Exploring Italian Consumers' Willingness to Pay for Sustainable Fashion: The Roles of Eco-Consciousness and Vintage Preference

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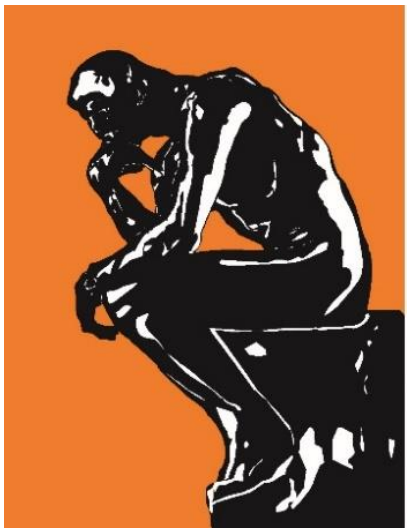

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"Crow recalls the story about his ancestor, Crow Forefather and Peacock, drawing feathers together. Crow Forefather had drawn a beautiful outfit for Peacock, but when it was the turn for Peacock to draw, Crow Forefather was in such a hurry to eat that he told Peacock to just pour the black ink bucket onto him. Since then, the Crows have lived with pit black, ugly-looking feathers."

—In “Contentment”; The Kingfisher Story Collection (2022).

Abstract

Studying the psychology behind the purchase of eco-friendly products and second-hand items can offer valuable insights to promote sustainable consumer behavior. This paper examines factors influencing Italian consumers’ willingness to pay regarding bio-based clothing and second-hand items. Drawing from data collected from 402 Italian participants, we examine how motivations and socio-demographic factors are associated with willingness to pay in the context of sustainable fashion. Our findings reveal that motivations related to environmental concerns are positively associated with consumers’ willingness to pay higher premiums for bio-based clothing. Higher income and education levels are also associated with the willingness to pay higher premiums. Meanwhile, motivation related to vintage appeal is associated with lower desired discounts for second-hand items, particularly among older consumers. Gender differences also influence discount preferences, with men seeking larger discounts on second-hand clothing compared to women. By providing insights into Italian consumers’ sustainable fashion choices, this study offers implications for businesses, policymakers, and researchers aiming to promote eco-conscious consumption and sustainability in the fashion industry.

Keywords: bio-based clothing; circular bioeconomy; second-hand clothing; motivations; gender; age; eco-surplus culture

1. Introduction

The surge in the production and consumption of fashion products has resulted in significant environmental impacts, including pollution, overexploitation of raw materials, and increased carbon emissions (Fang, 2023; Mukherjee, 2015; Niinimäki et al., 2020). In recent years, the global volume of textile and fashion production is estimated to exceed 100 to 150 billion items of clothing per year, with the number of garments used having doubled since 2000. Meanwhile, fashion consumers now purchase over 80 billion new pieces of clothing annually, a fourfold increase in consumption over the past twenty years (Bick et al., 2018). This rapid increase in the production and consumption of clothing generates fast fashion, leading to millions of tons of clothing being dumped into landfills annually (Coskun & Basaran, 2019). Fast fashion is a major driver of environmental degradation due to excessive resource consumption and worker exploitation (Centobelli et al., 2022).

Efforts to address environmental pollution have led to a shift towards renewable resources, including the utilization of agro-residual biomass fibers (Jayaprakash et al., 2022). For instance, Hildebrandt et al. (2021) advocate for circular design strategies in leather production to reduce the environmental impact of the fashion industry by promoting bio-based leather. Additionally, waste reduction initiatives are converting food industry waste into textiles, creating a closed-loop system, and minimizing waste generation. Provin and de

Aguiar Dutra (2021) suggest using bacterial cellulose from probiotic drinks to create 'biotextiles', aligning with circular economy principles. Efficient management of bio-based resources and reused clothes also helps capture atmospheric carbon through photosynthesis or reduce carbon dioxide from the air, thus lowering the carbon footprint and mitigating climate change (Jia et al., 2020; Tan & Lamers, 2021).

Despite these benefits, implementing the circular bioeconomy in fashion faces several challenges. Firstly, maintaining an eco-friendly production process requires a complex supply chain and coordination among various stakeholders from the upstream to downstream stages (D'Itria & Aus, 2023; Tan & Lamers, 2021). Secondly, biotextiles demand significant technological innovation, which can be hindered by a lack of technical know-how, as seen in the Indian fashion industry (Khurana, 2022). Thirdly, consistent metrics and measurements are essential to assess the effects of a circular bioeconomy, but these are not uniformly adopted among stakeholders, complicating the success of circular bioeconomy initiatives (Tan & Lamers, 2021). Lastly, shifting consumer behavior towards circular fashion, especially in adopting bio-based and second-hand clothes, presents a significant challenge. It requires considerable effort to educate consumers and encourage them to embrace circularity (D'Itria & Aus, 2023).

Despite the challenges in shifting consumer behavior towards circular fashion, there is a positive trend among environmentally conscious consumers who are increasingly favoring bio-textile products (Seidu et al., 2024). However, two main obstacles exist: price and certification of bio-based products (Sandra & Alessandro, 2021; Thinakaran et al., 2022). Interestingly, environmentally conscious Italian consumers are willing to pay a premium for bio-textile products sourced from certified origins, effectively overcoming the price barrier. Their willingness to pay for such premium products ranges from 64% to 128% above standard prices, depending on the product type (Sandra & Alessandro, 2021). Conversely, in India, the absence of certification poses a significant challenge, hindering the adoption of eco-friendly products (Thinakaran et al., 2022).

In recent years, European countries, particularly Italy, have pursued the EU's Bioeconomy Action Plan to implement bioeconomy strategies (Fava et al., 2021). This initiative presents opportunities for European wood-based industries to develop environmentally beneficial products. Increasing numbers of consumers with high environmental concerns are showing interest in eco-friendly products (Sandra & Alessandro, 2021). Additionally, D'Adamo and Colasante (2022) highlight that Italian consumers have a positive attitude towards sustainable fashion. However, there is a "sustainability bias" where consumers are more willing to purchase bio-based clothes than second-hand clothes.

Existing literature indicates Italian consumers' inclination towards bio-based and second-hand clothing. Still, few studies have analyzed the predictors of the premium consumers are willing to pay for bio-based clothes and the discount they seek for second-hand clothes. To address the gap, our study employs the Mindsponge theory, a framework that delineates how individuals perceive and process information, to investigate the relationships between

motivations, socio-demographic factors, and consumer behaviors in the context of sustainable fashion. Employing the Mindsponge Bayesian Framework (BMF) analysis on a dataset consisting of 402 respondents in Italy, the current study aims to answer the following research questions:

- How are motivations to buy bio-based clothes and socio-demographic factors associated with the premium Italian consumers willing to pay for bio-based clothes?
- How are motivations to buy bio-based clothes and socio-demographic factors associated with the discount Italian consumers want for second-hand clothes?

In the following sections, we detail our research methodology, emphasizing the application of the Mindsponge theory and BMF analysis. Following this, we present and expand upon our research findings in Section 3. Then, in Section 4, we explore the theoretical and practical implications arising from our study's results, concluding with a discussion that summarizes the key insights and contributions of our research.

