their overall financial knowledge on a 7-point Likert scale, where 1 indicated "very low" and 7 indicated "very high." Higher scores reflect a higher level of self-perceived financial knowledge. Investment experience years (IEY) was measured using a categorical item that asked respondents how long they had actively invested in financial products. Response options ranged from "never invested" to "more than 10 years," and were coded from 0 to 5 in ascending order of experience. Thus, higher values indicate greater investment experience. Investment experience items (IE_1 to IE_8) assessed the breadth of investment activity by asking whether respondents had ever invested in eight types of financial products, including individual stocks, bonds, mutual funds, ETFs, real estate, cryptocurrencies, ESG-focused funds, and others. Each item was dichotomously coded (1 = selected; 0 = not selected) and treated as a separate indicator of prior experience with a specific type of investment product.

To account for heterogeneity in individual characteristics and reduce omitted variable bias (Gutsche et al., 2023; Heeb et al., 2023), a range of socio-demographic control variables was included, such as gender, age, education, income, and race. Gender was coded as a binary variable (female = 1; male = 0), while age was treated as a continuous variable with its squared term added to capture potential nonlinear patterns. Education level, income, and race were operationalized as categorical variables based on predefined levels, as summarized in Table 1 in the Appendix.

3.3 Analytics

3.3.1 Model specification

To examine the causal effect of financial literacy on ESG investment attitudes, this study applies a Two-Stage Least Squares (2SLS) regression model. The rationale for using 2SLS stems from the theoretical and empirical concern that financial literacy may be endogenous—i.e., correlated with the error term in the outcome equation—due to reverse causality or omitted variable bias. The estimation follows two main equations.

Figure 2 – First Stage Equation:

$$\begin{aligned} \mathrm{FK}_i = \; & \alpha_0 + \alpha_1 \mathrm{SFK}_i + \alpha_2 \mathrm{IEY}_i + \sum_{j=1} \alpha_{2+j} \mathrm{IE}_{ij} \\ & + \alpha_{11} \mathrm{INC}_i + \alpha_{12} \mathrm{EDU}_i + \alpha_{13} \mathrm{AGE}_i + \alpha_{14} \mathrm{AGE}_i^2 \\ & + \alpha_{15} \mathrm{FEM}_i + \sum_{r=1}^{8} \eta_r \mathrm{RACE}_{ir} + \alpha_{24} \mathrm{ALTR}_i + \alpha_{25} \mathrm{MAT}_i + u_i \end{aligned}$$

Figure 3 – Second Stage Equation:

$$\begin{aligned}\text{ESGATT}_i = \; & \beta_0 + \beta_1 \widehat{\text{FK}}_i + \beta_2 \,\text{ALTR}_i + \beta_3 \,\text{MAT}_i \\ & + \beta_4 \,\text{INC}_i + \beta_5 \,\text{EDU}_i + \beta_6 \,\text{AGE}_i + \beta_7 \,\text{AGE}_i^2 \\ & + \beta_8 \,\text{FEM}_i + \sum_{r=1}^{8} \gamma_r \,\text{RACE}_{ir} + \varepsilon_i,\end{aligned}$$

For additional clarification regarding the structure and variables of the equation, see Figure A in the Appendix.

3.3.2 The rationale for using 2SLS

A central methodological concern in analyzing the effect of financial literacy on ESG investment attitudes lies in the potential endogeneity of financial literacy. This variable is unlikely to be purely exogenous, as it is shaped by various unobserved factors such as cognitive ability, socio-economic background, motivation, and especially prior investment experience (Lusardi & Mitchell, 2014). These unobserved traits may also influence ESG-related attitudes, thereby violating the exogeneity assumption of ordinary least squares (OLS) regression. As a result, applying a simple linear model risks yielding biased and inconsistent estimates due to omitted variable bias and reverse causality (Lusardi & Mitchell, 2014; Angrist & Pischke, 2009). For instance, while it is reasonable to assume that financial literacy affects ESG investment attitudes, it is equally plausible that individuals who already hold strong pro-ESG views may be more inclined to seek financial knowledge to ensure their investments reflect their values. This two-way causality introduces simultaneity bias, which cannot be adequately addressed through OLS estimation. To overcome these concerns, this study employs a two-stage least squares (2SLS) regression model, using subjective financial knowledge and investment experience variables as instrumental variables (IVs) for objective financial literacy. The rationale for selecting these instruments is grounded in economic theory and prior empirical research. Investment experience and perceived (subjective) financial knowledge are empirically and theoretically associated with actual (objective) financial knowledge, thereby satisfying the relevance condition (Staiger & Stock, 1997). These instruments are theoretically assumed to influence ESG attitudes only indirectly through their impact on objective financial literacy, conditional on included covariates that account for potential confounders. Hence, they also fulfill the exogeneity condition, provided that appropriate control variables (e.g., income, education, age, gender, altruism, materialism) are included to account for any residual confounding paths. This IV approach allows for consistent estimation even when the endogenous regressor is correlated with unobserved determinants of the dependent variable.

