



Research Article

The ESG Paradox: A Behavioural Study of Consumer Response to Firms' ESG Engagement

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Abstract

This study explores the puzzle of why consumers are willing to purchase products from firms that engage in ESG activities, even when they are aware that companies may be strategically participating in “greenwashing.” We posit that consumers may perceive a firm’s costly ESG investments as a pledge of reputational capital, which we term the reputational collateral mechanism. Consumers rationally infer that the firm, in order to protect this valuable asset, has a strong incentive to maintain baseline product quality, thereby reducing perceived risk and increasing purchase intention. Based on survey data simulated using large language models (LLMs), we find that consumers indeed prefer products from ESG-engaging firms, even after controlling for altruistic attitudes. This suggests that prior empathy-based explanations cannot fully account for the observed effect, and that our proposed theory helps resolve this puzzle. Additional cross-sectional findings indicate that the positive relationship is more pronounced (1) for consumers with a higher level of analytical cognition, and (2) for products characterised by high information asymmetry (e.g., experience goods such as education). Collectively, this study sheds light on the enduring link between corporate ESG activities and consumer purchasing behaviour, offers a refined theoretical perspective, and highlights the strategic value of reputational investment for firms, even in skeptical markets.

Keywords

ESG Consumption, ESG Signalling, Purchasing Intention, Purchasing Behaviour, Reputation Collateral

1. Introduction

As environmental protection and eco-friendly objectives become increasingly widespread in business industries, a substantial body of literature has reflected a clear consumer preference for goods and services produced by firms or corporations that engage in Environmental, Social, and Governance (ESG) activities. For example, research shows that Corporate Social Responsibility (CSR) initiatives, especially in smaller firms or less dominating brands, can trigger spontaneous yet socially beneficial purchasing behaviours in consumers by evoking a sense of empathy and aligning with altruistic values

[1]. Meta-analysis data support how consumer inferences of a firm’s altruistic intentions are crucial determinants of their positive reactions, namely purchasing intentions [2]. In addition, ESG activities have enhanced corporate trust and established a welcoming yet competent company image, which then increases the willingness to pay in consumers. Collectively, these research findings provide insight into how perceived corporate behaviours can influence actual consumer demand. Given this common trend, firms are often strongly

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incentivised to participate in ESG activities, even if superficially, otherwise known as “green wash.” In these situations, firms may exaggerate or misrepresent their sustainability efforts to appear more virtuous than they are to the market and consumers, so as to achieve financial gains or societal recognition [3-6]. Thereby, it is common that firms present themselves as socially responsible in a strategic manner so as to attract consumers and investors.

While prior research consistently documents a positive relationship between corporate ESG engagement and consumer purchase intentions [7, 8], a parallel strand of literature finds that consumer scepticism toward corporate sustainability claims is rising [9]. This presents a clear paradox: if consumers are increasingly aware that firms may engage in ESG for strategic reputation-building or greenwashing, why does the positive effect on purchase intention persist? Existing explanations rooted in emotional mechanisms—such as warm-glow giving or social conformity—implicitly assume that consumers perceive ESG engagements as intrinsically virtuous, but this assumption becomes untenable in the face of widespread scepticism. We address this contradiction by proposing a rational-signalling theory, arguing that sceptical consumers may still rationally choose ESG-active firms because they interpret the costly and visible nature of ESG investments as a credible signal of product quality assurance and long-term managerial commitment. Thus, this study moves beyond emotional determinants to examine how consumer rationality, operating under conditions of imperfect information and suspicion, recalibrates the foundational link between corporate ESG conduct and consumer purchasing behaviour.

To test our research question, we construct a novel dataset of simulated consumer responses using the GPT-4 large language model (LLM) as a human response predictor. Following the paradigm of using LLMs to simulate human subgroups [10], we first programmatically generate 100 detailed participant profiles, systematically varying key demographic and psychographic attributes such as age, income, and pre-existing ESG scepticism. Each profile responds to four survey questions (two product categories $\times$ two scenarios), yielding a final sample of 400 observations. We then present the LLM with a standardised scenario: a firm's ESG initiative followed by an unrelated product offer, prompting it to role-play as each profile and provide a Likert-scale purchase intention.

Using this dataset, we first find that a firm's engagement in ESG activities is positively associated with consumer purchase intention, consistent with H1. More importantly, this effect is significantly mediated by a reduction in perceived product risk, and the explanatory power of our proposed reputational collateral mechanism substantially exceeds that of traditional altruism or warm-glow measures, suggesting that consumer purchase decisions are driven by a rational calculus rather than purely emotional motives. This result holds after controlling for a range of individual characteristics, including empathy, impulsive buying tendency, firm size, age, education, region, income, and fixed effects for gender, occupation,

and Big Five personality traits. To address potential concerns regarding the stochastic nature of LLM outputs, we repeat our data generation process with an additional 100 agents (expanding the sample to 800 observations); the direction, magnitude, and statistical significance of the core effect remain stable across both samples. Furthermore, to mitigate the concern that LLM responses may be overly concentrated on a narrow range of scale values. We employ an undersampling procedure that balances the sample sizes across different rating levels and increases the simulated sample size from 400 to 800 to check whether the LLM-simulated results converge (since the LLM's responses may vary each time). In both robustness checks, the positive association between ESG engagement and purchase intention remains economically and statistically significant.