2. Methodology

2.1. Theoretical foundation and assumption

The study employed Mindsponge Theory (MT) to provide a theoretical foundation for the research question. Mindsponge Theory, a psychological and social theory of minds, is developed from the mindsponge mechanism and is derived from the latest findings in brain and life sciences (Vuong, 2023; Vuong & Napier, 2015). This theory is based on the information processing approach to studying human minds, which views information as the fundamental basis of physical reality. This approach facilitates the investigation of complex phenomena requiring multidisciplinary knowledge (Davies & Gregersen, 2014). Various studies have used Mindsponge Theory as a theoretical underpinning for exploring socio-psychological phenomena, including environmental and conservation psychology (Alzahrani et al., 2023; Asamoah et al., 2023; Huang et al., 2023; Khuc, Dang, et al., 2023; Khuc, Tran, et al., 2023; Nguyen et al., 2024; Nguyen & Jones, 2022b).

The MT offers a dynamic perspective on information processing, enhancing existing psychological and social theories by clarifying concepts, resolving contradictions, and establishing connections at the level of human cognition underlying these behaviors. This makes MT a helpful tool for generating insights into the motivations behind these consumer preferences. Moreover, MT provides a framework for explaining how individuals collect, process, and integrate information to make decisions, which is a good fit with the current study's objectives. Specifically, MT views the mind and the environment as two primary spectrums. The mind functions as an information collection and processing unit, while the environment is a broader information-processing system (e.g., Earth system, social system) that encompasses the human mind (Vuong et al., 2022). The primary goal of the mind is to prolong the existence of the system, whether through survival, growth, or reproduction. The mind is constituted by the mindset, the buffer zone (or comfort zone), and the multi-filtering system.

A mindset is defined as a collection of highly trusted information or core values within the human mind. The buffer zone is a conceptual area where information is temporarily held before being assessed by the multi-filtering system (Vuong et al., 2022). The multi-filtering system performs two main functions: information integration and differentiation. If the absorbed information aligns with the mindset's core values, it is synthesized and integrated. However, if the new information significantly differs from the existing core values, it undergoes evaluation through differentiation, where the costs and benefits of accepting or rejecting the new information are assessed. In general, if new information is perceived as potentially beneficial, it will be accepted into the mindset, influencing subsequent thinking, filtering processes, and behaviors. If it is perceived as costly, the information will be rejected. If the perceived costs and benefits are unclear, the information will be stored in the buffer zone for later evaluation when sufficient information for assessment is available.

Due to its characteristics, MT allows researchers to investigate the motivations behind consumers' willingness to pay a premium for bio-based clothes (referred to as *Premium_bio*) and the discounts they seek for second-hand clothes (referred to as *Discount_second*). The willingness to pay in this context is seen as the outcome of consumers' information processing that gathers, processes, and evaluates information about the products, motivations, and various influencing factors. This process involves perceiving, assessing, and integrating information into consumers' thinking, ultimately influencing their choice between paying a premium or seeking a discount.

Based on this reasoning, we hypothesize that consumers' willingness to pay in the circular bioeconomy, particularly regarding the purchase of bio-based clothes and second-hand items, is influenced by a combination of motivations and socio-demographic factors. These motivations may include environmental consciousness, a desire for exclusivity (e.g., vintage), quality preferences, cost savings, etc. With these insights, we aim to develop a better understanding of the underlying drivers of consumers' thinking and subsequent behavior and provide implications for promoting sustainability in the textile and apparel industry.

2.2. Model Construction

2.2.1. Variable Selection and Rationale

This study utilized secondary data from a dataset comprising 402 Italian participants, gathered through the Amazon Mechanical Turk (MTurk) platform as conducted by D'Adamo and Colasante (2022). The questionnaire administered to 402 Italian respondents consisted of approximately 35 items and was structured as a descriptive online cross-sectional study, following the behavioral approach method. It featured diverse question types such as Likert scale inquiries, value scale assessments, yes/no queries, closed-ended prompts, and open-ended reflections. The questions were formulated with contributions from various disciplines, including economics, psychology, and engineering, with the primary objective of comprehending consumers' attitudes towards sustainable purchasing in the fashion industry.

Given the increasing focus on the transition from a linear to a circular economy, the survey also concentrated on the second-hand market. Additionally, questions to assess consumer behavior towards bio-based clothing were included (D'Adamo & Colasante, 2022).

Two variables were computed to capture consumers' willingness to pay: the premium for bio-based clothing and the discount for second-hand clothing. The premium was calculated by deducting the participants' offered price for the bio-based item from its original price, reflecting their willingness to pay extra for its eco-friendly attribute. Similarly, the discount for second-hand clothing was derived by subtracting the original price from the participants' proposed price, indicating their willingness to pay less for the pre-owned nature of the item. This approach allowed researchers to analyze participants' preferences and perceptions regarding the value of these attributes. This dataset has been published in *Data in Brief* and can be accessed at the provided address.

https://www.sciencedirect.com/science/article/pii/S2352340922005820

For the research objective of the current study, 17 variables were employed for thestatistical analysis (see Table 1).

Table 1: Variable Description

Variable	Description	Type of variable	Value
age	The respondent's age	Numerical	Actual age in years
gender	The respondent's gender	Binary	0: Female 1: Male
education	The respondent's educational level	Numerical	1: Did not attend school 2: High/secondary school or equivalent 3: Bachelor's degree (e.g., BA, BSc) 4: Master's degree (e.g., MA, MSc, MRes, MEd) 5: Doctorate (e.g., PhD)
income	The respondent's income level	Numerical	1: Low income 2: Low middle income 3: Upper middle income

			4: High income
bio_eco	The extent to which respondents consider environmental factors when making decisions about purchasing bio-based clothing.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
bio_vintage	The respondents' preference for vintage styles within the context of bio-based clothing.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
bio_quality	The respondents' perception of the quality, durability, and performance of bio-based clothing compared to conventional options	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
bio_endlife	The respondents' concerns about what happens to bio-based clothing after it is no longer in use, including biodegradability and recyclability.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
bio_pollution	The respondents' concerns regarding the pollution generated throughout the production, use, and disposal of	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree

	clothing, and the potential for bio-based alternatives to address these concerns.		
bio_peer	The extent to which respondents' preferences for bio-based clothing are influenced by their peers' opinions and behaviors.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
Premium_bio	The premium that respondents are willing to pay for bio-based clothing.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
second_peer	The extent to which individuals' decisions to purchase second-hand clothing are influenced by social influence from peers or social circles.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
second_pollution	The motivations or reasons individuals consider when choosing to buy second-hand clothing, specifically related to reducing pollution associated with the production of new clothes.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree

second_endlife	The motivations or reasons individuals consider when choosing to buy second-hand clothing, specifically reflecting the importance placed on using items that have not yet reached the end of their life cycle.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
second_quality	The motivations or considerations individuals have when choosing to buy second-hand clothing, specifically focusing on the quality of the product.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
second_vintage	The motivations or considerations individuals have when choosing to buy second-hand clothing, specifically related to the desire to find exclusive or unique items with a vintage aesthetic.	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
Discount_second	The discounts or reduced prices associated with second-hand clothing items that the respondents prefer	Numerical	1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree

2.2.2. Statistical model

To test our hypotheses, we constructed two different analytical models. The first model was designed to examine the first research question, investigating whether motivations for purchasing bio-based clothes and socio-demographic factors are positively associated with the premium Italian consumers willing to pay for bio-based clothes.