The key strength of the 2SLS method lies in its two-stage structure. In the first stage, the potentially endogenous regressor—objective financial literacy—is regressed on the instrumental variables and controls to derive its predicted values, capturing only the exogenous variation. In the second stage, these predicted values are substituted into the main regression to estimate the impact of financial literacy on ESG attitudes. This technique enables the model to isolate and estimate the causal effect of financial literacy that is not confounded by omitted variables or reverse feedback. Empirical work in financial behavior supports the efficacy of this approach. For example, Bucher-Koenen et al. (2021) show that IV-based estimation substantially alters the relationship between financial literacy and financial planning behavior, indicating that failure to address endogeneity may lead to over- or under-estimation of key effects. Similarly, Heeb et al. (2023) note that ESG investment decisions are shaped by complex value systems and prior learning, further emphasizing the need to isolate exogenous variation in literacy to make valid inferences about its influence on sustainability-related outcomes.

The rationale for 2SLS is also grounded in broader theoretical traditions in behavioral economics and social psychology. According to human capital theory (Becker, 1962), financial literacy is the result of deliberate investments in education and experience, often influenced by prior beliefs, motivations, or social environments. Likewise, the theory of planned behavior (Ajzen, 1991) conceptualizes attitudes as being shaped by knowledge and perceived behavioral control—variables that are likely endogenous to one another. These theoretical frameworks highlight the dynamic and reciprocal nature of knowledge and attitudes, implying that any empirical strategy seeking to identify the direction and magnitude of their relationship must account for such feedback mechanisms. Consistent with these theoretical assumptions, diagnostic tests support the empirical validity of the instruments: the Hansen's J test fails to reject the null hypothesis of instrument exogeneity ($p = .743$), and the endogeneity test indicates a borderline concern ($p = .056$), justifying the use of IV estimation. The use of 2SLS aligns with this need, offering a methodologically sound approach to resolving endogeneity in attitudinal models involving knowledge-based predictors.

Lastly, the use of 2SLS enhances the interpretive clarity of the estimation results. While OLS can only answer associational questions—such as whether higher financial literacy is correlated with more positive ESG attitudes—2SLS allows for causal interpretation, answering the more policy-relevant question: *What would happen to ESG attitudes if financial literacy were exogenously increased—for instance, through targeted education or institutional intervention?* This distinction is crucial for informing the design of financial education programs, regulatory interventions, or ESG product development strategies. In this regard, 2SLS not only serves to correct for statistical issues but also strengthens the practical and theoretical implications of the research.

4. RESULTS

4.1 Scale Validation

4.2 Cronbach's Alpha

To evaluate the internal consistency of the latent constructs used in the study, Cronbach's alpha coefficients were calculated for each multi-item scale. According to Nunnally (1978), a Cronbach's alpha value of 0.70 or above is generally considered acceptable for exploratory research, while values above 0.90 indicate excellent reliability (also see Hair et al., 2019). As shown in Table 3, all three constructs demonstrated excellent internal consistency. Specifically, the ESG Attitude scale (5 items) yielded a Cronbach's alpha of .93, the Altruism scale (9 items) showed an alpha of .91, and the Materialism scale (9 items) demonstrated an alpha of .94. These results indicate that the items within each scale consistently measure the underlying construct and provide a reliable basis for further structural and causal analysis.

4.3 Confirmatory Factor Analysis

To evaluate construct validity, a single-factor confirmatory factor analysis model was estimated for each latent variable (ESG Attitude, Altruism, Materialism). Model fit was evaluated using multiple fit indices: Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index

(CFI), Standardized Root Mean Square Residual (SRMR), and Coefficient of Determination (CD), following established recommendations (Brown, 2015; Hu & Bentler, 1999; Kline, 2011). For the ESG Attitude construct (5 items), the CFA results indicated excellent model fit. The RMSEA was .000, the CFI was 1.00, and the SRMR was .010, all of which meet or exceed commonly accepted thresholds (RMSEA ≤ .06, CFI ≥ .95, SRMR ≤ .08). The Coefficient of Determination (CD) was .943, suggesting a high proportion of explained variance. The Altruism construct (9 items) also demonstrated an acceptable model fit, based on conventional thresholds. The RMSEA was .052, the CFI was .989, and the SRMR was .032. These values fall within the acceptable ranges, with the RMSEA below .06 and the CFI and SRMR exceeding .95 and falling below .08, respectively. The CD value was .891, indicating substantial explanatory power. Lastly, the Materialism construct (9 items) demonstrated robust factorial validity, as evidenced by favorable model fit indices. The model fit indices were RMSEA = .050, CFI = .993, and SRMR = .027, all within favorable thresholds. The CD for this construct was .937, further confirming model adequacy.

Overall, the CFA results support the construct validity of the three latent variables—ESG Attitude, Altruism, and Materialism. Each construct met commonly accepted thresholds across multiple fit indices (RMSEA, CFI, SRMR, CD), based on established guidelines in the psychometric literature (Brown, 2015; Hu & Bentler, 1999; Kline, 2011). The results indicate that the unidimensional measurement models are appropriate and can be retained for subsequent structural analysis.