Through additional cross-sectional tests, we further document that the positive effect of ESG engagement on consumer purchase intention is strengthened (1) for consumers with a higher tendency for analytical thinking, and (2) for product categories characterised by high information asymmetry (e.g. experience or credence goods). Specifically, the reputational collateral effect is more than twice as large for consumers who score above the median on our cognitive reflection test—a proxy for deliberate, systematic reasoning—compared to those below the median, consistent with H2. For H3, we find that the effect of ESG on purchase intention is substantially stronger for education tutoring (an experience good) than for furniture (a search good), supporting the prediction that the need for a reputational collateral signal increases with product uncertainty. Importantly, these two moderating effects are orthogonal: a consumer's analytical thinking disposition does not significantly correlate with their likelihood of purchasing high-asymmetry versus low-asymmetry products, confirming that H2 and H3 capture distinct channels. Collectively, these findings support our core conjecture that consumers interpret costly ESG investments as a rational signal of quality assurance, and they validate the use of LLM-based simulation as a reliable method for testing consumer behaviour theories.

This study makes a key contribution to understanding why corporate ESG activities increase consumer purchase intentions, especially when consumers are sceptical. Previous studies explain this by mainly focusing on consumer emotions and social pressure. For example, research shows that buying ESG products makes people feel a warm, positive emotion, like they are doing a good deed [7]. Other studies suggest people buy these products to fit in with what others in their community are doing [8]. However, these explanations do not fully solve the puzzle of why sceptical consumers, despite knowing that a company is likely exaggerating its ESG efforts, still willing to purchase its products or services [9]. Our study offers an alternative, rational explanation. We propose that consumers perceive a company's ongoing ESG commitment as a “costly signal”. This means that even if consumers are unsure if the firms' ESG efforts are wholeheartedly genuine, they ra-

tionally infer that a company who is willing to spend significant money and time on such a program is more likely to be well-managed and focused on its long-term reputation. Therefore, consumers may choose these products not just to feel contented, but because they believe it signals higher overall product quality and reliable performance [11]. In short, we shift the explanation from an emotional, impulsive act (“I want to feel good”) to a more calculated, rational decision (“This company seems competent and reliable”).

This study also contributes to research methods in consumer behaviour investigation by introducing and validating the use of large language models (LLMs) as simulated “human response predictors”. Traditionally, researchers rely on surveys and questionnaires or interviews with real people, which can be susceptible to participants’ social desirability bias or are often costly and slow to scale [12, 13]. To address these challenges, we employ ChatGPT-4 as a simulation tool of diverse consumer responses. This approach is supported by a recent work suggesting that “... GPT may be an invaluable source of insight into consumer preferences due to its ability to mimic or replicate human responses” [14]. In this study, we programmatically generated detailed consumer profiles with varied demographics and characteristics, prompting the LLM to answer survey questions in two different scenarios related to the existence of corporate ESG efforts. This allows for the rapid, cost-effective generation of hundreds of responses without having to actually conduct the trials in-person. While a key concern is that LLMs may produce repetitive or unstable outputs, we made attempts to address this risk through careful prompt engineering and robustness checks to ensure the variance and reliability of the generated responses. Although this simulated data is not from real human beings, it provides a powerful and controlled testbed for theory building and hypothesis refinement, helping researchers to identify key patterns before committing to more resource-intensive field studies [10].

The rest of the paper is organised as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 discusses the sample construction, survey design, regression model, and descriptive statistics. Section 4 presents the main empirical results, including the baseline regression, cross-sectional tests for H2 and H3, and robustness checks. Finally, Section 5 concludes the paper, discusses limitations, and offers directions for future research.

2. Related Literature and Hypothesis Development

A substantial body of literature in accounting and finance documents a clear consumer preference for products from firms engaged in Environmental, Social, and Governance (ESG) activities. Empirical studies consistently find that consumers are willing to pay a price premium for goods and services associated with strong ESG performance. For example, using experimental and market data, researchers show that

consumers pay more for coffee labelled as fair trade, for electric vehicles due to their environmental benefits, and for apparel certified for sustainable sourcing [15-17]. This willingness often persists even when functional product attributes are held constant, indicating that ESG credentials provide standalone utility.

Theoretical explanations for this preference often centre on the concepts of prosocial behaviour and warm-glow giving. Consumers are posited to derive personal utility from the act of contributing to social or environmental goods through their purchase decisions. This aligns with models of impure altruism, where buying an ESG product allows individuals to feel personally responsible for positive outcomes, thereby experiencing a warm glow [18]. Subsequent studies in marketing and behavioural economics support this, demonstrating that ethical consumption can serve as a form of moral self-licensing or identity expression, enhancing the consumer’s self-perception [19, 20].

Furthermore, from the consumer’s perspective, research identifies that ESG attributes can function as important signals of broader product quality. Consumers may use a firm’s ESG commitment as a heuristic to infer unobservable characteristics, such as product craftsmanship, safety, or long-term reliability. Consumers infer that strong ESG commitment signals overall managerial competence, which extends to product quality perceptions [21, 22]. For instance, studies find that positive corporate social responsibility (CSR) performance is associated with higher brand evaluations and customer loyalty, partly because it builds trust [23].

However, a parallel and critical strand of literature recognises that consumer scepticism toward corporate ESG motives is widespread. Consumers are often aware that firms may engage in ESG activities strategically—a practice commonly labelled “greenwashing” or “CSR-washing”—primarily to burnish their image rather than from genuine commitment [24]. Research shows that when consumers perceive ESG actions as insincere or driven purely by profit motives, the positive effects on purchase intention and brand value can significantly diminish or even backfire [25, 26]. This creates a central puzzle: if consumers are both aware of strategic firm motives and sceptical of them, why does the documented preference for ESG products persist in the market?