Model 1 is shown as follows:

$$Premium\_bio \sim \text{normal}(\mu, \sigma) \quad (1.1)$$

$$\mu_i = \beta_0 + \beta_1 * age_i + \beta_2 * education_i + \beta_3 * income_i + \beta_4 * bio\_Eco_i + \beta_5 * bio\_vintage_i + \beta_6 * bio\_quality_i + \beta_7 * bio\_endlife_i + \beta_8 * bio\_pollution_i + \beta_9 * bio\_peer_i \quad (1.2)$$

$$\beta \sim normal(M, S) \quad (1.3)$$

The probability around μ is determined by the form of the normal distribution, whose width is specified by the standard deviation σ. μ_i indicates the premium respondent i is willing to pay for bio-based clothing. In equation (1.2), the variables bio_Eco_i, $bio\_vintage_i$, $bio\_quality_i$, $bio\_endlife_i$, $bio\_pollution_i$, and bio_peer_i represent different motivations associated with purchasing bio-based clothes. The model has an intercept of β_0, coefficients of β_1-β_9, and the standard deviation of the "noise", σ. The coefficient values are normally distributed around the mean denoted M with the standard deviation denoted S.

The second model was built to examine the second hypothesis, which tests the motivations for purchasing bio-based clothes and whether socio-demographic factors are negatively associated with Italian consumers' desire for discounts on second-hand clothes.

$$Discount\_Second \sim \text{normal}(\mu, \sigma) \quad (2.1)$$

$$\mu_i = \beta_0 + \beta_1 * Age_i + \beta_2 * education_i + \beta_3 * income_i + \beta_4 * second\_peer_i + \beta_5 * second\_pollution_i + \beta_6 * second\_endlife_i + \beta_7 * second\_quality_i + \beta_8 * second\_vintage_i \quad (2.2)$$

$$\beta \sim normal(M, S) \quad (2.3)$$

In equation (2.2), the variables $second\_peer_i$, $second\_pollution_i$,$second\_endlife_i$, $second\_quality_i$, and $second\_vintage_i$ represent different motivations associated with purchasing second-hand clothes.

2.2.3. Analysis and Validation

The current study utilized Bayesian Mindsponge Framework (BMF) analytics for several reasons (Nguyen et al., 2022; Vuong et al., 2022). Firstly, BMF combines the logical reasoning of Mindsponge Theory with the inferential strengths of Bayesian analysis, making them highly compatible (Nguyen et al., 2022). Secondly, Bayesian inference is a statistical

approach that treats all parameters probabilistically (Csilléry et al., 2010; Gill, 2014), allowing for the reliable prediction of parsimonious models. Thirdly, Bayesian inference has several advantages over the frequentist approach, such as using credible intervals for result interpretation instead of solely relying on *p*-values for binary decisions (Halsey et al., 2015; Wagenmakers et al., 2018).

In Bayesian analysis, choosing the appropriate prior is crucial during the model-building phase (van de Schoot et al., 2021). This study employed two types of priors to improve the reliability of the analysis. Uninformative priors are chosen to maintain objectivity and minimize subjective bias during exploratory analysis. These priors prioritize the influence of likelihood (i.e., data) in estimating posterior distribution. Meanwhile, informative priors expressing our disbelief in the associations between motivations, socio-demographic factors, and willingness to pay were also used for two main purposes. Firstly, it is a prior-tweaking technique that helps researchers evaluate whether the estimated results are robust when the prior belief is changed. If the estimated posterior distributions remain unchanged, the results can be deemed robust. Secondly, informative priors assist in addressing potential multicollinearity issues, especially in studies with numerous predictor variables (Adepoju & Ojo, 2018; Jaya et al., 2019; Leamer, 1973).

Following the model fitting process, we employed Pareto-smoothed importance sampling leave-one-out (PSIS-LOO) diagnostics to assess the goodness-of-fit of the model (Vehtari & Gabry, 2019; Vehtari et al., 2017). The LOO computation is outlined as follows:

$$LOO = -2LPPD_{loo} = -2\sum_{i=1}^{n} \log \int p(y_i|\theta) p_{post(-i)}(\theta) d\theta$$

The posterior distribution $p_{post(-i)}(\theta)$ is calculated based on the data excluding data point i. In the PSIS method, *k*-Pareto values are used to compute leave-one-out cross-validation, which helps identify observations with a high degree of influence on the PSIS estimate. Observations with *k*-Pareto values greater than 0.7 are often considered influential and may pose problems for accurately estimating leave-one-out cross-validation. Generally, a model is considered well-fitted when the *k* values are below 0.5.

If the model demonstrated a good fit with the data, we proceeded with convergence diagnostics and result interpretation. The convergence of Markov chains is typically validated using both statistical measures and visual illustrations. Statistically, the effective sample size (*n_eff*) and the Gelman–Rubin shrink factor (*Rhat*) are used to assess convergence. The *n_eff* value represents the number of iterative samples that are not auto-correlated during stochastic simulation, with values larger than 1000 indicating sufficient effective samples for reliable inference (McElreath, 2018). The *Rhat* value, also known as the potential scale reduction factor or Gelman–Rubin shrink factor (Brooks & Gelman, 1998), should be equal to 1 for the model to be considered convergent; values exceeding 1.1 indicate non-convergence. Visually, convergence is also validated using trace plots of

the Markov chains.

The Bayesian analysis was conducted in R using the open-access **bayesvl** package, which offers good visualization capabilities (La & Vuong, 2019). To ensure data transparency and facilitate reproducibility, all data and code snippets from this study have been deposited on a preprint server for public access and reuse (Vuong, 2018). The dataset and code can be accessed at https://zenodo.org/records/11945936.

3. Results

The model fitting processes for all models were conducted using R version 4.4.0, employing four Markov chains. Each chain comprised 5000 iterations, with 2000 iterations allocated for the warmup period.

3.1. Model 1: The premium for bio-based clothes

Model 1 was utilized to examine the associations between motivations for purchasing bio-based clothing, socio-demographic factors, and the premium that consumers are willing to pay for bio-based clothes.