Table 3 Reliability & Validity

	Reliability	Validity			
	Cronbach's alpha	RMSEA	CFI	SRMR	CD
ESG Attitude (5 items)	.93	.000	1.00	.010	.943
Altruism (9 items)	.91	.052	.989	.032	.891
Materialism (9 items)	.94	.050	.993	.027	.937

4.4 Correlation

To assess whether the data were normally distributed, a Shapiro–Wilk test was conducted (Table 8 in the Appendix). For the independent variables – altruism, materialism, objective financial knowledge (fk_total), and the instrument variable, subjective financial knowledge (sub_fk) – as well as the dependent variable, attitude toward ESG investing, the test results were insignificant ($p > 0.05$). This indicates that the null hypothesis of normality cannot be rejected and that the data are approximately normally distributed. Therefore, the Pearson correlation coefficient was considered appropriate for assessing relationships among the variables.

Table 4 presents the Pearson correlation coefficients among the major variables of the study and summarizes the strength, direction, and statistical significance of each bivariate association.

Table 4 Correlation analysis

	FK score	Sub. FK	Altruism	Materialism	ESG Attitude
FK score	1.00				
Sub. FK	.54***	1.00			
Altruism	.16	.25**	1.00		
Materialism	-.26**	-.10	-.39***	1.00	
ESG Attitude	.20*	.01	.44***	-.45***	1.00

*p < .05, **p < .01, ***p < .001

A significant and positive correlation was observed between objective and subjective financial knowledge ($r = .54$, $p < .001$), indicating that the two forms of financial knowledge tend to move together. Objective financial knowledge was negatively correlated with materialism ($r = -.26$, $p < .01$), suggesting that individuals with higher levels of financial knowledge tend to exhibit lower levels of materialistic values. In addition, objective financial knowledge was positively associated with ESG investment attitude ($r = .20$, $p < .05$), indicating that individuals with greater financial knowledge are more likely to hold favorable views toward ESG-related investments. However, this relationship did not remain statistically significant in the final model after accounting for endogeneity through 2SLS estimation. Subjective financial knowledge was positively associated with altruism ($r = .25$, $p < .01$), indicating that individuals with higher perceived financial knowledge also tend to report higher levels of altruistic values. Furthermore, altruism was negatively associated with materialism ($r = -.39$, $p < .001$), suggesting that individuals who exhibit stronger altruistic values tend to score lower on materialistic orientation. Altruism was also positively correlated with ESG investment attitude ($r = .44$, $p < .001$), indicating that higher levels of altruism are associated with more positive attitudes toward ESG investing. Lastly, materialism showed a significant negative correlation with ESG attitude ($r = -.45$, $p < .001$), suggesting that individuals with stronger materialistic values are less likely to endorse ESG-related investments.

Overall, the correlation analysis provides preliminary evidence of the directional relationships among financial knowledge, personal value orientation, and ESG-related investment attitudes. While these correlations offer initial insights, it does not account for the potential endogeneity of financial literacy, which has been theoretically and empirically addressed in the previous section. The following analysis therefore presents the results of the Two-Stage Least Squares (2SLS) estimation to identify the causal effect of financial literacy on ESG investment attitudes.

4.5 Regression Results

4.5.1 First-Stage IV Estimates

As part of the two-stage least squares (2SLS) estimation procedure, a first-stage regression was conducted to extract the exogenous component of objective financial knowledge (fk_total). In this stage, fk_total was regressed on subjective financial knowledge (sub_fk), indicators of investment experience (IE_years and ie_1 to ie_8), and a set of control variables including income, education, age, gender, race, altruism, and materialism. As reported in Table 5 in the Appendix, subjective financial knowledge (sub_fk) was a statistically significant determinant of objective financial knowledge, with a coefficient of 0.32 ($p < .001$), indicating that a one-point increase in perceived financial knowledge is associated with a 0.32-point increase in actual financial knowledge scores. Additionally, the materialism variable showed a significant negative association (coefficient = −.02, $p < .01$), suggesting that individuals with stronger materialistic values tend to exhibit lower levels of financial literacy. A non-linear relationship was observed for age: the linear term was negatively associated with fk_total (coefficient = −.10, $p < .05$), while the squared term was positively associated (coefficient = .00, $p < .05$). This quadratic pattern implies that financial knowledge tends to decline with age initially but may increase again in later life stages.

The overall first-stage regression model demonstrated a moderate level of explanatory power, with an R-squared of 0.42, indicating that the included variables explain approximately 42% of the variance in objective financial knowledge (fk_total)—a substantial proportion within the context of behavioral finance research. The joint significance of the instruments and covariates was confirmed by an overall F-test result of $F(21, 128) = 4.36$, $p < .001$, supporting the

adequacy of the model specification. Instrument relevance was further assessed using the first-stage F-statistic specific to the endogenous regressor.