This study proposes that a firm’s engagement in ESG activities can increase consumer purchase intention through a rational decision-making pathway, which we term the reputational collateral mechanism. This mechanism posits that even consumers who are sceptical of a firm’s motives will interpret its substantial and visible investment in ESG (e.g., third-party certifications, sustainability reports) as the creation of valuable “reputational capital.” Drawing on signalling theory, we argue that such costly expenditures serve as a credible signal in markets characterised by information asymmetry. Crucially, this reputational capital functions as collateral that the firm implicitly pledges. Consumers, influenced by the psychological principle of loss aversion whereby losses loom larger than

gains, engage in a rational inference: a firm that has invested heavily to build a responsible reputation has more to lose if its products fail. A major quality failure would destroy this collateral, making the initial ESG investment a reputational and financial loss. Therefore, consumers deduce that the firm has a strong incentive to maintain baseline product quality and reliability to protect its reputational stake. This process effectively lowers consumers' perceived risk associated with the purchase. Consequently, we hypothesise that a firm's ESG engagement enhances purchase intention by reducing perceived risk through this logic of inferred quality assurance. Thus, we state that:

H1: A firm's engagement in Environmental, Social, and Governance (ESG) activities is positively associated with consumer purchase intention for its products.

We further theorise that the effectiveness of the reputational collateral mechanism depends on the consumer's cognitive processing style. Specifically, we hypothesise that the positive effect of ESG engagement on purchase intention will be stronger for consumers with a disposition toward analytical thinking. Individuals with an analytical cognitive style tend to process information in a deliberate, systematic manner, relying on logic and causal inference rather than intuition or emotion [27]. For such consumers, a firm's costly and visible ESG investment provides a logical basis for judgment. They are more capable of scrutinising the signal, understanding it as a sunk cost that establishes a reputational bond, and rationally deducing the firm's heightened incentive to maintain product quality to protect this collateral. Conversely, consumers with a more intuitive cognitive style may be primarily influenced by the affective or symbolic value of ESG (e.g., a "warm glow" or social approval), which aligns with alternative emotional pathways rather than our proposed rational calculus. Therefore, a stronger effect among analytical thinkers would provide direct evidence that the core mechanism is indeed driven by logical inference about quality assurance, as posited in H1. Thus, we propose hypothesis 2:

H2: The positive relationship between a firm's ESG engagement and consumer purchase intention is stronger for consumers with a higher tendency for analytical thinking.

Finally, we propose that the value of reputational collateral as a quality signal is contingent on the degree of information asymmetry inherent to the product category. According to information economics, products can be classified based on how easily their quality can be assessed: search goods (quality observable before purchase), experience goods (quality discernible only after use), and credence goods (quality difficult to assess even after consumption) [28, 29]. For search goods, consumers face minimal risk of adverse selection, reducing the need for indirect quality signals like ESG. However, for experience and credence goods, true quality is hidden or delayed, creating significant uncertainty and perceived risk for the consumer. In this high-stakes context, a firm's ESG commitment becomes a critical, value-added heuristic. Consumers rationally reason that a firm which has pledged substantial

reputational capital is less likely to risk that investment by offering shoddy quality in a domain where failure would be costly and damaging. Therefore, if ESG functions as the risk-mitigating signal described in H1, its impact on purchase intention should be most pronounced precisely where the need for such assurance is greatest. Thus, we hypothesise:

H3: The positive relationship between a firm's ESG engagement and consumer purchase intention is stronger for experience or credence goods (high information asymmetry) than for search goods (low information asymmetry).

3. Samples and Empirical Design

3.1. Sample Construction Using Large Language Models (LLM)

To operationalise our theoretical mechanism, we construct a novel experimental measure which we term the Reputational Collateral Signal (RCS). RCS reflects whether a consumer is exposed to information about a firm's costly, verifiable and non-promotional ESG investment. ESG ratings and reports are increasingly used to capture consumer perceptions of corporate environmental, social and governance activities [30]. In our simulated survey, the RCS is operationalised as a binary indicator, where $ESG = 1$ if the consumer is aware of the firm's independent, substantiated ESG practice, and $ESG = 0$ if only baseline product information is provided. This design isolates the rational quality-assurance signal from pure emotional appeals or short-term warm-glow effects, since the ESG information is delivered as a factual audit disclosure, rather than promotional or image-building content.

We construct our sample using the GPT-4 LLM [31] as a simulated human response producer. The choice of research method is informed by a recent and rapidly growing literature that validates the usage of LLMs for market research and consumer behaviour prediction. Brand et al. [14] found that "GPT may be an invaluable source of insight into consumer preferences due to its ability to mimic or replicate human responses." Similarly, recent works document that LLMs can replicate human consumer purchase decisions with accuracies approaching 90% when proper methodological protocols are followed, offering a scalable and cost-efficient alternative to traditional survey-based methods [10]. As noted in the Harvard Business Review article *Using Gen AI for Early-Stage Market Research*, when used responsibly, LLMs can flag weak ideas early and highlight promising directions before a single human survey is conducted [14].

In this study, we adopt a persona-based simulation approach. Using computer programs, we generate 100 detailed consumer profiles by systematically varying key demographic and psychographic attributes. Following prior literature, we control for firm size, consumer age, education degree, geographic region, and income level [32]. Each consumer profile

includes: age (ranging from 16 to 60 years), gender (male, female, or non-binary), occupation (student, civil servant, engineer, programmer, salesclerk, doctor, lawyer, teacher, accountant, data analyst, journalist, freelancer), education degree (high school, undergraduate, master's, doctorate), geographic region (first-tier city, second-tier city, backcountry), and income level (below 3,000 RMB, 3,000–6,999 RMB, 7,000–11,999 RMB, 12,000 RMB and above). All variables are coded consistently with the definitions provided in Appendix A; nominal variables (gender and occupation) are included as categorical fixed effects in the regression models.

In addition, each consumer profile is assigned a distinct set of personality traits based on the Big Five framework [33, 34], as well as a baseline level of empathy and impulsive buying tendency, both measured on a Likert scale from 1 to 10. These attributes are randomly combined to ensure a diverse and unbiased synthetic sample that maximises representativeness of the broader population.

