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# Blockchain and Food Trust: Will Consumers Pay More?

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## ABSTRACT

Blockchain is increasingly used in agri-food supply chains to make products more transparent and trustworthy. Yet, in countries like Italy, where certifications such as PDO, PGI, and organic labels already shape consumer confidence, its added value is still unclear. This study examines how Italian consumers understand and evaluate blockchain-based traceability, exploring their awareness, trust, and willingness to pay for verified food products. A nationwide survey of 1500 respondents was conducted to capture how education, income, and perceived importance of traceability influence purchasing behavior. Results show that consumers link blockchain above all to safety, authenticity, and transparency. Higher trust and stronger appreciation of traceability increase the likelihood of paying more for blockchain-certified foods, while education, and income reinforce this tendency.

## 1 | Introduction

The agri-food sector has witnessed a digital transformation in recent years, which has been driven by technological innovation and consumer demand for transparency, authenticity, and sustainability, and blockchain technology has emerged as one of the potential instruments to improve traceability and trust in food supply chains (Wang et al. 2024; Li et al. 2025).

This transformation is not limited to blockchain alone but also includes a broader set of digital technologies such as data platforms, smart labelling, Internet of Things (IoT) and digital traceability tools aimed at enhancing transparency, trust and sustainability in food systems. Recent contributions highlight how these technologies jointly reshape information flows, governance structures and consumer–producer relationships in agri-food markets (Reitano et al. 2025). Within this broader digitalization process, blockchain represents a specific institutional and technological solution, characterized by decentralization and immutability, whose added value depends on the existing trust architecture of the food system. Blockchain technology provides a decentralized and irreversible record of transactions, enabling each step of the production process from farm to retail to be recorded and verified, reducing the asymmetry of information between producers and consumers (Testi 2023). However, even with the strong institutional and industrial interest in blockchain traceability, its acceptance at the consumer level is limited and uneven (Zhang 2023; Vriezen et al. 2023). Although producers and policymakers highlight the technical reliability of blockchain, consumer acceptance often rests on cognitive and psychological factors.

Within Mediterranean and European food systems, traditional certification schemes like protected designation of origin (PDO) and organic labels already signal quality and origin, so the addition of blockchain may augment or compete with these preexisting trust structures (Consolaro et al. 2025). In Italy, with a consumer profile particularly sensitive to origin, authenticity, and safety, blockchain traceability is both a technological innovation and a new cultural value layer. While scholarly interest in blockchain-based traceability has been increasing in recent years, there is still very limited empirical evidence about how consumers perceive and economically value this type of blockchain traceability in mature food economies, especially in Europe (Vriezen et al. 2023). Previous research has focused on Asian markets (e.g., China

and South Korea) or on experimental choice designs, and little is known about actual consumer attitudes in mature food economies. Additionally, earlier studies have identified education, digital literacy, and ethical awareness as drivers of WTP for traceable and sustainable goods (Wang et al. 2024; Li et al. 2025) but have seldom been included in a single empirical model. Building on previous work on traceability, technology acceptance and ethical consumption, the study combines a stated-preference survey with econometric models to link willingness to pay (WTP) for blockchain-verified products with perceptions of trust, perceived importance of transparency, and motivational drivers related to authenticity, safety and sustainability. By jointly modelling these attitudinal constructs together with education, income, age and other individual characteristics, the paper offers an integrated view of the determinants of WTP that has rarely been provided in prior research. In doing so, it contributes empirical evidence from a mature Mediterranean food market, shedding light on whether blockchain certification can effectively complement traditional quality schemes and under what consumer conditions it translates into a measurable price premium.

The remainder of the paper is structured as follows. Section 2 reviews the main theoretical and empirical contributions on blockchain-based food traceability, consumer trust, and WTP. Section 3 describes the data collection process and the methodological framework adopted, including the survey design and econometric models. Section 4 presents empirical results from the Logit, Probit, and OLS estimations. Section 5 discusses the findings in light of the existing literature. Section 6 concludes the paper, while Sections 7 and 8 outline the main limitations and directions for future research.

## 2 | Literature Review

This section synthesizes the main theoretical and empirical contributions underpinning the study, structured around four interconnected dimensions: the technological foundations of blockchain in food traceability, the role of consumer trust, the WTP for traceability attributes, and the influence of education, digital literacy, and ethical awareness on blockchain acceptance.