4.5.1.1 Multicollinearity Issue

To assess potential multicollinearity among the predictors in the first-stage regression model, the variance inflation factor (VIF) was examined. Given that age and age squared (agesq) are mathematically dependent, only age was retained in the variance inflation factor (VIF) calculation to avoid artificial inflation of collinearity statistics. This approach follows standard practice in multicollinearity diagnostics when polynomial terms are included in regression models. As shown in Table 6 in the Appendix, the analysis revealed that the mean VIF was 1.76, which is well below the commonly accepted threshold of 5.00 (Kutner et al., 2004). Moreover, all individual VIF values were below 3.00, with the highest VIF observed for IE_years at 2.92. These results indicate that there is no evidence of problematic multicollinearity among the explanatory variables used to predict objective financial knowledge (fk_total). Therefore, the stability of coefficient estimates in the first-stage regression is not compromised by excessive linear dependency among the regressors.

4.5.2 Second-Stage 2SLS

The second-stage regression of the 2SLS estimation was conducted to assess the causal effect of financial knowledge (fk_total) on attitudes toward ESG investing (esg_att), using the exogenous variation in fk_total isolated from the first stage. In this model, the observed FK score is replaced by the estimated FK value from the first stage, which is used as an exogenous proxy in the second stage. This approach accounts for potential endogeneity arising from latent traits which may influence both financial knowledge and ESG attitudes and are not directly observed in the survey.

As shown in Table 7 in the Appendix, the coefficient for financial knowledge (fk_total) was −1.03 ($p = .220$), indicating that after controlling for endogeneity, financial knowledge does not have a statistically significant effect on ESG attitudes. This result contrasts with the earlier correlation analysis, where a positive bivariate association was observed. This finding suggests that the previously observed correlation may have been confounded by omitted variable bias, and once endogeneity is accounted for through 2SLS, the estimated causal effect of financial knowledge weakens and becomes statistically indistinguishable from zero (Angrist & Pischke, 2009). Meanwhile, psychological value-based predictors retained strong and statistically significant relationships. Specifically, altruism (altr) had a positive and significant coefficient of 0.27 ($p < .001$), suggesting that higher levels of altruism are causally associated with more favorable ESG attitudes. Conversely, materialism exhibited a negative and significant effect (coefficient = −.26, $p < .001$), indicating that individuals with higher materialistic values tend to report less favorable attitudes toward ESG investing. Other control variables, including income, education, age, gender, and race categories, did not demonstrate statistically significant effects in this model. The R-squared value of 0.35 suggests that the model explains a moderate proportion of the variance in ESG attitudes.

4.5.2.1 Instrument validity and Endogeneity diagnostics

The strength of the instrumental variables was confirmed in the first-stage regression, where the robust F-statistic was 5.13 ($p < .001$). Although the F-statistic falls below the conventional threshold of 10 for strong instruments (Stock & Yogo, 2005), it remains statistically significant, supporting the instruments' predictive validity for the endogenous regressor. The test of overidentifying restrictions (Hansen's J test) yielded a p-value of 0.74, indicating that the null hypothesis of instrument exogeneity cannot be rejected. This supports the validity of the instruments used in the model. The endogeneity test returned a p-value of 0.056, which is near the conventional threshold of 0.05. While not statistically significant at the 5% level, the result suggests that financial knowledge may not be strictly exogenous, thereby supporting the appropriateness of applying a 2SLS approach.

Based on the results, the following conclusions can be drawn regarding the hypotheses:

Table 8 Hypothesis Acceptance

H1: Financial literacy will be positively related to attitudes toward ESG investing.	Rejected
H2: Altruism will be positively related to attitudes toward ESG investing.	Supported
H3: Materialism will be negatively related to attitudes toward ESG investing.	Supported
H4: The effect of financial literacy on attitudes toward ESG investing will significantly differ after correcting for endogeneity.	Supported

5. DISCUSSION

This study examined the effects of financial knowledge and value orientations—specifically altruism and materialism—on attitudes toward ESG investing, using a two-stage least squares (2SLS) approach to address potential endogeneity. Several findings emerged that align with, diverge from, or add nuance to existing literature. First, the first-stage regression indicated that materialism was negatively associated with objective financial knowledge ($b = -.02$, $p < .01$). This suggests that individuals with higher materialistic values tend to exhibit lower levels of financial knowledge. Segev et al. (2015) reached a similar conclusion, arguing that materialistic individuals are less inclined to engage in long-term financial planning or financial education due to a focus on immediate consumption. Likewise, previous studies have found that high materialism is associated with impulsive financial decision-making and lower financial literacy (Pinto, Parente, & Palmer, 2000; Roberts & Jones, 2001). In contrast, Roberts and Clement (2007) found no significant relationship between materialism and financial knowledge, attributing this to measurement differences in materialism and financial literacy scales. In the present study, the consistent and statistically significant relationship supports the view that value orientation influences financial cognition, particularly by shaping the motivation to acquire financial knowledge.