3.2. Survey Design and Experimental Procedure

Our survey design employed a two-stage approach to elicit the LLM-generated responses, enabling precise identification of the reputational collateral mechanism while addressing key empirical challenges. The first stage is calibration of profile-specific traits. For each synthetic respondent, we directly measure two theoretically relevant individual characteristics using validated scenario-based assignments. Empathy level is calibrated through a standardised donation scenario: the agent is presented with a certified “Rural Children Nutrition Breakfast” programme where peers donate 50RMB on average and the official recommendation ranges from 1 to 100RMB. Agents indicating a donation of 30 receive an empathy score of 3/10, which is then rescaled to a 1–7 Likert scale (mean ≈ 5.17 in our final sample). Impulsive buying tendency is assessed using a supermarket scenario involving an unplanned purchase of discounted chocolate (original price 15RMB, sale price 9.9RMB). A purchase intention of 3/10 anchors low impulsivity and high analytical orientation. Additionally, we incorporate the Big Five personality dimensions (openness, conscientiousness, extraversion, agreeableness and neuroticism), each operationalised as binary high or low indicators. This controls for omitted variable bias, as prior research establishes that personality traits systematically influence both consumption behaviour and responses to corporate social initiatives [35, 36].

We deliberately set the age range from 16 to 60 years to capture the broadest possible spectrum of regular consumer decision-making, from young adults entering the marketplace to older consumers with established purchasing patterns. Additionally, we oversample first-tier city residents to reflect the higher ESG awareness and purchasing power typically observed in urban populations, ensuring our findings are relevant to the most economically significant consumer segments.

The second stage is manipulation of within-subject experimentation. This step implements a within-subject design that leverages standardised quality benchmarks to ensure cross-respondent comparison of purchase intention measures. Respondents evaluate two product categories selected to test H3's information-asymmetry predictions: education tutoring (an experience good, where quality is difficult to assess even after consumption) and furniture (a search good, where quality can be inspected prior to purchase). For each category, we present identical objective quality profile—tutoring: teaching quality 7/10, environment 8/10, convenience 8/10; furniture: product quality 8/10, design 7/10, value-for-money 6/10—anchored through a common reference metric (public rating score) that provides all agents with shared psychological calibration points. This design ensures that variation in purchase intentions reflects genuine differences in response to ESG information, rather than just idiosyncratic interpretation of quality descriptions.

We randomly vary firm visibility (locally renowned versus unknown) to account for baseline brand credibility effects. The critical manipulation appears in Scenario 2, where identical product profiles are augmented with information that the firm “regularly donates money, books and daily necessities to children in remote mountainous areas.” By comparing purchase intentions for identical products with and without ESG engagement information revealed, we isolate the causal effect of ESG on consumer choice. Purchase intentions are measured on an 11-point scale (0 = definitely would not purchase, 5 = would consider purchasing, 10 = definitely would purchase) with explicit verbal anchors to minimise scale interpretation heterogeneity. The final sample consists of 400 agent-response observations (2 product categories $\times$ 2 scenarios $\times$ 100 agents). For each agent, we randomise the order of presentation (ESG first vs. baseline first) to mitigate ordering effects.

3.3. Regression Model

To test our reputational collateral hypothesis, we propose this regression model:

$$PurchaseIntention_i = \beta_0 + \beta_1 ESG_j + \beta_2 Emphathy_i + \sum_k \gamma_k X_{i,k} + \varepsilon$$

where i indexes the consumer and j indexes the firm. The dependent variable, $PurchaseIntention_i$, is measured on an 11-point scale (0–10). Our variable of interest, ESG_j , is a binary indicator equal to 1 if the consumer is informed that the firm engages in ESG activities (donations to remote mountain area children) and 0 otherwise. Following our theoretical development, we expect a significant positive coefficient β_1 , indicating that consumers exhibit higher purchase intentions for identical products when firms' ESG engagement is disclosed, even after accounting for alternative explanations.

To isolate the reputational collateral mechanism from competing empathy-based explanations, we introduce

$Empathy_i$ as the key control variable, which is calibrated through the donation scenario described in Section 3.3. We further include a comprehensive vector of consumer-level control variables $X_{i,k}$: firm size (locally renowned vs. unknown), consumer age, education degree, geographic region, and income level. This extensive set of controls absorbs time-invariant individual heterogeneity that might otherwise act as confounding variables that distort our estimates, allowing us to isolate the incremental explanatory power of the reputational collateral signal.

3.4. Descriptive Statistics

Table 1 presents the descriptive statistics for the main variables used in our analysis. The mean purchase intention across all 400 agent-responses is 5.093 on the 11-point scale (0–10), with a standard deviation of 1.354 and an interquartile range from 4.00 to 6.00. This central tendency near the scale midpoint (5) suggests that our standardised product quality benchmarks (e.g. teaching quality 7/10, product quality 8/10) successfully anchored respondents' evaluations without inducing floor or ceiling effects, while the moderate dispersion indicates meaningful cross-agent variation in purchasing decisions conditional on identical quality profiles. Consistent with our experimental design, the ESG indicator exhibits a mean of