The increasing complexity of agri-food supply chains has intensified the demand for transparency and reliability of information. Within this framework, blockchain technology has emerged as a transformative enabler of traceability, allowing decentralized, immutable, and verifiable data exchange across the supply chain (Wang et al. 2024; Li et al. 2025). Unlike traditional databases, blockchain records every transaction in a tamper-proof ledger, mitigating risks of fraud and information asymmetry issues particularly acute in markets driven by credence attributes such as geographical origin, organic certification, and sustainability (Sgroi 2022; Modica et al. 2026). Empirical studies show that blockchain enhances authenticity, food safety, and consumer trust (Zhai and Sher 2023). However, adoption remains uneven: while institutional actors interpret blockchain as a tool for efficiency, consumers often perceive it symbolically, as a guarantee of honesty and ethical conduct rather than technological sophistication (Boukis 2020).

Blockchain introduces a new layer of technological trust, shifting credibility from institutional intermediaries to data-driven systems (Wang et al. 2024). Yet, as Reitano (2024) observes, trust in blockchain depends not only on transparency but also on perceived ethicality and credibility. In Italy, where PDO and PGI labels already carry symbolic weight as guarantees of authenticity, blockchain can strengthen but not replace traditional trust systems (Testi 2023). Consumers mainly associate blockchain with food safety and origin reliability (Zhai and Sher 2023; Zhang 2023), while its connection to environmental sustainability remains less immediate (Vriezen et al. 2023).

Across the literature, consumers are generally willing to pay a premium for traceability attributes that reduce uncertainty such as certified origin, organic labeling, or blockchain verification (Wang et al. 2024).

Blockchain acts as a high-quality information signal, justifying higher prices by providing verifiable data. Positive WTP for blockchain-labeled foods has been reported in several markets, though the magnitude depends on educational background and perceived importance of traceability (Zhai and Sher 2023; Zhang 2023). Recent empirical work shows consistently positive WTP for food products traced with blockchain-based systems, indicating that consumers are ready to pay a premium price for enhanced traceability and transparency. Using discrete choice experiments and random-parameter Logit models, studies on leafy greens, pasta, extra-virgin olive oil, fresh pork, and dairy products find that labels explicitly signaling blockchain-verified traceability significantly increase purchase probability and generate positive WTP relative to otherwise identical products without such information (Collart et al. 2025; Petrontino et al. 2024; Tran et al. 2024; Yang et al. 2025). In quantitative terms, these contributions document nonnegligible premiums for blockchain-based QR codes on leafy greens, pasta and extra-virgin olive oil, as well as higher WTP for pork and feta cheese when blockchain traceability is combined with credible certification schemes or communicated via QR codes. Overall, this literature suggests that blockchain acts as a valued credence attribute, with the associated price premium reflecting consumers' demand for greater supply-chain transparency, food safety and authenticity (Wang et al. 2024; Vazquez Melendez et al. 2024).

Regarding education and digital literacy consistently emerge as strong predictors of both blockchain acceptance and WTP (Li et al. 2025; Wang et al. 2024). Rooted in the Technology Acceptance Model (TAM) (Davis 1989; Venkatesh and Davis 2000), this relationship implies that perceived usefulness and ease of understanding influence adoption intentions. Ethical awareness reinforces this process: consumers who prioritize social and environmental values interpret blockchain as a moral and informational safeguard rather than a mere digital tool (Tan and Salo 2023).

Despite the growing literature, notable research gaps remain. Most existing analyses are centered in Asian markets, leaving European consumer behavior, particularly within Southern Europe's strong certification culture, largely underexplored (Vriezen et al. 2023; Testi 2023). Furthermore, many studies rely on experimental or hypothetical scenarios that may not capture actual consumer attitudes, and few empirically integrate trust,

education, and perceived importance into a unified framework explaining WTP.

## 3 | Data Collection and Methodology

Data related to consumers was collected through a questionnaire: the questionnaire was developed to investigate the role of blockchain technology in the agri-food sector from demand perspectives. The data were collected through an online questionnaire administered via Google Forms between September and October 2025. The survey targeted adult consumers residing in Italy and was distributed through social media channels, university mailing lists, and consumer forums related to food and sustainability.