Second, the effect of age on financial knowledge followed a U-shaped curve. The linear term for age was negative, while the squared term was positive, indicating a non-linear relationship across life stages. This result aligns with Lusardi and Mitchell (2007), who suggested that middle-aged individuals may experience a temporary decline in financial literacy due to time constraints and life complexity, whereas financial knowledge increases again later in life due to retirement-related planning. In contrast, Chen and Volpe (1998) found a linear increase in knowledge with age, emphasizing experience as the key mechanism. The U-shaped relationship between age and financial knowledge observed in this study indicates that financial knowledge tends to decline during mid-life but increase again in later years. This pattern may be explained by life-stage-specific demands and cognitive engagement, as suggested by Lusardi and Mitchell (2007), who note that financial learning and decision-making are often

shaped by factors such as time availability, perceived need, and planning for retirement. Third, the second-stage regression showed that financial knowledge had no significant effect on ESG investing attitudes once endogeneity was addressed ($b = -1.03$, $p = .220$). This finding diverges from studies such as Lusardi and Mitchell (2014) and van Rooij et al. (2011), which reported a positive association between financial literacy and financial decision-making, including sustainable investment behavior. However, it aligns with Behrman et al. (2012), who emphasized that financial knowledge is often endogenous to behavioral outcomes due to shared underlying factors such as education and motivation. Moreover, Fernandes et al. (2014) conducted a meta-analysis showing that the explanatory power of financial literacy significantly declines after correcting for endogeneity. In the current data, the initially positive relationship between knowledge and ESG attitudes disappeared in the 2SLS model, suggesting that previous associations may reflect omitted variable bias rather than a direct causal effect.

Fourth, altruism was positively associated with ESG investment attitudes ($b = .27$, $p < .001$), indicating a strong and statistically robust relationship. This is in line with the Value–Attitude–Behavior (VAB) theory (Homer & Kahle, 1988), which posits that personal values influence attitudes and subsequent behaviors. Empirical findings from Gutsche et al. (2023) and Heeb et al. (2023) also demonstrated that pro-social values, such as altruism, are significant predictors of sustainable financial preferences. The present study confirms these findings, highlighting altruism as a stable and exogenous driver of positive ESG attitudes. Fifth, materialism was negatively associated with ESG investment attitudes in the second-stage model ($b = -.26$, $p < .001$). This confirms prior studies such as Hurst et al. (2013), who found that materialistic consumers are less likely to engage in environmentally or socially responsible consumption. Similarly, Burroughs and Rindfleisch (2002) demonstrated that materialism is inversely related to prosocial behavior, including ethical consumption. The strength and consistency of the materialism effect in both stages of this study underscore its role as a central barrier to ESG engagement.

Finally, most socio-demographic control variables—including income level, gender, age (as a main effect), and race—were statistically insignificant in predicting ESG investment attitudes. This result contrasts with earlier findings by Nilsson (2009), who reported that demographic characteristics such as age and income positively influenced sustainable investment behavior. However, more recent research (Adam & Shauki, 2014; Gutsche et al., 2023) has shown that once value-based and psychological constructs are included, the explanatory power of demographic variables diminishes. The current data supports this position, suggesting that ESG investment attitudes are more strongly influenced by internalized value systems than by observable demographic traits. In sum, the results indicate that value orientations—specifically altruism and materialism—are more influential than financial knowledge or demographics in shaping ESG investment attitudes. While financial knowledge may show a positive association in simple models, its explanatory power diminishes once endogeneity is addressed. These findings reinforce the importance of considering value-based mechanisms when analyzing or promoting sustainable financial behavior.

6. IMPLICATIONS

The findings of this study offer several implications for industry practitioners, particularly those involved in asset management, sustainable finance, and ESG investment product development. One key insight is the limited role of financial knowledge in shaping ESG investment attitudes once endogeneity is accounted for. This challenges the common industry assumption that enhancing financial literacy alone will translate into higher adoption of ESG financial products. First, the results suggest that investor education strategies focused solely on improving cognitive understanding—such as explaining ESG ratings, risk-return tradeoffs, or regulatory disclosures—may be insufficient to foster meaningful engagement. Instead, educational initiatives may benefit from incorporating value-based components that appeal to investors' underlying motivations. For example, prosocial framing techniques, which emphasize the societal or environmental benefits of ESG investing, or messaging that evokes moral satisfaction ("warm-glow" effects), may be more effective in influencing investor attitudes than purely informational approaches (Heeb et al., 2023).