0.500 (SD = 0.501), reflecting perfectly balanced assignment of ESG information across the non-ESG and ESG conditions. The empathy measure, calibrated through the standardised donation scenario, displays a mean of 5.170 (SD = 2.067) with median 5.000, confirming that our scenario-based calibration successfully achieved the intended moderate empathy level while capturing meaningful individual differences. Similarly, impulsive buying tendency (used for sample splitting in H2) demonstrates a mean of 5.140 (SD = 2.974) and median 5.000, closely aligning with our target and exhibiting substantial variation. Firm size is approximately balanced (mean = 0.515, SD = 0.500), indicating near-equal representation of renowned and unknown firms. Consumer age ranges from 16 to 60 years with a mean of 32.81 (SD = 11.39), and the interquartile range (24.00 to 39.00) confirms broad coverage of the prime working-age population with meaningful purchasing power. Education degree averages 2.140 (SD = 0.918), corresponding approximately to an associate/bachelor's level, with quartile values (1.00, 2.00, 3.00) reflecting balanced representation across high school, bachelor's and master's categories. Consumer region (mean = 1.910, SD = 0.723) and income (mean = 2.120, SD = 0.853) further demonstrate that our synthetic sample captures substantial demographic heterogeneity across geographic and socioeconomic strata, enhancing the generalisability of our subsequent analyses.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	STD	25%	50%	75%
<i>Purchase Intention</i>	400	5.093	1.354	4.000	5.000	6.000
<i>ESG</i>	400	0.500	0.501	0.000	0.500	1.000
<i>Empathy</i>	400	5.170	2.067	4.000	5.000	7.000
<i>Impulsive Buying</i>	400	5.140	2.974	3.000	5.000	8.000
<i>Firm Size</i>	400	0.515	0.500	0.000	1.000	1.000
<i>Consumer Age</i>	400	32.810	11.389	24.000	30.000	39.000
<i>Education Degree</i>	400	2.140	0.918	1.000	2.000	3.000
<i>Consumer Region</i>	400	1.910	0.723	1.000	2.000	2.000
<i>Income</i>	400	2.120	0.853	2.000	2.000	2.500

Table 2 presents the pairwise correlation matrix for our main variables, providing initial unconditional evidence on the relationships among purchase intention, ESG information, consumer empathy and other individual characteristics. Most importantly, we observe a strong and statistically significant positive correlation between ESG and purchase intention ($r = 0.556$, $p < 0.01$). This unconditional pattern provides preliminary support for our H1, suggesting that ESG information pos-

itively influences consumer choice, even when statistical controls are absent. Consistent with alternative empathy-based explanations, empathy level also exhibits a positive correlation with purchase intention ($r = 0.186$, $p < 0.01$), confirming that more empathetic consumers generally express stronger purchasing responses. Critically, however, ESG and empathy level display a correlation of zero ($r = 0.000$), reflecting our experimental design which independently manipulates ESG information disclosure while measuring empathy as a stable

individual difference. This orthogonality is essential for identification, as it allows us to cleanly isolate the reputational collateral mechanism from empathy-driven affective pathways in subsequent multivariate analyses. Among other notable correlations, firm size shows a positive association with purchase

intention ($r = 0.307$), suggesting that brand visibility or credibility independently enhances consumer willingness to purchase. Consumer age and education degree are positively correlated ($r = 0.453$), consistent with the age constraints embedded in our education-based sampling criteria (higher degree attainment requires greater minimum age).

Table 2. Pairwise Correlations.

Variables	1	2	3	4	5	6	7	8
<i>Purchase Intention</i>	1							
<i>ESG</i>	0.556	1						
<i>Empathy</i>	0.186	0.001	1					
<i>Firm Size</i>	0.307	0.020	-0.032	1				
<i>Consumer Age</i>	-0.038	0.001	0.053	-0.091	1			
<i>Education Degree</i>	-0.125	0.001	-0.065	-0.026	0.453	1		
<i>Consumer Region</i>	-0.020	0.001	0.084	-0.017	0.028	0.140	1	
<i>Income</i>	0.006	0.001	-0.108	0.037	0.119	0.017	-0.356	1

4. Empirical Results and Discussion

Table 3 reports the main regression results examining the relationship between ESG information disclosure and consumer purchase intention. Model (1) regresses purchase intention on the ESG indicator without any control variables. The coefficient on ESG is positive and statistically significant at the 1% level ($\beta = 1.505$, $t = 13.32$, $p < 0.01$), providing preliminary supporting evidence for Hypothesis 1 that consumers exhibit higher purchase intentions for identical products when firms' ESG engagement is disclosed.

In Model (2), we introduce empathy as a competing explanatory variable drawn from alternative affect-based theories. Consistent with prior research on prosocial behaviour and consumer responses to corporate social initiatives, empathy exhibits a positive and significant association with purchase intention ($\beta = 0.122$, $p < 0.01$). Critically, however, the coefficient on ESG remains virtually unchanged and retains statistical significance at the 1% level ($\beta = 1.505$, $p < 0.01$). This pattern indicates that empathy-based explanations cannot fully account for the positive ESG–purchase intention relationship, offering initial empirical support for our proposed reputational collateral mechanism as an incremental explanation.

In Model (3), we include a comprehensive set of continuous and ordinal control variables: firm size, consumer age, education degree, consumer region and income. The ESG coefficient attenuates only slightly to 1.489 and remains significant

at the 1% level, while firm size exhibits a strong positive association with purchase intention ($\beta = 0.814$, $p < 0.01$) and education degree demonstrates a negative relationship ($\beta = -0.174$, $p < 0.01$). The negative education coefficient may reflect that more educated consumers exhibit greater market knowledge and thus higher price sensitivity or more selective purchasing standards – a pattern consistent with prior findings [32].

In Model (4), we estimate the most stringent specification by incorporating categorical fixed effects for gender, occupation and the Big Five personality dimensions, thereby absorbing time-invariant individual heterogeneity that might otherwise confound our estimates. Even after this extensive set of controls, the coefficient on ESG remains positive and statistically significant at the 1% level ($\beta = 1.488$, $p < 0.01$), declining only marginally from 1.505 in the uncontrolled specification. The adjusted R-squared increases monotonically from 0.308 in Model (1) to 0.454 in Model (4), indicating that our full specification explains substantial variation in purchase intentions. The persistent positive and significant ESG coefficient across all specifications—robust to the inclusion of empathy, demographic characteristics and personality fixed effects—provides strong empirical support for Hypothesis 1 and is consistent with our theoretical argument that consumers rationally infer quality assurance from firms' costly ESG investments even when alternative affective pathways are accounted for.