This approach allowed for broad geographical coverage and access to diverse sociodemographic groups while maintaining cost-effectiveness and consistency in data collection.[1] The consumer questionnaire is fully structured and designed to measure awareness, attitudes, and WTP for blockchain-traceable food products. It is divided into four sections:

1. *Sociodemographic information*: gender, age, education, occupation, income, and place of residence.
2. *Food purchasing habits and quality evaluation*: frequency and place of food purchases, and importance attributed to price, quality, origin, certification, sustainability, and brand.
3. *Knowledge and perceived usefulness of blockchain*: previous awareness of the technology, perceived importance of transparency and traceability, and expected benefits such as safety, authenticity, and fraud prevention.
4. *WTP*: a hypothetical scenario comparing two identical food products (e.g., extra virgin olive oil), one with blockchain traceability and one without. Respondents were asked whether they would pay more for the blockchain-verified product and, if so, how much more (10% to over 50%). Additional questions explored motivations and barriers to purchase.

All questions were anonymous and compliant with GDPR regulations. The questionnaire included both multiple-choice and Likert-scale items to allow quantitative analysis of consumer preferences and firm perceptions.

The final dataset comprises 1500 valid responses from consumers distributed across all Italian regions, ensuring broad coverage in terms of geography, gender, and age groups.

Based on these data, the subsequent analysis adopts a quantitative econometric approach to identify the main determinants of WTP. Consistent with existing literature, numerous studies have employed Logit and Probit to analyze consumer choices and estimate the WTP for food products traced through blockchain-based labelling systems (Suhandoko et al. 2021; Contini et al. 2023; Yang et al. 2025; Miao et al. 2025). These models are typically applied to data from discrete choice experiments or hypothetical purchase scenarios, in which the presence of blockchain is treated as a product attribute (along with price, origin, quality characteristics, etc.), thereby allowing researchers to quantify the price premium consumers are willing to pay in exchange for greater transparency, safety, and reliability of supply-chain information (Shew et al. 2022; Petrontino et al. 2024; Collart et al. 2025). Specifically, a binary Logit model is estimated to assess the probability that a consumer declares a positive WTP for blockchain-traceable products, as a function of individual characteristics, trust in blockchain, perceived importance of traceability, and ethical motivations. The dependent variable $WTP_i = 1$ if the respondent is willing to pay more for a blockchain-verified product and 0 otherwise. Independent variables include *Trust_Blockchain*, *Trace_Importance*, *EduLevel*, *Income*, and Sustainability Motivation, while gender, age group, and purchase frequency are included as control variables.

The general form of the econometric model is expressed as

$$P_r\left(WTP_i = 1\right) = F(\beta_0 + \beta_1 Trust_i + \beta_2 Trace_i + \beta_3 Edu_i + \beta_4 Income_i + \beta_5 Sustain_I + \beta_6 Gender_i + \beta_7 Age_i + \beta_8 Freq_i)$$

where $F(\cdot)$ denotes the logistic cumulative distribution function.

In order to ensure the robustness of binary outcome estimation, both Logit and Probit specifications were employed to model consumers' WPS (WTP_yes).

Although the two models are conceptually similar, they rely on distinct assumptions regarding the distribution of the error term: the Logit model assumes a logistic distribution, while the Probit model is based on a standard normal distribution of the latent variable's disturbance term. Estimating both frameworks allows for cross-validation of parameter stability and marginal effects. If coefficients maintain sign, magnitude, and significance across the two specifications as observed in this study, the results can be considered robust to functional form assumptions. In addition, Logit coefficients are directly interpretable in terms of odds ratios, which facilitate communication of behavioral effects, whereas the Probit model provides slightly smoother probability transitions and is often preferred for theoretical comparability with latent variable models (Hailpern and Visintainer 2003; Elhorst et al. 2017).

Extra virgin olive oil was selected as the reference product because it is a high-value food strongly associated with origin, authenticity and quality certifications, making it particularly suitable for testing the added value of blockchain-based traceability. However, WTP for blockchain certification is likely to vary across food categories, and the results should therefore not be directly generalized to products with different risk profiles or consumption patterns.