Second, asset managers and fund marketers should consider moving beyond demographic segmentation in identifying target investors for ESG products. The present findings indicate that socio-demographic variables—such as age, gender, income, and education—are not statistically significant predictors of ESG investing attitudes. This implies that segmentation strategies based on demographic assumptions may lack precision. Instead, focusing on value-based segmentation—such as distinguishing between investors with high levels of altruism versus those with materialistic orientations—may provide a more accurate and actionable basis for designing and marketing ESG offerings. To operationalize these findings, industry practitioners might begin by assessing the value orientations of their investor base using validated survey instruments (e.g., altruism and materialism scales). This diagnostic step can be embedded in onboarding questionnaires, digital investor profiles, or annual client reviews. Based on these assessments, asset managers can develop segmented educational materials and marketing campaigns. For example, investors scoring high on altruism may be invited to exclusive ESG webinars highlighting measurable social and environmental impact, while those high in materialism could receive tailored communications focusing on the personal financial advantages of sustainable investing—such as long-term risk-adjusted returns, tax incentives, or alignment with premium brands. This contrasts with messaging for altruistic investors, who may be more responsive to narratives of impact and responsibility. Additionally, fund providers can pilot A/B testing of messaging strategies in digital campaigns to empirically determine which value-based framings drive higher engagement and conversion rates among specific investor segments. These interventions should be systematically evaluated via attitude and behavior metrics (e.g., intention to invest, actual ESG fund uptake, retention rates), allowing continuous refinement of communication and product design.

At a broader policy level, industry regulators and professional bodies may consider updating best practice guidelines to explicitly recommend value-based segmentation and education as part of ESG product development and distribution. This could include offering training for financial advisors on value diagnostics and ethical communication, as well as supporting research on the efficacy of these approaches in driving sustainable investment adoption.

7. LIMITS AND FUTURE RESEARCH

This study is subject to several limitations that should be considered when interpreting the findings. First, the data were collected using non-probability sampling, primarily through personal networks and convenience-based recruitment. While this method facilitated data access, it may have

introduced selection bias and limited the generalizability of the results. Respondents may not fully represent the broader population of retail investors in terms of financial behavior, attitudes, or demographic diversity.

Second, due to constraints related to survey length and participant fatigue, the measurement of financial knowledge was prioritized using a brief objective test. As a result, more comprehensive assessments—such as a 15-item ESG knowledge scale or scenario-based ESG comprehension tasks—were not included. Future research should consider incorporating such extended measures to better capture the nuanced relationship between ESG-specific knowledge and investment attitudes. In addition, rather than treating financial knowledge as an exogenous predictor, future studies could examine its underlying factors—such as cognitive ability, financial self-efficacy, prior investment experience, and motivational traits—as factors that may simultaneously influence both financial literacy and ESG investment attitudes (Behrman et al., 2012; Lusardi & Mitchell, 2014; Tang & Baker, 2016; Yoong, 2011). Doing so may also allow for a more rigorous application of the Knowledge–Attitude–Behavior (KAB) model in the ESG domain.

Fourth, methodological limitations related to analytic complexity should be noted. As the study was conducted at the undergraduate level, advanced techniques—such as structural equation modeling (SEM), latent interactions, or moderated mediation analysis—were not employed. Moreover, although experimental designs that capture willingness to pay (WTP), investment intention, or portfolio choice could provide stronger behavioral validity, such approaches were beyond the scope of this study due to constraints in research design capacity and resource availability. Future research at the graduate or institutional level may address these gaps by testing interaction effects (e.g., altruism × financial knowledge) and implementing controlled experiments to provide deeper insights into the mechanisms that drive sustainable financial decision-making.

8. CONCLUSION

The central question of this research was, "How do investor characteristics influence attitudes toward ESG investing, and to what extent does correcting for endogeneity alter these relationships?" The results indicate that altruism has a positive and significant effect on ESG attitudes, while materialism has a negative and significant effect. Financial literacy, though initially associated with positive ESG attitudes, lost significance after correcting for endogeneity. Moreover, socio-demographic factors such as age, gender, income, and education showed limited explanatory power. These findings suggest that value orientations, rather than cognitive capacity, play a more decisive role in shaping ESG investment attitudes. This conclusion emphasizes the relevance of ensuring that ESG investment promotion strategies are grounded in investors' underlying value orientations, as these internal motivations—rather than cognitive capacity or demographic traits—appear to drive meaningful engagement with sustainable finance.

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10. APPENDICES

Table 1 Descriptive information of survey sample

Table 1 Descriptive information of survey sample

Type	Variable	Mean	S.D.	Frequency	%
Dependent	ESG Attitude	21.42	6.09		
Instrumental	Financial Knowledge Score	2.43	.89		
Instrumental	Subjective Financial Knowledge	4.32	1.49		
Independent	Altruism	26.47	7.72		
Independent	Materialism	26.95	8.07		
Instrumental	IE years				
	Less than 1 year			32	21.33
	1-3 years			33	22.00
	4-6 years			25	16.67
	7-10 years			23	15.33
	More than 10 years			37	24.67
Instrumental	IE types				
	Stocks			133	88.67
	Bonds			45	30.00
	Mutual funds			52	34.67
	ETFs			77	51.33
	Real Estate			52	34.67
	Cryptocurrencies			76	50.67
	ESG/SRI Funds			39	26.00
	Others			2	1.33
Control	Income				
	Less than €10.000			36	24.00
	€10,000 - €19,999			3	2.00
	€20,000 - €29,999			8	5.33
	€30,000 - €39,999			8	5.33
	€40,000 - €49,999			22	14.67
	€50,000 - €74,999			34	22.67
	€75,000 - €99,999			11	7.33
	€100,000 - €149,999			10	6.67
	€150,000 or more			18	12.00
Control	Age	36.78	13.82		
	Gender				
	Male			76	50.67
	Female			74	49.33
Control	Education				
	Lower than high school			1	.67
	High school			14	9.33
	Some college/associate's			3	2.00
	Bachelor's			91	60.67
	Graduate or higher			41	27.33
Control	Race				
	White			90	60.00
	Asian			57	38.00
	Native Hawaiian or Other Pacific			1	.67
	Islander				
	Prefer not to say			1	.67
	Other			1	.67