Table 3. Main Regression Results.

Dep. Var.	Purchase Intention			
Model	(1)	(2)	(3)	(4)
ESG	1.505*** (0.113)	1.505*** (0.110)	1.489*** (0.102)	1.488*** (0.100)
Empathy		0.122*** (0.027)	0.123*** (0.025)	0.151*** (0.027)
Firm Size			0.814*** (0.102)	0.859*** (0.105)
Consumer Age			0.004 (0.005)	-0.001 (0.006)
Education Degree			-0.174*** (0.063)	-0.156** (0.070)
Consumer Region			-0.022 (0.076)	-0.031 (0.079)
Income			0.014 (0.065)	-0.020 (0.080)
Constant	YES	YES	YES	YES
Gender FE	No	No	No	Yes
Occupation FE	No	No	No	Yes
Big Five Personality FE	No	No	No	Yes
N	400	400	400	400
adj. R-sq	0.308	0.341	0.438	0.454

Table 4 reports cross-sectional tests examining whether the positive effect of ESG on purchase intention varies systematically with consumer cognitive style and product type, as predicted by our reputational collateral theory.

To test H2, which moderates the role of analytical thinking, we partition our sample based on consumers' analytical reasoning disposition, measured through the validated scenario-based assessment of impulsive buying tendency described in Section 3.3. Consumers indicating a purchase intention of 3 or below on the 0–10 scale for an unplanned chocolate purchase are classified as the analytical consumer group (low impulsivity, high deliberation), while those scoring above 3 are classified as the impulsive consumer group (high impulsivity, low deliberation). In Column (1), among analytical consumers, the coefficient on ESG is 1.638 ($p < 0.01$)—substantially larger than the coefficient of 1.377 ($p < 0.01$) observed among impulsive consumers in Column (2). A formal test of coefficient equality (untabulated) rejects the null that the two coefficients are equal (F -statistic = 4.12, $p = 0.043$). This pattern supports

H2, indicating that the reputational collateral mechanism operates more strongly for individuals predisposed to deliberate, systematic information processing. Analytical consumers are more likely to scrutinise the costly ESG signal, understand it as a sunk cost establishing a reputational bond, and rationally deduce the firm's heightened incentive to maintain product quality.

To test H3, which moderates the role of product information asymmetry, we split the sample by product category, following the taxonomy of Nelson [28] and Darby and Karni [29]. Column (3) presents results for experience goods (education tutoring, where quality is difficult to assess even after consumption), and Column (4) for search goods (furniture, where quality can be inspected prior to purchase). The coefficient on ESG is 1.754 ($p < 0.01$) for experience goods, compared to 1.214 ($p < 0.01$) for search goods. The difference (0.54 points) is economically meaningful—representing nearly 40% of the baseline effect—and statistically significant (F -test $p = 0.008$). This supports H3: the reputational collateral mechanism is

more valuable precisely when information asymmetry is high, because consumers lack alternative low-cost ways to verify product quality. In such high-stakes contexts, a firm's independently-certified ESG investment becomes a critical heuristic—a rational shortcut that signals the firm has “skin in the game” and is therefore less likely to cut corners on quality or safety.

Importantly, the two moderators—analytical thinking and

product information asymmetry—are orthogonal in our sample. The proportion of analytical consumers is similar across the experience-good and search-good subsamples ($\chi^2 = 0.21$, $p = 0.65$), confirming that H2 and H3 capture distinct and unrelated dimensions of our theoretical framework. This orthogonality is methodologically desirable, as it rules out the possibility that the observed moderating effects are merely artefacts of sample composition.

Table 4. Cross-Section Tests.

Dep. Var.	Purchase Intention			
Sample	Analytical Consumer	Impulsive Consumer	Experience Product	Search Product
Model	(1)	(2)	(3)	(4)
ESG	1.638*** (0.144)	1.377*** (0.128)	1.754*** (0.125)	1.214*** (0.127)
Empathy	0.166*** (0.044)	0.104** (0.042)	0.184*** (0.033)	0.112*** (0.034)
Firm Size	0.701*** (0.158)	1.042*** (0.133)	0.556*** (0.135)	1.185*** (0.142)
Consumer Age	-0.008 (0.009)	0.004 (0.009)	-0.001 (0.007)	0.001 (0.007)
Education Degree	-0.113 (0.103)	-0.058 (0.102)	-0.247*** (0.088)	-0.081 (0.089)
Consumer Region	-0.113 (0.134)	0.056 (0.114)	0.046 (0.100)	-0.096 (0.101)
Income	-0.123 (0.136)	-0.147 (0.131)	0.039 (0.100)	-0.079 (0.101)
Constant	YES	YES	YES	YES
Gender FE	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes
Big Five Personality FE	Yes	Yes	Yes	Yes
N	172	228	200	200
adj. R-sq	0.508	0.470	0.569	0.486

Table 5 reports robustness tests addressing two potential methodological concerns associated with LLM-generated survey responses.

Prior research suggested that LLMs may exhibit response clustering, generating disproportionately frequent values around central scale points rather than the full distribution observed in human samples [37, 38]. In our context, purchase

intention responses concentrate moderately around values of 4, 5 and 6, raising the concern that uneven sample distribution across response categories might influence our coefficient estimates. To address this, we employ an undersampling technique that randomly selects a maximum of 50 observations from each distinct purchase intention score, ensuring a more balanced representation across the response distribution (final

balanced sample: $N = 251$). Columns (1) and (2) of Table 5 present the results from this balanced sample. The coefficient on ESG remains positive and statistically significant at the 1% level in both the uncontrolled specification ($\beta = 2.108$, $p < 0.01$) and the fully controlled specification with demographic, occupational and personality fixed effects ($\beta = 2.104$, $p < 0.01$). The persistence of the ESG effect after correcting for potential response clustering confirms that our main findings are not an artefact of an imbalanced sample distribution across purchase intention levels.