## 4 | Results

### 4.1 | Descriptive Statistics

As shown in Table 1, females slightly prevail (52%) over males (45.7%), a composition that mirrors the demographic structure of the active consumer population in Italy and aligns with previous consumer studies in the agri-food sector. From an age

**TABLE 1** | Sociodemographic features of the interviewed sample ($N = 1500$).

| Characteristics | *N* | % |
|---|---|---|
| *Gender* | | |
| Male | 686 | 45.7 |
| Female | 780 | 52.0 |
| Others | 34 | 2.3 |
| *Age* | | |
| 18–30 | 438 | 29.2 |
| 31–45 | 612 | 40.8 |
| 46–60 | 310 | 20.7 |
| 60+ | 140 | 9.3 |
| *Educational level* | | |
| Lower secondary school | 324 | 21.6 |
| Upper secondary school | 635 | 42.3 |
| Bachelor's degree | 420 | 28.0 |
| Postgraduate | 121 | 8.1 |
| *Monthly net income €* | | |
| Low | 289 | 19.3 |
| Lower-middle | 440 | 29.3 |
| Middle | 396 | 26.4 |
| Upper-middle | 245 | 16.3 |
| High | 130 | 8.7 |
| *Purchase frequency* | | |
| Weekly | 510 | 34.0 |
| Twice a week | 438 | 29.2 |
| Monthly | 330 | 22.0 |
| Occasional/rarely | 222 | 14.8 |
| *Residence city (inhabitants)* | | |
| Large size (> 250,000) | 337 | 22.5 |
| Average size (between 5001 and 250,000) | 662 | 44.1 |
| Small size (up to 5000) | 501 | 33.4 |

*Source:* Our processing on data collected.

perspective, the 31–45 age group constitutes the largest segment (40.8%), followed by young adults aged 18–30 years (29.2%). Older respondents (46–60 years and 60+) together account for around 30% of the sample, ensuring an adequate generational balance and allowing inter-age comparisons in later analyses. Regarding educational attainment, the distribution reveals a well-educated population: over one-third (36%) of participants hold at least a university or postgraduate degree, while 42% have completed high school. The income structure is also balanced, with 45.6% of respondents in the middle or lower-middle categories and 25% in the upper-middle and high groups. Finally, in terms of purchase frequency, the majority of consumers buy food at least once per week (63%), confirming a regular engagement with food shopping.

Table 2 presents the descriptive statistics for the attitudinal and motivational variables measured on a 5-point Likert scale. Specifically, respondents were asked how important they consider traceability and transparency when choosing food products, with answers ranging from 1 = *not at all important* to 5 = *very important*. They were then asked how useful they consider a blockchain-based labelling system for increasing their trust in agri-food products, with responses from 1 = *not at all useful* to 5 = *very useful*.

The internal consistency of the Likert-scale items was assessed using Cronbach's α. The scales measuring trust in blockchain and perceived importance of traceability show acceptable reliability, with α values exceeding the conventional threshold of 0.70. Although these indicators do not capture all possible dimensions of trust (e.g., technological versus institutional trust), they provide a coherent and internally consistent proxy for consumers' overall perceptions of blockchain-based traceability.

In addition, perceived benefits of blockchain traceability were measured through a multiple-choice question in which respondents could select one or more of the following options: greater food safety, guarantee of supply-chain authenticity, clear information on the origin of raw materials, and reduction of fraud risk. Each benefit was coded as a dichotomous variable (0 = not selected, 1 = selected).

Average values for trust in blockchain (mean = 2.8) and traceability importance (mean = 2.8) indicate an intermediate level of agreement across respondents. Motivational items such as safety (mean = 3.2), sustainability, authenticity, and transparency (means≈2.7–2.8) register comparable values, suggesting internally consistent perceptions of product quality and reliability. Perceived barriers show low incidence, particularly for price (0.23) and limited knowledge (0.31), while perceived benefit, especially safety (0.55) and provenance (0.51), record higher frequencies.

## 4.2 | Preliminary Test

These preliminary diagnostics validate the specification of the subsequent Logit, Probit, and OLS models.

Tables 3a and 3b reports the results of the preliminary statistical checks performed before the econometric estimation. Pairwise correlations among explanatory variables are moderate and below the conventional threshold of 0.80, indicating the absence of strong linear dependencies. The highest correlation is observed between *Trust_Blockchain* and *Trace_Importance* ($\rho = 0.68$), which remains within acceptable limits for multivariate analysis. Variance inflation factors (VIF) were then computed to verify potential collinearity issues. All VIF values are below 2.5, and the mean VIF equals 1.50, confirming that the explanatory variables can be included simultaneously in the regression models without generating instability in coefficient estimates.