Table 2 Major variables and questionnaire

Table 2 Major variables and questionnaire

Factor	Items	Source	Code
Investment experience	Years (IEY) (min. = 0; max. = 5)	***IEY.*** *How many years have you been actively investing in financial products? (Please consider any form of investing, including stocks, bonds, mutual funds, ETFs, or other financial instruments.)*	*I have never invested = 0* *less than 1 year = 1* *1-3 years = 2* *4-6 years = 3* *7-10 years = 4* *More than 10 years = 5*
	Items (IE) (min. = 0; max. = 1)	***IE.*** *Which of the following types of investment products have you personally invested in? (Select all that apply.)* *ie_1 = Stocks (individual shares);* *ie_2 = Bonds (government or corporate);* *ie_3 = Mutual Funds;* *ie_4 = Exchange-Traded Funds (ETFs); ie_5 = Real Estate;* *ie_6 = Cryptocurrencies (e.g., Bitcoin, Ethereum);* *ie_7 = ESG/Socially Responsible Investment Funds;* *ie_8 = Other (please specify)*	*Not selected = 0* *Selected = 1*
Financial knowledge (FK)	Objective financial knowledge (OFK) (min. = 0; max. = 3)	***OFK1.*** *Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?*	*More than $102 = 1* *Exactly $102 = 0* *Less than $102 = 0*
		OFK2. *Imagine that the interest rate on your savings account is 1 percent a year and infation is 2 percent a year. After one year, would the money in the account buy more than it does today, exactly the same or less than today?*	*More than today = 0* *Exactly the same = 0;* *Less than today = 1*
		OFK3. *Buying a single company's stock usually provides a safer return than a stock mutual fund.*	*True = 0* *False = 1*
	Subjective financial knowledge (SFK) (min. = 1; max. = 7)	***SFK.*** *How would you assess your overall financial knowledge?*	*Very low = 1* *Very high = 7*
Altruism (AL)	The 9-SRA Scale (min. = 9; max. = 45)	***AL1.*** *I have given money to a charity.*	*Never = 1* *Always = 5*
		AL2. *I have donated goods or clothes to a charity.*	*Never = 1* *Always = 5*
		AL3. *I have done volunteer work for a charity.*	*Never = 1* *Always = 5*
		AL4. *helped carry a stranger's belongings.*	*Never = 1* *Always = 5*
		AL5. *I have made change for someone I did not know.*	*Never = 1* *Always = 5*

		AL6. *I have helped an acquaintance to move houses.*	*Never = 1* *Always = 5*
		AL7. *I have let a neighbor I did not know well borrow an item of some value to me.*	*Never = 1* *Always = 5*
		AL8. *I have offered to help a disabled or elderly stranger across a street.*	*Never = 1* *Always = 5*
		AL9. *I have offered my seat to a stranger who was standing.*	*Never = 1* *Always = 5*
Materialism (MA)	The 9-item short version of the MVS (min. = 9; max. = 45)	***MA1.*** *I admire people who own expensive homes, cars, and clothes.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA2. *The things I own say a lot about how well I'm doing in life.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA3. *I like to own things that impress people.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA4. *I try to keep my life simple, as far as possessions are concerned. (R)*	*Strongly agree = 1* *Strongly disagree = 5*
		MA5. *Buying things gives me a lot of pleasure.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA6. *I like a lot of luxury in my life.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA7. *My life would be better if I owned certain things I don't have.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA8. *I'd be happier if I could afford to buy more things.*	*Strongly disagree = 1* *Strongly agree = 5*
		MA9. *It sometimes bothers me quite a bit that I can't afford to buy all the things I'd like.*	*Strongly disagree = 1* *Strongly agree = 5*
Attitude towards ESG investing (ESGA)	5 items adapted from TPB (min. = 5; max. = 35)	***ESGA1****. I consider corporate ESG performance whenever I am choosing an investment stock.*	*Strongly disagree = 1* *Strongly agree = 7*
		ESGA2*. I believe that investing in a company with ESG performance consideration is a wise decision.*	*Strongly disagree = 1* *Strongly agree = 7*
		ESGA3*. I believe that investing in companies with ESG performance consideration is ethical.*	*Strongly disagree = 1* *Strongly agree = 7*
		ESGA4*. I consider investments in companies with ESG performance consideration to be more reliable than conventional investments.*	*Strongly disagree = 1* *Strongly agree = 7*
		ESGA5*. For me, investing in companies considering their ESG performance would be pleasant.*	*Strongly disagree = 1* *Strongly agree = 7*