Initially, the PSIS-LOO test was conducted to assess the goodness of fit between Model 1 and the collected data. The visualized PSIS-LOO plot indicates that all *k* values are below 0.5, implying that Model 1 aligns well with the dataset (see Figure 1)

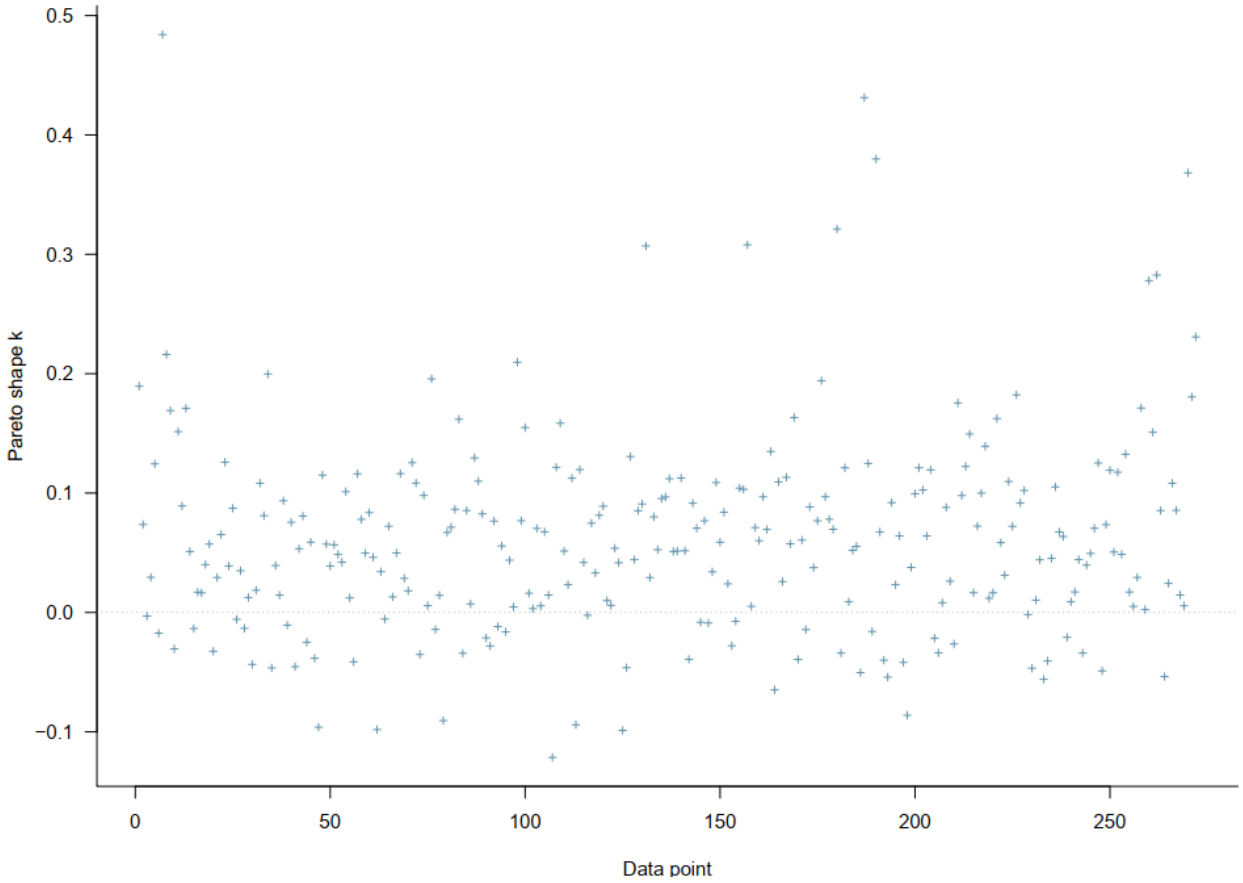

Figure 1. Model 1's PSIS-LOO diagnosis with uninformative priors

The effective sample size (*n_eff* > 1000) and Gelman shrink factor (*Rhat* = 1) of all simulated posterior coefficients portray a good convergence of the model's Markov chains (see Table 2). The convergence can also be visually diagnosed using trace plots. The *y*-axis of the trace plots represents the posterior values of each parameter, while the *x*-axis represents the iteration order of the simulation. The colored lines in the middle of the trace plots are Markov chains. Figure 2 demonstrates the healthy mixing of all coefficients' Markov chains around an equilibrium, which is a good signal of convergence.

Table 2. Model 1′s simulated posteriors.

Parameters	Uninformative Priors				Informative Priors			
	M	S	*n_eff*	*Rhat*	M	S	*n_eff*	*Rhat*
Constant	-3.68	2.12	8032	1	-2.71	1.79	9194	1
b_bio_eco_Premium_bio	0.30	0.26	9942	1	0.22	0.23	11506	1
b_biovintage_Premium_bio	0.22	0.27	11167	1	0.21	0.23	10994	1

b_bioquality_Premium_bio	-0.20	0.30	10417	1	-0.10	0.25	11638	1
b_biopollution_Premium_bio	0.41	0.26	11232	1	0.35	0.23	12865	1
b_biopeer_Premium_bio	0.23	0.27	10602	1	0.19	0.23	11751	1
b_gender_Premium_bio	-0.45	0.52	12446	1	-0.23	0.36	12651	1
b_age_Premium_bio	0.01	0.02	11541	1	0.01	0.02	11368	1
b_education_Premium_bio	0.71	0.42	9729	1	0.46	0.32	10606	1
b_income_Premium_bio	0.28	0.20	10613	1	0.28	0.18	13193	1