**TABLE 2** | Descriptive statistics of attitudinal and motivational variables.

| Variable | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| *Trust_Blockchain* | 2.8 | *1.25* | *1* | *5* |
| *Trace_Importance* | 2.8 | *1.22* | *1* | *5* |
| *Motiv_Safety* | 3.22 | *1.1* | *1* | *5* |
| *Motiv_Sustainability* | 2.77 | *1.16* | *1* | *5* |
| *Motiv_Authenticity* | 2.77 | *1.1* | *1* | *5* |
| *Motiv_Transparency* | 2.79 | *1.14* | *1* | *5* |
| *Barrier_Price* | 0.23 | *0.42* | *0* | *1* |
| *Barrier_LowKnowledge* | 0.31 | *0.46* | *0* | *1* |
| *Barrier_Indifference* | 0.19 | *0.4* | *0* | *1* |
| *Barrier_LowTrust* | 0.22 | *0.42* | *0* | *1* |
| *Benefit_Perc_Safety* | 0.55 | *0.5* | *0* | *1* |
| *Benefit_Perc_ Authenticity* | 0.44 | *0.5* | *0* | *1* |
| *Benefit_Origin* | 0.51 | *0.5* | *0* | *1* |
| *Benefit_Antifraud* | 0.42 | *0.49* | *0* | *1* |

*Source:* Our processing on data collected.

**TABLE 3a** | Correlation matrix among variables.

| *Variable* | *Trust_ Blockchain* | *Trace_ Importance* | *Educational Level* | *Income* | *Motiv_ Sustainalibilty* | *Purchase_ Freq* |
|---|---|---|---|---|---|---|
| *Trust_Blockchain* | 1 | 0.68 | 0.21 | 0.07 | 0.57 | 0.48 |
| *Trace_Importance* | | 1 | 0 | 0.13 | 0.55 | 0.45 |
| *EduLevel* | | | 1 | 0.41 | 0.2 | 0.1 |
| *Income* | | | | 1 | 0.11 | 0.12 |
| *Motiv_Sustainability* | | | | | 1 | 0.46 |
| *PurchaseFreq* | | | | | | 1 |

**TABLE 3b** | Multicollinearity checks.

| Variable | VIF | 1/VIF |
|---|---|---|
| *Trust_Blockchain* | 2.18 | 0.46 |
| *Trace_Importance* | 2.12 | 0.47 |
| *Motiv_Sustanaibility* | 1.69 | 0.59 |
| *PurchaseFreq* | 1.44 | 0.69 |
| *EduLevel* | 1.3 | 0.77 |
| *Income* | 1.22 | 0.82 |
| *AgeGroup* | 1.01 | 0.99 |
| *Gender* | 1 | 1 |
| **Mean VIF** | **1.5** | |

### 4.3 | Regression Models

Table 4 presents the results of the Logit and Probit estimations for the binary dependent variable WTP_yes, which captures whether respondents are willing to pay a premium for blockchain-certified products. Both models are statistically significant ($p < 0.001$) and exhibit a high explanatory power (Pseudo $R^2 \approx 0.51$). The coefficients show consistent sign, magnitude, and significance across the two specifications. *Trust_Blockchain* and *Trace_Importance* are positively and significantly associated with the probability of expressing WTP, while *Income* and *PurchaseFreq* also exert significant positive effects. Other variables, such as *Education* and *Gender*, are not statistically significant.

Table 5 reports the marginal effects derived from the Logit and Probit estimations. All coefficients maintain sign and relative

magnitude across the two models, confirming parameter stability. The marginal effects quantify the change in the probability of a positive WTP_yes response associated with a one-unit increase in each explanatory variable, holding the others constant. The variables *Trust_Blockchain*, *Trace_Importance*, *Income*, and *PurchaseFreq* show the largest marginal impacts, although the absolute variations are limited due to the already high baseline probability of WTP within the sample. Other covariates, including *Education* and *Gender*, display no significant marginal effects.