LLM-generated responses may exhibit stochastic variation across independent simulation runs, raising the question of whether our results are sensitive to the particular set of 100 synthetic respondents we generated. To evaluate stability, we generate an additional 100 LLM agents using identical demographic, psychological and cognitive parameterisation procedures, yielding a total sample of 200 synthetic respondents and 800 agent-response observations (2 product categories $\times$ 2 scenarios $\times$ 200 agents). Columns (3) and (4) report the re-

gression results using this expanded sample. The ESG coefficient remains positive and statistically significant at the 1% level in both the uncontrolled specification ($\beta = 1.488$, $p < 0.01$) and the specification including the full vector of controls and fixed effects ($\beta = 1.505$, $p < 0.01$). Notably, the coefficient estimates are nearly identical to those obtained from our original sample of 100 agents reported in Table 3 ($\beta = 1.488$ in Model 4), and the standard errors decrease substantially due to the increased sample size. This pattern indicates that while individual LLM responses may exhibit some stochastic variation, the estimated ESG effect converges to a stable value at our original sample size of 100 agents. The consistency of results across both robustness exercises – alternative sampling distributions and expanded sample size – provides confidence that our main findings are not driven by methodological artefacts specific to LLM-based survey simulation, and that the positive relationship between ESG disclosure and purchase intention reflects a stable underlying economic relationship consistent with our reputational collateral theory.

Table 5. Robustness Test.

Dep. Var.	Purchase Intention			
Method	UnderSampling		IncreaseSampling	
Model	(1)	(2)	(3)	(4)
ESG	2.108*** (0.196)	2.104*** (0.194)	1.488*** (0.076)	1.505*** (0.077)
Empathy	0.197*** (0.049)	0.216*** (0.052)	0.107*** (0.018)	0.103*** (0.019)
Firm Size		0.852*** (0.209)		0.908*** (0.079)
Consumer Age		-0.001 (0.011)		0.000 (0.004)
Education Degree		-0.264* (0.151)		-0.229*** (0.052)
Consumer Region		0.008 (0.150)		0.066 (0.063)
Income		-0.012 (0.155)		0.014 (0.057)
Constant	No	Yes	No	Yes
Gender FE	No	Yes	No	Yes
Occupation FE	No	Yes	No	Yes
Big Five Personality FE	No	No	Yes	Yes
N	158	158	800	648

Dep. Var.	Purchase Intention			
Method	UnderSampling		IncreaseSampling	
Model	(1)	(2)	(3)	(4)
adj. R-sq	0.470	0.517	0.343	0.465

5. Conclusion

This study addresses a persistent puzzle in consumer behaviour: why consumers continue to purchase products from firms engaged in ESG activities even when they suspect that such engagement may be motivated by strategic self-presentation or greenwashing. Complementing prior literature that emphasises empathy-based affective pathways [7, 18], we propose and test a reputational collateral theory that frames consumer decision-making as a rational inference process. We argue that consumers interpret costly and visible ESG investments as a form of pledged collateral—a reputational bond that the firm would lose if product quality were to fail. This credible commitment mechanism reduces perceived risk and increases purchase intention through logical quality-assurance reasoning rather than through altruistic affect alone.

To test this conjecture, we construct a novel experimental measure, the Reputational Collateral Signal (RCS), using the LLM of GPT-4 as a large-scale simulated consumer response generator, a methodology increasingly validated in the market-research literature [10, 14]. Our primary result indicates that, relative to a baseline with no ESG information, consumers exposed to the costly ESG signal report significantly higher purchase intention (coefficient ≈ 1.49 on an 11-point scale, $p < 0.01$, adjusted R-squared up to 0.45). This effect is economically immense—about 1.1 standard deviations of the dependent variable—and is not explained away by traditional empathy or warm-glow measures. In additional cross-sectional tests, we find that the positive effect of ESG on purchase intention is strengthened by two orthogonal factors: (1) consumer analytical thinking (H2), supporting the view that deliberate, logic-based information processing amplifies the rational signal extraction; and (2) product information asymmetry (H3), confirming that consumers rely on the ESG signal as a risk-mitigation heuristic precisely when product uncertainty is highest. These findings hold after a series of robustness checks, including undersampling to address central-tendency bias and sample expansion to verify replicability across multiple independent runs of the LLM.

This study also demonstrates the viability of using large language model agents to simulate human survey responses in consumer behaviour research. Our two-stage design, which combined persona-based demographic and psychological profiling with scenario-calibrated individual difference measures,

offers several innovations: (i) the use of standardised donation scenarios to calibrate empathy levels; (ii) impulsive purchase scenarios to measure analytical reasoning disposition; (iii) the inclusion of Big Five personality traits to address omitted variable bias; and (iv) the incorporation of public rating benchmarks (e.g. online platform scores) as common psychological anchors to ensure cross-respondent comparability. The robustness procedures we implement—undersampling to correct for response clustering and sample expansion to address stochastic variation—provide practical methodological safeguards for future studies employing LLM-generated survey data.

Lastly, some minor limitations of this current study and its findings suggest a promising direction for future work. First, although LLM agents can approximate human response distributions, our synthetic sample may not perfectly capture certain real-world demographic configurations (e.g. some personality trait combinations we generated may be empirically underrepresented in actual populations). Future research could address this limitation by employing calibration techniques that adjust LLM-generated responses using small amounts of auxiliary human data [39], or by incorporating more granular occupational and cultural constraints derived from large-scale panel surveys. Also, we have examined only two product categories (education tutoring and furniture) and one specific form of ESG investment (donations to children in remote areas). Whether the reputational collateral mechanism generalises to other industries (e.g., financial services, food, apparel) and other ESG domains (e.g., carbon neutrality, fair labour certifications) remains an open empirical question.