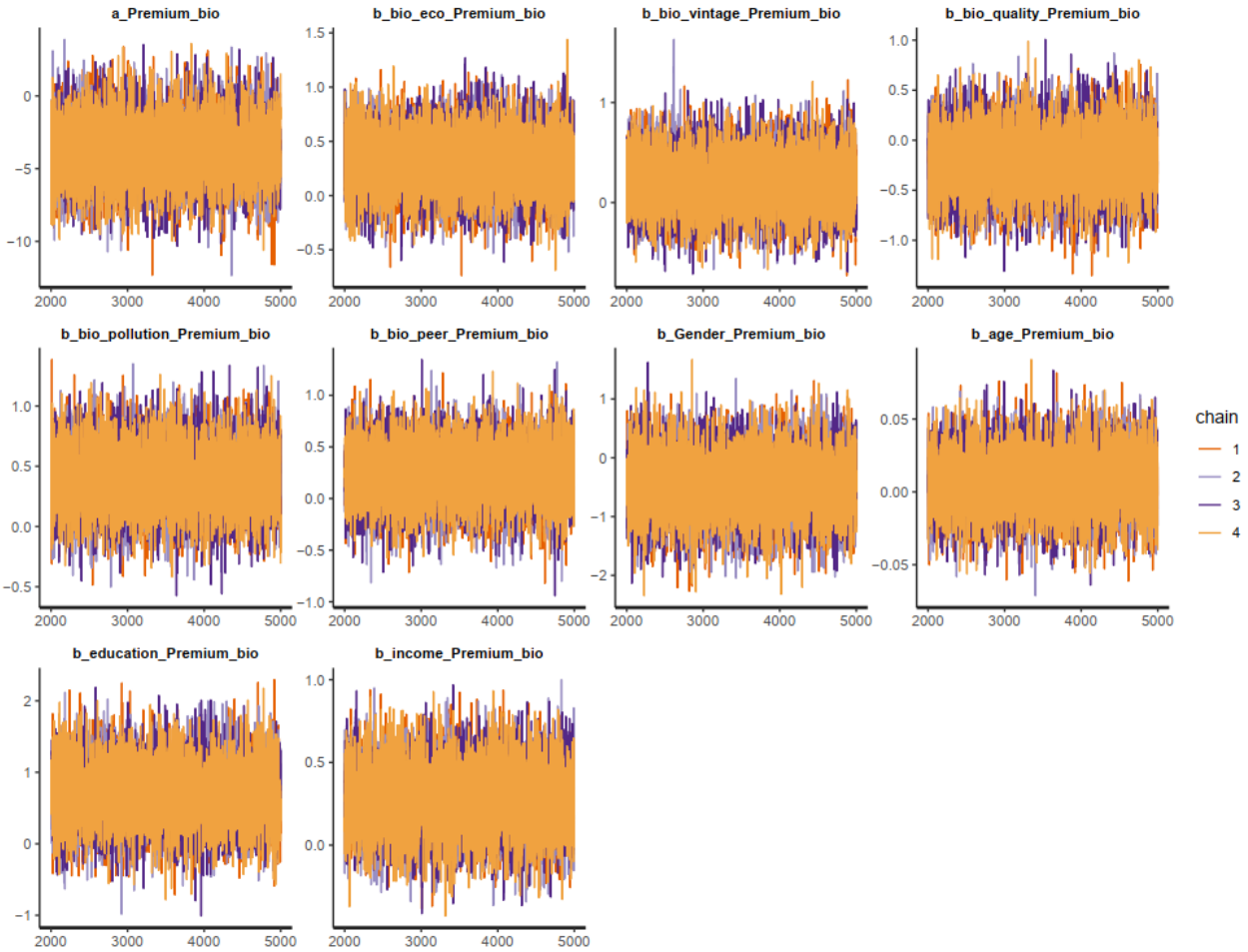

Figure 2: Model 1's trace plots with uninformative priors

The estimated posterior distributions, using uninformative priors, indicate that bio_eco, $bio\_pollution$, age, $education$, and $income$ have positive associations with the premium that consumers are willing to pay for bio-based clothes ($M_{b\_bioeco\_Premiumbio} = 0.22$ and

$S_{b\_bioeco\_Premiumbio} = 0.22$; $M_{b\_biopollution\_Premiumbio} = 0.35$ and $S_{b\_biopollution\_Premiumbio} = 0.23$; $M_{b\_education\_Premiumbio} = 0.45$ and $S_{b\_education\_Premiumbio} = 0.32$; $M_{b\_income\_Premiumbio} = 0.28$ and $S_{b\_income\_Premiumbio} = 0.18$)

The posterior distributions of these variables are in Figure 3. The thick blue lines in Figure 3 indicate the probability mass contained within the 89% highest posterior density intervals (HPDI), whereas the thin blue lines show the probability mass situated outside the highest credible region. As we can see, the HPDI of *bio_pollution*, *education,* and *income* lies entirely on the positive side of the *x*-axis, suggesting that the positive associations between *bio_pollution*, *education,* and *income* and the premium that consumers are willing to pay for bio-based clothes are highly reliable (with at least 89% probability of being positive). For *bio_eco*, a small proportion of its HPDI is still located on the negative side, so its positive association with the bio-based clothes' premium can only be deemed moderately reliable. For other variables (e.g., *bio_quality, bio_vintage*, *bio_peer*, *gender,* and *age*), their associations with the bio-based clothes' premium exhibit ambiguous tendencies.

When "prior-tweaking" is performed using informative priors representing our disbelief in the associations between motivations, socio-demographic factors, and bio-based clothes' premium, the change is negligible (see Table 2). As a result, the Model 1's results are deemed robust.

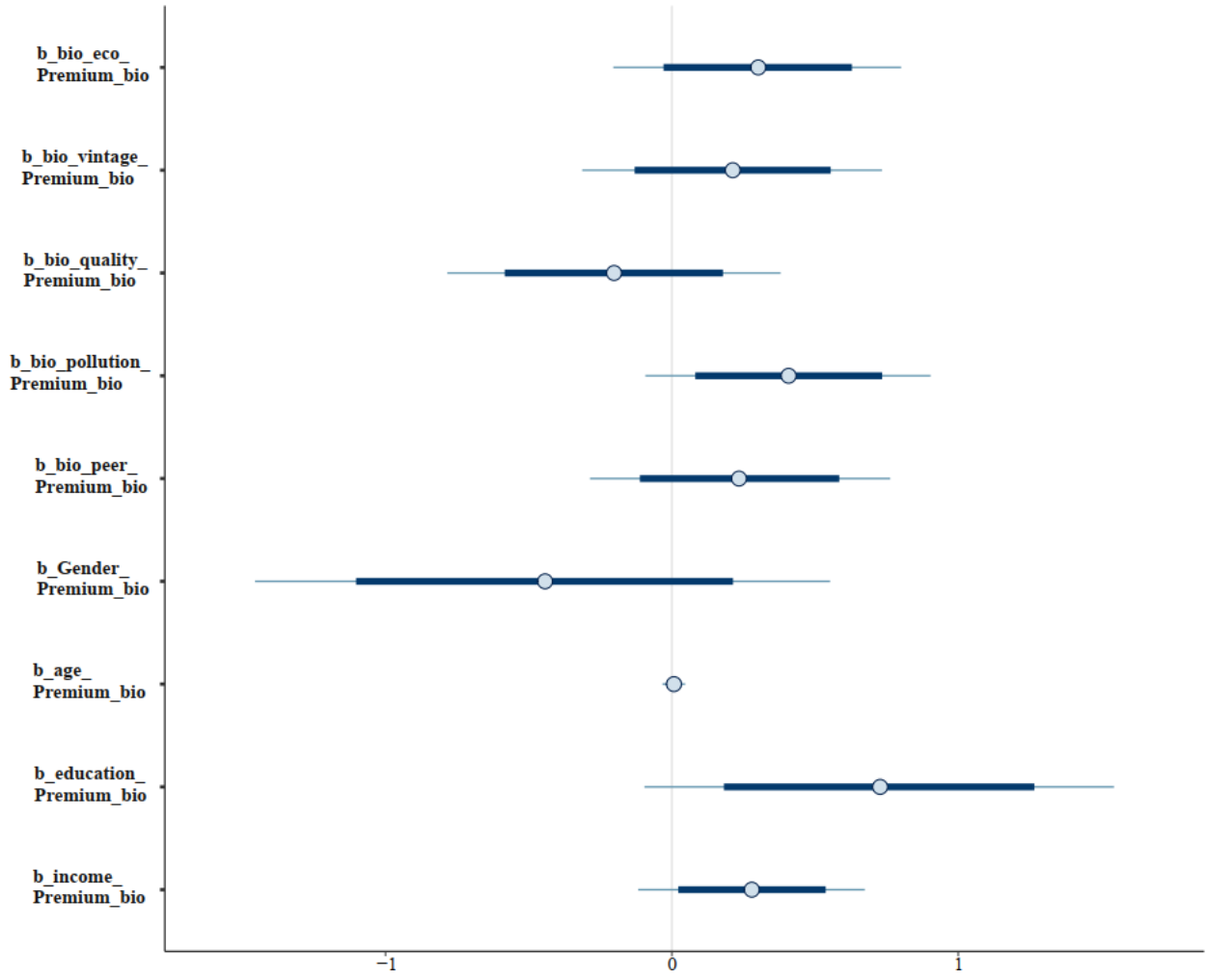

Figure 3. Model 1's interval plot with uninformative priors

3.2. Model 2: The discount for second-hand clothes

Model 2 was examined to check the associations between motivations to buy second-hand clothes, socio-demographic factors, and the discount Italian consumers want for second-hand clothes. The PSIS-LOO test shows that only one *k* diagnostic value, which accounts for 0.6% of the total number of *k*-Pareto values, is slightly higher than 0.5 (an ok threshold). Thus, it is plausible to consider Model 2 to have an acceptable goodness of fit with the dataset (see Figure 4).