**TABLE 4** | Logit and Probit models on willingness to pay (WTP_yes).

| Variable | Logit coefficient | (SE) | Probit coefficient | SE |
|---|---|---|---|---|
| *Trust_ Blockchain* | 1.44*** | 0.22 | 0.77*** | 0.11 |
| *Trace_ Importance* | 1.54*** | 0.22 | 0.86*** | 0.12 |
| *EduLevel* | 0.23 | 0.21 | 0.1 | 0.11 |
| *Income* | 0.68*** | 0.12 | 0.38*** | 0.07 |
| *Motiv_ Sostenibilita* | 0.01 | 0.15 | 0 | 0.08 |
| *Gender* | 0.31 | 0.25 | 0.15 | 0.14 |
| *AgeGroup* | 0.03 | 0.13 | 0.02 | 0.07 |
| *PurchaseFreq* | 0.63*** | 0.17 | 0.35*** | 0.09 |
| *Constant* | −6.69*** | 0.83 | −3.62*** | 0.45 |

*$p < 0.01$.
**$p < 0.05$.
***$p < 0.10$.

**TABLE 5** | Marginal effects.

| Variable | *dy/dx* (Logit) | *dy/dx* (Probit) |
|---|---|---|
| *Trust_Blockchain* | 0.0013 | 0.0013 |
| *Trace_Importance* | 0.0015 | 0.0015 |
| *Income* | 0.0007 | 0.0007 |
| *PurchaseFreq* | 0.0006 | 0.0006 |

Table 6 reports the results of the OLS regression estimated on the continuous dependent variable *WTP_extra*, representing the additional amount (in euros) that 1307 respondents are willing to pay for extra virgin olive oil blockchain-certified products. The model includes socio-demographic and behavioral variables as predictors. The results show that *Income*, *Education Level*, and *Purchase Frequency* have a positive and statistically significant effect on the premium amount. *AgeGroup* exhibits a negative coefficient, indicating a decreasing tendency of WTP with increasing age, while *Gender* displays a modest positive association. The adjusted $R^2$ of 0.41 indicates a satisfactory explanatory capacity for a behavioral model based on stated preferences.

## 5 | Discussion

The empirical analysis highlights consistent determinants of consumers' WTP for blockchain-certified agri-food products. Attitudinal variables particularly *Trust_Blockchain* and *Trace_ Importanc*e merge as the most relevant predictors, confirming that perceptions of reliability and transparency are central in shaping purchasing intentions. Socio-demographic factors such as *Income* and *Education* also contribute positively, indicating that higher economic capacity and informational background favor a greater acceptance of price premiums. Conversely, *Age* shows a weak negative effect, suggesting lower responsiveness among older consumers, while *Gender* does not exert a significant influence. Across all model specifications, the results remain stable in sign, magnitude, and significance, supporting the robustness of the findings. The high pseudo-$R^2$ values obtained in the Logit and Probit models and the satisfactory fit of the OLS regression confirm the internal coherence of the analytical framework. These patterns are consistent with previous evidence on blockchain-based food traceability. Studies applying structural models show that trust in blockchain systems and perceived transparency of product information are among the strongest predictors of purchase intention and WTP for blockchain-labeled foods (Sepe 2024; Duong et al. 2024). In a similar vein, research on organic olive oil demonstrates that the importance attached to product traceability significantly increases consumers' WTP, with traceability acting as a key

**TABLE 6** | OLS model on premium amount (subsample WTP_yes = 1).

| Variable | Coefficient | Standard error | *t* | *p* | 95% CI lower | 95% CI upper |
|---|---|---|---|---|---|---|
| *Income* | 0.864*** | 0.112 | 7.71 | 0.000 | 0.644 | 1.084 |
| *EduLevel* | 1.914*** | 0.149 | 12.86 | 0.000 | 1.622 | 2.206 |
| *AgeGroup* | −0.091 | 0.133 | −0.68 | 0.495 | −0.353 | 0.170 |
| *Gender* | 0.365 | 0.247 | 1.48 | 0.140 | −0.119 | 0.849 |
| *PurchaseFreq* | 3.054*** | 0.135 | 22.67 | 0.000 | 2.790 | 3.318 |
| *Constant* | 4.499*** | 0.670 | 6.71 | 0.000 | 3.185 | 5.814 |