Despite certain drawbacks, our study still benefits practical implications. For example, taking the perspective of firms' managers, our findings suggest that ESG investments should be framed not only as appeals to consumer benevolence but as credible commitments to quality that economically rational consumers will reward. Firms should prioritise verifiable, costly ESG activities that can be independently audited (e.g. long-term certification, transparent supply-chain investments), instead of purely relying on promotional or symbolic green initiatives. Such credible signals appear to be particularly effective among analytical consumer segments and for products, where quality is otherwise difficult for consumers to assess.

This study also brings broader significance to the academic field, contributing to the literature on ESG and consumer behaviour by introducing a rational-choice framework that operates alongside established affective pathways. Our findings

suggest that consumers are not merely deceived by corporate virtue-signalling, nor solely motivated by warm-glow giving. Instead, they actively engage in sophisticated causal inference about firm incentives. Furthermore, our study illustrates how computational social science methods, specifically LLM-based survey simulation, can complement traditional empirical approaches to test theoretical mechanisms. This methodology also brings higher efficiency, scale and internal validity than conventional methods alone permit. As LLMs continue to improve in their ability to approximate human reasoning across diverse cultural and demographic contexts, we anticipate that the methodological approach developed here will find increasing application in accounting, finance and consumer research more generally.

Abbreviations

ESG	Environmental, Social, and Governance
CSR	Corporate Social Responsibility
LLM	Large Language Model
RCS	Reputational Collateral Signal
GPT	Generative Pre-trained Transformer

Author Contributions

Tianyue Zhao: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data Curation, Writing – original draft, Writing – review & editing, Visualization, Project Administration

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix: Variable Definition

Table A1. Variable Definition

Variable	Definition
Dependent Variable	
Purchase Intention	The likelihood that a consumer will purchase the product from the focal firm, measured on an 11-point scale where 0 = definitely would not purchase, 5 = would consider purchasing, and 10 = definitely would purchase.
Independent Variable	
ESG	A binary indicator equal to 1 if the consumer is exposed to information that the firm engages in ESG activities (donations to children in remote mountainous areas), and 0 if only baseline product information is provided. This operationalises the Reputational Collateral Signal (RCS).
Consumer Trait Variables	
Empathy Level	Consumer's prosocial concern, calibrated through a standardised donation scenario: the agent is presented with a certified "Rural Children Nutrition Breakfast" programme where peers donate 50 RMB on average and the official recommendation ranges from 1 to 100 RMB. The donation amount (1–100) is then mapped to a 0–10 scale (donation ÷ 10), and subsequently rescaled to a 1–7 Likert scale for regression analysis.
Empathy Donation	The raw donation amount (1–100 RMB) selected by the agent in response to the standardised donation scenario.
Impulsive Buying Level	Consumer's spontaneous purchase tendency, assessed through a supermarket scenario involving an unplanned purchase of discounted chocolate (original price 15 RMB, sale price 9.9 RMB). A purchase intention of 3/10 anchors low impulsivity and high analytical orientation; a score of 8/10 anchors high impulsivity. Measured on a 0–10 scale.
Demographic Control Variables	
Firm Size	A binary indicator of the firm's visibility or brand credibility, where 1 = locally renowned firm and 0 = unknown firm. Randomly assigned across consumer profiles and varied across the four survey questions.
Consumer Age	Age of the simulated consumer in years, ranging from 16 to 60. Age is constrained by education-appropriate lower bounds: high school (16), bachelors (19), masters (23), doctorate (28); and by occupation-specific minimum ages (e.g., doctor/lawyer/teacher: 22; data analyst/accountant/engineer: 20).
Education Degree	Highest level of formal education attained by the consumer, coded as an ordinal variable: 1 = high school, 2 =

Variable	Definition
	bachelors, 3 = masters, 4 = doctorate. Education is matched with age via minimum age constraints and with income via soft weight biases to ensure realistic socioeconomic configurations.
Consumer Region	Geographic classification of the consumer's residence, coded as: 1 = first-tier city, 2 = second-tier city, 3 = rural/backcountry. Region weights are applied during sampling to oversample first- and second-tier city residents to capture higher ESG awareness and purchasing power.
Income Level	Monthly household income bracket, coded as: 1 = below 3,000 RMB, 2 = 3,000–6,999 RMB, 3 = 7,000–11,999 RMB, 4 = 12,000 RMB and above. Income is generated through a weighted process incorporating region-specific, occupation-specific, and age-specific biases to ensure realistic demographic combinations.
Fixed Effect Variables	
Gender FE	Fixed effect for consumer gender, included as a categorical variable: Female (F), Male (M), or Others.
Occupation FE	Fixed effect for consumer occupation, included as a categorical variable with 12 categories: student, teacher/professor, IT programmer/software engineer, data analyst, accountant/auditor, doctor, journalist, engineer (mechanical/electronic/civil), retail staff/store manager, civil servant, lawyer, freelancer. Minimum education requirements apply: doctor, lawyer, teacher/professor, data analyst, accountant/auditor, and engineer require at least a bachelor's degree.
Big Five Personality FE	Fixed effects for the five broad personality dimensions (openness, conscientiousness, extraversion, agreeableness, neuroticism), each operationalised as binary high/low indicators. Big Five traits are assigned via archetype-based sampling (e.g., “Stable Conservative”, “Rational Introverted”, “Sensitive Cautious”) to ensure correlated, realistic personality configurations (John, Donahue & Kentle, 1991; John, Naumann & Soto, 2008).
Archetype	Categorical label capturing the Big Five personality archetype assigned to each consumer. Examples include “Stable Conservative”, “Rational Introverted”, and “Sensitive Cautious”.

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