Table 3. Model 2′s simulated posteriors.

Parameters	Uninformative Priors				Informative Priors			
	M	S	*n_eff*	*Rhat*	M	S	*n_eff*	*Rhat*

Constant	0.80	2.70	10073	1	0.22	2.29	9374	1
b_ second_eco_Discount_second	-0.11	0.34	14274	1	-0.10	0.27	14595	1
b_ second_vintage_Discount_second	-0.34	0.27	14173	1	-0.30	0.23	14693	1
b_second_quality_Discount_second	-0.31	0.40	11987	1	-0.27	0.30	12524	1
b_second_endlife_Discount_second	0.11	0.36	14596	1	0.03	0.28	13444	1
b_second_pollution_Discount_second	-0.22	0.33	13580	1	-0.17	0.26	14051	1
b_second_peer_Discount_second	-0.16	0.29	13361	1	-0.09	0.25	13690	1
b_Gender_Discount_second	0.92	0.60	15299	1	0.40	0.38	15835	1
b_age_Discount_second	-0.03	0.03	12684	1	-0.03	0.03	11618	1
b_education_Discount_second	-0.38	0.47	13124	1	-0.24	0.34	11612	1
b_income_Discount_second	-0.24	0.30	13600	1	-0.21	0.25	13686	1

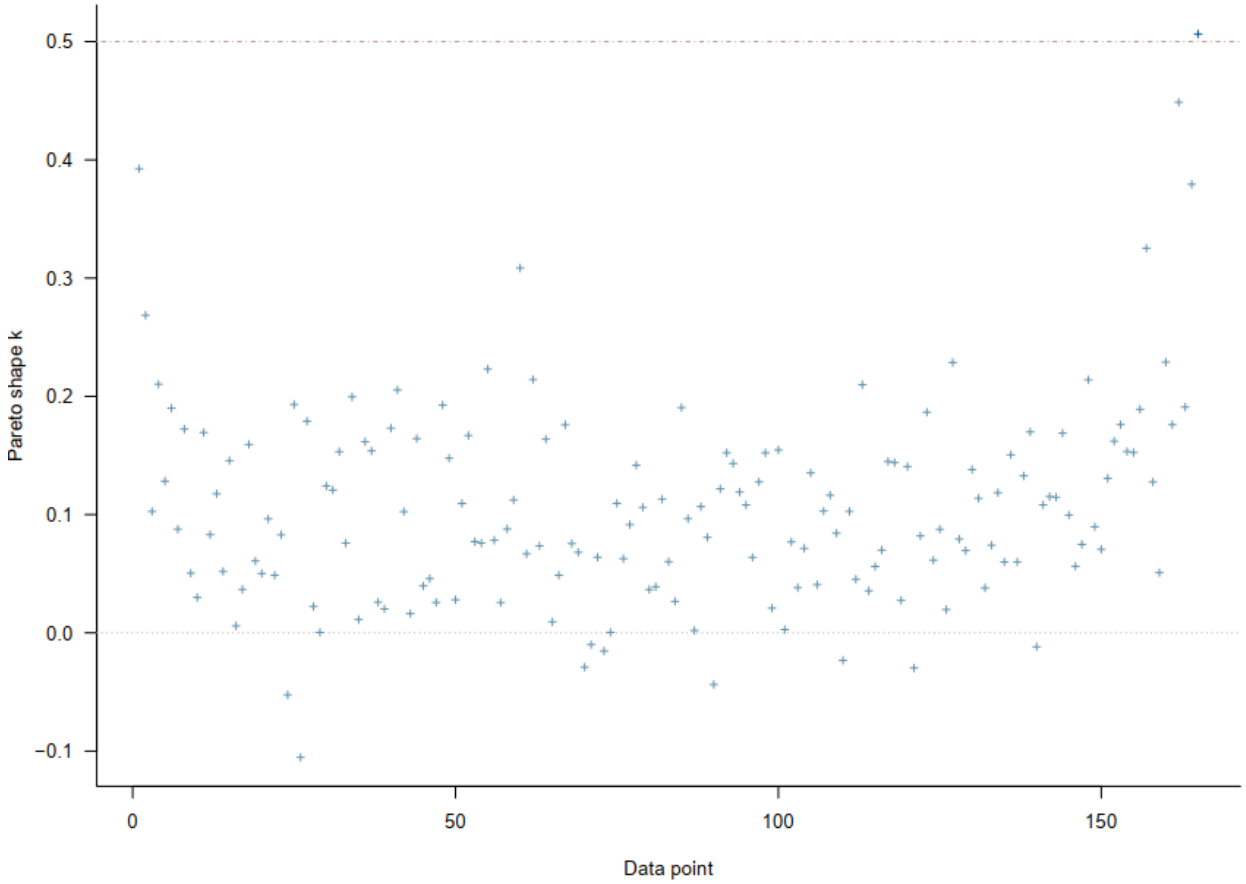

Figure 4. Model 2's PSIS-LOO diagnosis with uninformative priors

Convergence diagnostic values (*n_eff* and *Rhat*) of the model indicate that the models' Markov chains are convergent (see Table 3). The trace plots also confirm the convergence of Markov chains (see Figure 5).