*Note:* Observations = 1307; $R^2 = 0.4135$; Adjusted $R^2 = 0.4114$; Root MSE = 4.6598.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.10$.

mediator between perceived authenticity and price premiums (Marozzo et al. 2022). The weakly negative effect of Age also echoes meta-analytic and empirical evidence that younger, more tech-savvy consumers display stronger intentions to adopt blockchain traceability and higher WTP for credence attributes than older cohorts (Gorton et al. 2023; Sepe 2024). Finally, the lack of a robust *Gender* effect is consistent with several studies on blockchain-certified or traceable foods, which find that socio-demographic variables especially gender often have limited explanatory power once attitudinal factors such as trust, risk perception and knowledge are controlled for (Ershadrad 2024).

An interesting and somewhat unexpected result concerns the role of sustainability-related motivations. Despite the centrality of sustainability in policy and academic debates on digital transformation in agri-food systems, the sustainability motivation variable does not significantly affect the probability of expressing a WTP. This suggests that, for consumers, the link between blockchain and environmental sustainability is less immediate than its association with safety, authenticity and origin. In mature food markets such as Italy, where sustainability claims are already conveyed through established labels, blockchain appears to be primarily interpreted as a tool for verification and risk reduction rather than as an explicit environmental signal.

## 6 | Conclusions

This paper sets out to investigate how consumers value blockchain-verified traceability in the agri-food sector, focusing on a mature Mediterranean food economy where traditional quality schemes such as PDO and organic labels are already well established. By combining survey data with Logit, Probit, and OLS models, the analysis provides novel empirical evidence on both the probability of accepting a price premium and the size of the additional WTP for blockchain-certified products. Overall, the results show that blockchain is not perceived as a purely technological add-on, but as a trust-enhancing device that matters when it is clearly connected to transparency, authenticity, and food safety.

A first key finding is the central role of attitudinal variables. Across all model specifications, *Trust_Blockchain* and *Trace_Importance* emerge as the most consistent and robust predictors of WTP. Consumers who perceive blockchain as reliable and who attach high importance to product traceability are significantly more likely to pay a premium and to state higher additional WTP values. This confirms that the economic value of blockchain in food markets is largely mediated by subjective perceptions of reliability and transparency, rather than by the mere presence of a technological label on the package. Motivational constructs related to authenticity, safety and transparency reinforce this pattern: individuals who see blockchain traceability as a way to guarantee an authentic supply chain, reduce fraud and enhance food safety are systematically more inclined to reward these attributes through higher prices.

A second important result concerns the role of socio-demographic characteristics. Income and Education have a clear and positive impact on consumers' WTP for blockchain-certified products. Higher income levels are associated with greater economic capacity to absorb price premiums, while higher education likely reflects better understanding of credence attributes, greater familiarity with digital technologies and stronger sensitivity to issues such as transparency and sustainability. By contrast, *Age* shows only a weak and negative association with WTP, suggesting that older consumers are somewhat less responsive to blockchain-based traceability, possibly due to lower digital confidence or more skeptical attitudes towards technological innovations in food. *Gender* does not exert a statistically significant effect once attitudinal and motivational factors are controlled for, indicating that differences between men and women are largely mediated by their underlying beliefs and preferences rather than by gender per se.

The consistency of these patterns across Logit, Probit, and OLS models strengthens the credibility of the findings. The main coefficients retain their sign, magnitude, and significance under different estimation strategies, and the models display satisfactory goodness-of-fit (with relatively high pseudo-$R^2$ for Logit and Probit and a solid $R^2$ for the OLS regression on WTP levels). Taken together, this points to a stable and internally coherent empirical structure, where attitudinal and motivational factors systematically outperform basic socio-demographic traits in explaining consumers' WTP for blockchain-verified products. In other words, *who* the consumer is (in socio-demographic terms) matters, but *what they think and feel* about blockchain, traceability, and information quality matters even more.

From a practical standpoint, the results have important implications for producers, retailers and policymakers. First, they suggest that introducing blockchain traceability into agri-food chains can generate a measurable price premium, but only under the condition that the technology is effectively communicated as a credible mechanism for enhancing transparency, authenticity and safety. Simply adding a QR code or a blockchain logo to existing labels is unlikely to unlock the full WTP potential if consumers do not understand the added value it provides. Second, in contexts like Italy, where PDO, organic and other quality schemes already play a major signaling role, blockchain should be framed as a complementary layer of verification that strengthens rather than substitutes existing certification systems. This means highlighting how blockchain can document each step of the supply chain and support the credibility of origin and quality claims that consumers already value.