Table 5 First-Stage Regression

	Outcome = Financial Knowledge Score		95% C.I.	
	b	SE	Low	High
Subjective Financial Knowledge	.32***	.06	.21	.43
IE years	.01	.07	-.13	.14
IE types				
Stocks	-.20	.25	-.69	.29
Bonds	.04	.18	-.31	.39
Mutual funds	-.11	.19	-.49	.27
ETFs	.07	.16	-.25	.40
Real Estate	-.13	.17	-.46	.20
Cryptocurrencies	-.05	.15	-.36	.25
ESG/SRI Funds	.35	.22	-.08	.77
Others	.55	.61	-.66	1.75
Income	-.02	.04	-.09	.06
Education	.10	.06	-.02	.22
Age	-.10*	.05	-.20	-.00
Age²	.00*	.00	.00	.00
Female	-.05	.13	-.31	.22
Race				
Asian	.16	.15	-.14	.47
Native Hawaiian or Other Pacific Islander	.11	.79	-1.45	1.66
Prefer not to answer	-.23	.80	-1.81	1.34
Other	1.38	.79	-.19	2.95
Altruism	-.00	.01	-.02	.02
Materialism	-.02**	.01	-.04	-.01
Constant	3.08**	.97	1.16	5.01
R^2	.42			
F	4.36***			

*p < .05, **p < .01, ***p < .001

Table 6 VIF and Tolerance

	VIF	1/VIF
Subjective Financial Knowledge	1.89	.53
IE years	2.92	.34
IE types		
Stocks	1.66	.60
Bonds	1.82	.55
Mutual funds	2.31	.43
ETFs	1.88	.53
Real Estate	1.65	.61
Cryptocurrencies	1.63	.61
ESG/SRI Funds	2.45	.41
Others	1.35	.74
Income	2.46	.41
Education	1.58	.63
Age	2.37	.42
Female	1.22	.82
Race		
Asian	1.47	.68
Native Hawaiian or Other Pacific Islander	1.13	.89
Prefer not to answer	1.17	.86
Other	1.15	.87
Altruism	1.71	.58
Materialism	1.41	.71
Mean VIF	1.76	

Table 7 Second-Stage Regression

Table 7 Second-Stage Regression

	Outcome = ESG Attitude		95% C.I.	
	b	SE	Low	High
$\hat{Financial\ Knowledge}$	-1.03	.84	-2.67	.61
Altruism	.27***	.07	.14	.41
Materialism	-.26***	.06	-.38	-.15
Income	-.13	.24	-6.0	.33
Education	.71	.40	-.07	1.50
Age	-.25	.28	-.81	.30
Age²	.00	.00	-.00	.01
Female	.35	.80	-1.21	1.92
Race				
Asian	.68	.93	-1.16	2.51
Native Hawaiian or Other Pacific Islander	-.97	.83	-2.60	.65
Prefer not to answer	-18.34***	1.28	-20.86	-15.83
Other	3.38*	1.50	.45	6.31
Constant	22.92***	5.85	11.46	34.38
Chi^2	1020.74***			
R^2	.35			

*p < .05, **p < .01, ***p < .001

Table 8 Shapiro-Wilk test (Normality test)

Table 8 Shapiro- Wilk test

	Statistic	Significance
FK score	.98	.08
Sub. FK	.97	.06
Altruism	.96	.07
Materialism	.98	.06
ESG Attitude	.98	.06

Figure A 2SLS Equations

First Stage Equation (Instrumental Variable Model)

$$y\left(FK_i\right) = f\left(SFK_i,\ IEY_i,\ IE_{ij},\ X_i\right) \text{ ... Equation (1)}$$

$$where\ X_i = \left\{INC,\ EDU, AGE,\ AGE^2,\ FEM,\ RACE_{ir},\ ALTR,\ MAT\right\}$$

where, i = observation; j = investment categories; r = race categories; FK = objective financial-knowledge score; SFK = subjective financial knowledge; IEY = categorical investment-experience years; IE_{ij} = binary indicators for experience with eight asset classes; INC = income categories; EDU = education categories; AGE = age; AGE^2 = age square; FEM = female; $RACE_{ir}$ = race-category dummies; ALTR = altruism; MAT = and materialism scores.

Second Stage Equation (Structural Equation)

$$y\left(ESGATT_i\right) = f(\hat{FK}_i,\ ALTR_i,\ MAT_i,\ INC_i,\ EDU_i,\ AGE_i,\ AGE_i^2,\ FEM_i,\ RACE_{ir}) \text{ … Equation (2)}$$

where, ESGATT = attitude toward ESG investment; $\hat{FK}_i$ = fitted value of objective financial knowledge from the first stage.

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