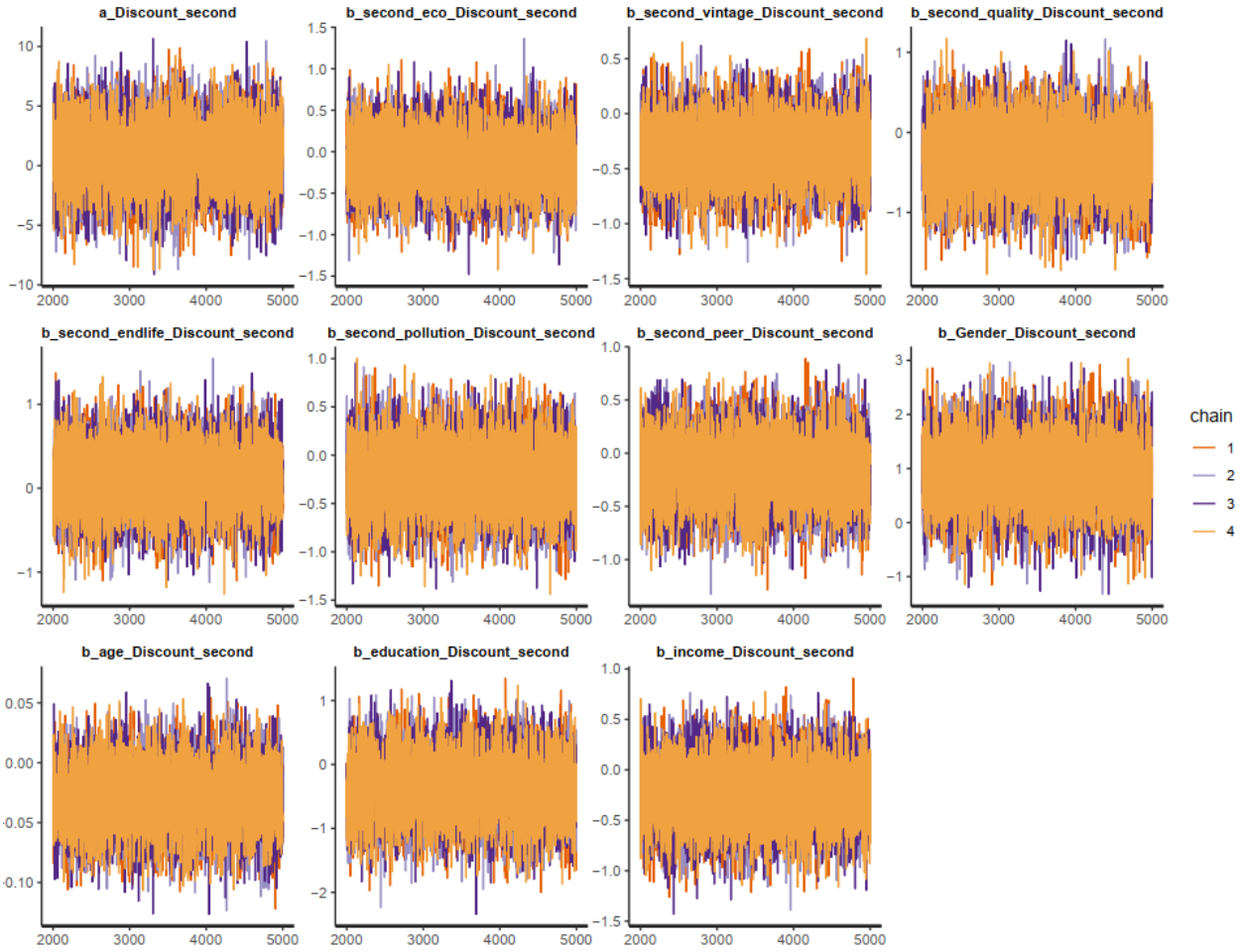

Figure 5. Model 2's trace plots with uninformative priors

As can be seen from the posterior distributions of Model 2, the positive association between *gender* and *Discount_second* is highly reliable. The associations between *age*, *second_vintage*, and *Discount_second* are negative. While the negative association of *second_vintage* is highly reliable as its HPDI is located entirely on the negative side, that of *age* and *Discount_second* is only moderately reliable as a small proportion of its HPDI is still located on the positive side. Other coefficients are more ambiguous (see Figure 6). Prior tweaking using informative priors reflecting our disbelief in the associations does not change the results, so these patterns are deemed robust (see Table 3).

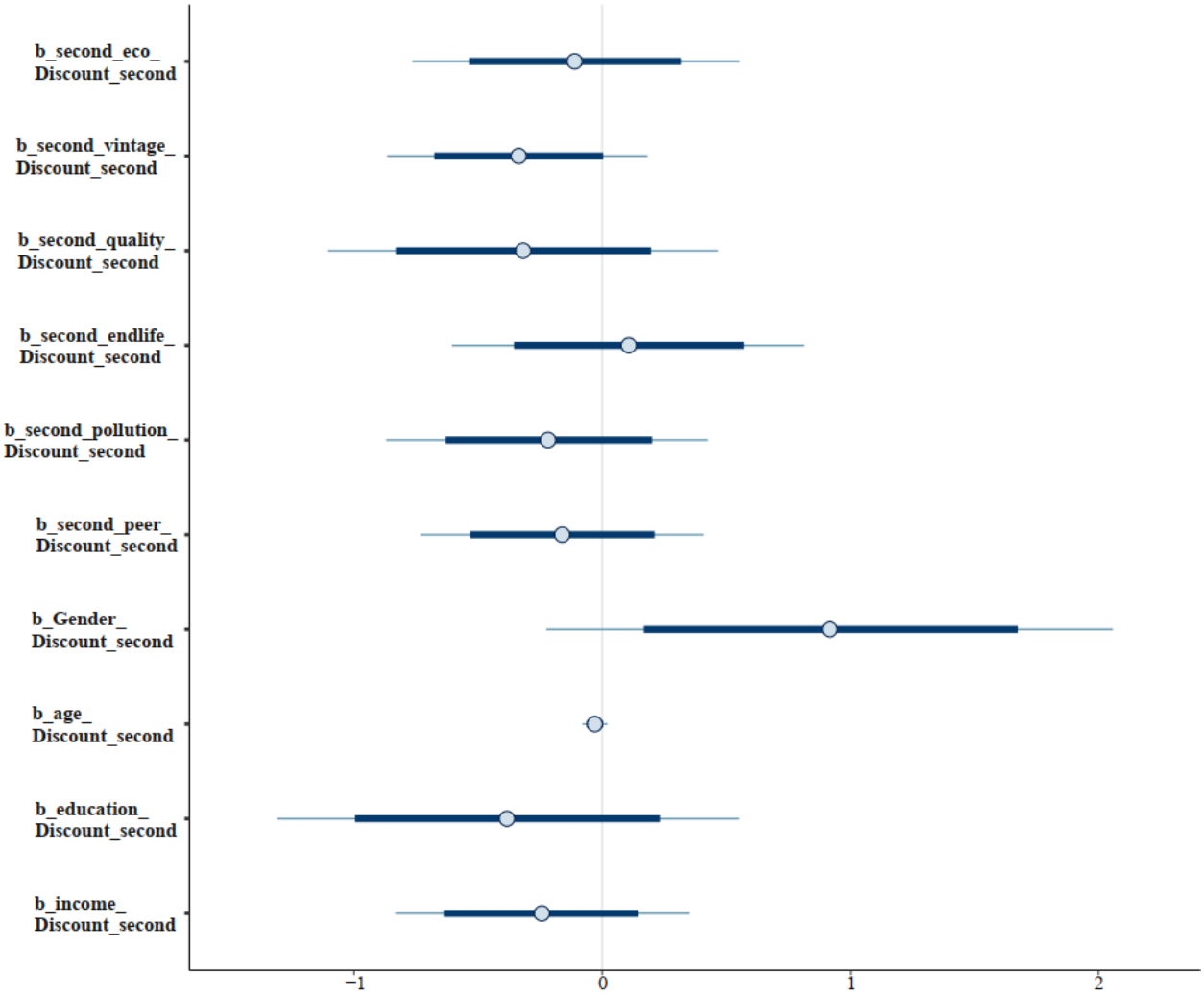

Figure 6. Model 2's interval plot with uninformative priors

4. Discussion

The study aimed to understand the factors associated with Italian consumers' willingness to pay for sustainable fashion, specifically regarding bio-based clothing and second-hand items. Through two models, it analyzed the relationships between motivations for sustainable clothing purchases, socio-demographic factors, and the premium that consumers are willing to pay for bio-based clothes and their desired discounts for second-hand items.