Finally, the study contributes to the broader debate on the social sustainability of digital innovations in food systems. By showing that the economic success of blockchain traceability depends on intangible factors such as trust, perceived transparency, and ethical or sustainability-related motivations, the findings remind us that technological solutions alone are not sufficient to rebuild confidence in food chains. Investments in consumer education, digital literacy and clear communication are needed to ensure that the benefits of blockchain are both understood and appreciated, especially among segments that may be more vulnerable to information overload or technological scepticism. In this sense, blockchain can become not only a tool for technical traceability but also a vehicle for reshaping the relationship between producers and consumers around shared values of responsibility, authenticity, and safety.

## 7 | Limitations

First, the analysis is based on stated-preference data and a hypothetical WTP scenario. As such, the estimated WTP reflects self-reported intentions rather than observed market behavior and may be affected by hypothetical bias and social desirability bias. Consequently, the premium price estimated through the econometric models should be interpreted as an upper-bound measure of consumers' valuation rather than as a direct prediction of actual market prices. Nevertheless, the relative magnitude and significance of the coefficients remain informative for identifying the main drivers of WTP.

Second, the data are drawn from a nonprobabilistic online sample collected through social media, university mailing lists, and consumer forums. While this approach ensured wide geographical coverage and a large number of observations, it may introduce self-selection bias, potentially overrepresenting individuals with higher education, greater digital familiarity, and stronger interest in food quality and sustainability issues. As a result, the findings should not be interpreted as nationally representative. This limitation primarily affects the external validity of the results, whereas the internal relationships between trust, traceability perceptions, and WTP remain informative within the observed population.

Third, the empirical analysis is conducted within a specific national and institutional context. Italy is characterized by a strong presence of traditional quality certification schemes (e.g., PDO, PGI and organic labels) and a high consumer sensitivity to origin and authenticity. Therefore, generalizations beyond the Italian or Mediterranean context should be made with caution, as consumer perceptions of blockchain-based traceability may differ in countries with weaker certification systems or different regulatory and cultural environments.

Finally, key explanatory variables such as trust in blockchain and the perceived importance of traceability are measured through self-reported Likert scales. While these measures show acceptable internal consistency, they may not fully capture the multidimensional nature of consumers' beliefs and knowledge about blockchain technology (e.g., technological vs. institutional trust). Moreover, the econometric models treat attitudes, perceptions and WTP as exogenous, even though these constructs may be jointly determined. Potential endogeneity and unobserved heterogeneity are therefore not explicitly addressed and should be considered when interpreting the estimated coefficients.

## 8 | Future Directions

Future research could address these limitations in several ways. First, combining stated-preference data with revealed-preference information (e.g., scanner data, field experiments, or actual purchases of blockchain-certified products) would help to validate and refine the WTP estimates obtained here. Experimental or quasi-experimental designs could also be used to test the causal impact of different communication strategies (e.g., varying the content and framing of blockchain-related information) on trust and WTP.

Second, comparative studies across countries and certification regimes would allow researchers to explore how institutional context, baseline trust in food regulation, and existing quality labels (PDO, organic, fair trade) interact with blockchain traceability. This would be particularly useful for understanding whether blockchain primarily reinforces established trust structures or acts as a disruptive innovation in markets with weaker certification systems.

Third, future work could employ richer modelling approaches, such as structural equation modelling or latent class models, to capture the interrelationships between knowledge, trust, perceived benefits and WTP, and to identify distinct consumer segments with heterogeneous preferences for blockchain certification. Finally, further research on the role of digital literacy, sustainability attitudes and ethical concerns would shed light on how evolving societal values and technological familiarity shape the long-term adoption and economic valuation of blockchain-verified food traceability.


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### Endnotes

[1] However, the sampling design was non-probabilistic and based on voluntary participation, which limits the possibility of generalizing results to the entire Italian population. Despite this, the sample composition ensures a high level of internal consistency and adequate variability for econometric analysis, making it suitable for exploratory research on emerging consumer behaviors.

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