This study's results show that consumers motivated by environmental concerns and those aware of the environmental impact of clothing production and disposal consistently demonstrate a willingness to pay a higher premium for bio-based clothing. The result supports the former study that found environmental concerns are positively associated with consumer attitudes toward purchasing organic cotton clothing (Seock et al., 2024), aligning with the growing global trend of sustainability and eco-conscious consumerism (Gam, 2011;

Sandra & Alessandro, 2021). The growing trend supports the principles of the circular economy, emphasizing waste reduction and material reuse (Lopes et al., 2024).

While the influence of gender and age is ambiguous, individuals with higher income and education levels are more willing to pay higher premiums for bio-based clothing. This highlights the importance of socio-economic factors in driving Italian consumer choices within the context of sustainable fashion. This suggests that marketing strategies and educational initiatives should be designed to promote eco-friendly consumer behavior across diverse demographics.

The study's results also imply that the motivation related to the vintage appeal is negatively associated with the discount desired. In other words, Italian consumers who prioritize vintage aesthetics in second-hand items tend to seek lower discounts when purchasing such goods. This behavior reflects a preference for authenticity and uniqueness often associated with vintage clothing. Consumers who value authenticity and uniqueness are more likely to be attracted to vintage items and may be willing to pay more for them (Amatulli et al., 2018; Aycock, 2021).

Socio-demographic factors like age and gender also influence the discount desired for second-hand clothes. Specifically, older consumers tend to have less desire for discounts on second-hand clothing. This might be possible because they have established income levels, and their shopping preferences change as they age, aligning with established theories of consumer behavior (Abdel Wahab et al., 2023). Meanwhile, male consumers tend to desire higher discounts when purchasing second-hand clothing than female counterparts. Socio-psychological factors may drive this gender difference in discount preferences, as societal expectations often pressure men to maintain a certain image, potentially leading to the perception that second-hand clothing is less valuable. As a result, men may seek larger discounts when purchasing such items (Altman, 2020).

Comparing these findings with consumers' willingness to pay a premium for bio-based clothing provides additional insights into sustainable fashion consumption among Italian consumers. Both sets of findings highlight the importance of motivations in shaping their willingness-to-pay decisions. Additionally, the observed socio-demographic differences suggest the need for appropriate strategies to encourage eco-friendly choices among various consumer segments.

The findings from this study have significant practical implications for businesses and policymakers operating within the circular bioeconomy, particularly in a sustainable fashion. By incorporating these insights into their existing strategies, they can effectively foster eco-friendly consumption habits and advocate for the adoption of sustainable fashion practices.

Firstly, consumers willing to pay a premium for bio-based fabrics prioritize environmental concerns, reflecting their core values prioritizing the environment. Therefore, businesses can capitalize on these values by promoting the unique environmental benefits of bio-based clothing, which can encourage broader adoption of sustainable practices in society (Vuong,

2023). One effective approach is through nature-inspired fashion. As a powerful form of expressing identities, beliefs, and values, fashion that incorporates elements from nature can highlight the beauty of nature and encourage wearers to reflect on their relationship with it (Vuong & Nguyen, 2023). Clothing featuring prints of plants and animals or made from sustainable materials, such as organic cotton or recycled fibers, can be seen as a physical representation or reminder of the beauty and importance of nature (Shatarah, 2024). Additionally, fashion campaigns and runway shows biodiversity, conservation efforts, and indigenous knowledge have the potential to raise awareness about environmental issues and inspire action (Pozzo, 2020). Wearing nature-inspired fashion can also foster a sense of connection and reverence for the natural world. As individuals interact with their surroundings while wearing these garments, they may develop a deeper appreciation for the ecosystems and wildlife that inspire the designs (Williams, 2018). This connection can lead to a greater commitment to sustainability and environmental conservation (Rognoli et al., 2022).

Secondly, transparent communication about sustainability efforts, including emphasizing specific pollutants mitigated by bio-based clothing, can enhance their appeal. Marketing campaigns promoting the pollution-reducing benefits of these clothes resonate strongly with environmentally conscious consumers, inspiring them to make conscious choices and fostering a deeper environmental appreciation (Anuradha et al., 2023; Nguyen & Jones, 2022a; Vuong, 2021). Moreover, emphasizing the quality and durability of sustainable products sets them apart in a market valuing long-term value (Hameed & Waris, 2018), aiding businesses in building a loyal customer base committed to sustainable fashion and driving the overall success of the circular bioeconomy.

Thirdly, integrating fashionable and trendy elements into sustainable products is crucial for attracting style-conscious consumers (Ray & Nayak, 2023). This approach satisfies the desire for the unique and distinctive charm of sustainable products, thereby enhancing their authenticity and attractiveness to consumers (DeLong et al., 2005; Ray & Nayak, 2023). By promoting the genuineness of sustainable fashion options, businesses can broaden their appeal beyond environmental benefits and encourage more widespread adoption of sustainable fashion practices (Turunen & Gossen, 2024).

Fourthly, the collaboration between policymakers and businesses plays a crucial role in educating consumers about the benefits of the circular bioeconomy and sustainable fashion (Klemm & Kaufman, 2024). Through joint educational campaigns, they can effectively communicate with consumers about the environmental impact of the fashion industry and the advantages of sustainable consumption, aiming to cultivate more informed consumer behavior and encourage the adoption of sustainable fashion practices (Bennetta & Oeppen Hill, 2022). This collaborative effort fosters an eco-surplus culture aligned with sustainability and circular economy principles, emphasizing the environmental benefits of purchasing second-hand items and encouraging consumers to view these products as valuable resources rather than disposable goods (Carvalho et al., 2020; Nguyen & Jones, 2022a;

Vuong & Nguyen, 2024). Moreover, integrating this culture into marketing strategies and educational initiatives empowers consumers with knowledge and fosters a deeper understanding of sustainability in fashion choices. Such collaborative efforts enable policymakers and businesses to reach a wider audience and cultivate more sustainable consumer behavior, emphasizing the shared responsibility in driving positive change toward a more sustainable fashion industry (van Langen et al., 2021; Vuong et al., 2021).

Acknowledging the study's limitations is crucial for understanding its scope and potential areas for improvement (Vuong, 2020). Firstly, the reliance on the MTurk platform and a sample size of 402 Italian participants may introduce biases and limit the generalizability of the findings. Additionally, exploring additional factors beyond those examined in this study that might influence the willingness to pay higher premiums for bio-based clothes and preferences for discounts in the second-hand clothing market could offer deeper insights into consumer behavior and decision-making processes. By addressing these limitations and venturing into new research directions, scholars can contribute to a more comprehensive understanding of sustainable fashion consumption patterns and inform more effective strategies for promoting eco-friendly consumer choices.

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