Hedonic price analysis of Central American specialty coffee auctions from 2016 to 2024

Leopoldo Dimas[1] ; Marvin Calix[2] ; Luis Sandoval[3]

[1,2]Universidad Zamorano, Honduras, *leopoldo.dimas@est.zamorano.edu, mcalix@zamorano.edu*

[3]Texas Tech University, United States of America, *luis.sandoval@ttu.edu*

Abstract– Coffee is one of the most important agricultural products worldwide. Currently, the coffee market presents significant challenges for producers. Therefore, the present study analyzes the factors that determine the price per pound of coffee in the Cup of Excellence® auctions across five Central American countries (El Salvador, Honduras, Guatemala, Nicaragua, and Costa Rica) during the period 2016–2024. A hedonic pricing model was applied to estimate the effect of variables such as variety, quality score, processing method, producing country, and year of participation on the final price. The estimated model explained 66.8% of the variability in the logarithmic price per pound. The results indicate that a higher cupping score significantly increases the price per pound by 35.80%. Among the varieties, Geisha coffee showed the smallest decrease of 0.90% in price compared to the reference variety (Bourbon). Regarding processing methods, natural processing showed the smallest price reduction of 4.40%, while washed and honey processing reflected larger decreases. Among the countries, Guatemala stood out with a 41.20% price increase compared to El Salvador, while Nicaragua showed a reduction of 10.60%. The study also found an upward trend in prices over time, with an average annual increase of 1.11%. It is concluded that the perceived quality of coffee, measured by attributes such as cupping score and country of origin, significantly influences price formation in the specialty coffee market and contributes to narrowing an academic gap on the subject. Finally, it is recommended to expand the analysis at a global level and to consider additional variables such as certifications, lot size, and buyer characteristics.

Keywords-- coffee, Central America, hedonic price analysis, auctions, price

I. INTRODUCTION

Coffee is a stimulating beverage obtained from the roasting and grinding of the coffee bean, primarily from the *Coffea arabica* and *Coffea canephora* (known as Arabica and Robusta, respectively) plants, native to tropical regions of Africa and introduced to the Americas during the 18th century [1]. Coffee is one of the most important agricultural products worldwide, as it is among the most traded commodities, especially for exporting countries, where it can account for a large portion of their export revenues. For instance, in 2024, Brazil exported coffee valued at approximately 11.4 billion U.S. dollars [2]. This market is projected to grow at a compound annual rate of 5.4% between 2024 and 2030, driven by increased consumption and the global expansion of coffee shop chains.[3]

Coffee is not only a globally traded commodity but also a product with deep cultural and social relevance. It is estimated that more than 2.25 billion cups of coffee are consumed worldwide each day, connecting smallholder farmers in producing countries to consumers across the globe [4]. This highlights the unique role of coffee in international agri-food systems, where production and consumption are directly linked across continents [5].

Given that approximately 70% of the world's coffee is produced by 25 million smallholder farmers and their families, it serves as an essential source of income and a significant job generator [6].

Beyond its economic importance, coffee production sustains rural development by generating employment and stabilizing local economies. Studies show that income from coffee provides critical livelihood security for millions of households, especially in regions with limited diversification opportunities [7,8]. This implies that volatility in coffee markets directly affects food security and community resilience.

Currently, the coffee market poses major challenges for coffee growers due to price instability caused by uncertainties affecting production, commercialization, and other key factors such as climate variability, rising labor costs, increased market segmentation, and the growing demand for specialty coffees in industrialized countries [9]. This instability negatively impacts small-scale farmers who rely on coffee production, making it difficult to secure income for future growing seasons.

Furthermore, climate change poses a severe threat to coffee cultivation. Rising temperatures, irregular rainfall patterns, and the spread of pests and diseases, such as coffee leaf rust (*Hemileia vastatrix*), have already caused significant yield losses in major producing regions [10]. These risks not only reduce farmer income but also jeopardize long-term global supply stability, making research into quality, adaptation, and resilience increasingly urgent.

Within the coffee market, specialty coffee has emerged as an alternative with economic, social, and environmental benefits for producers who focus on this segment. It requires the implementation of sustainable agricultural practices, research, and technological innovation aimed at producing higher-quality beans. These beans exhibit complex flavors and aromas and must meet certain standards, such as careful selection, proper processing, and a balanced, distinctive flavor and aroma profile [11]. As a result, they command a higher price than conventional coffee [12]. All coffee beans can be graded on a 100-point scale through a process known as "cupping." Coffee is considered "specialty" if it scores above 80 points. The cupping process follows a specific protocol that involves grinding the beans, brewing them with hot water, and

5th LACCEI International Multiconference on Entrepreneurship, Innovation and Regional Development - LEIRD 2025

"Entrepreneurship with Purpose: Social and Technological Innovation in the Age of AI" - Virtual Edition, December 1 – 3, 2025   1

tasting through short, slurping sips to spread the liquid across the tongue, allowing for detailed assessment of the coffee's attributes. This procedure is fundamental in the coffee industry for quality control, bean selection, and flavor profile determination.

Specialty coffee thus emerges as a promising alternative, offering both market opportunities and pathways toward sustainability. Its emphasis on traceability and quality aligns with growing consumer demand for environmentally and socially responsible products [13]. Consequently, the specialty coffee sector has attracted the attention of policymakers and researchers alike, as it can simultaneously foster rural development and meet global sustainability goals [14].

The most prestigious award for specialty coffees is the Cup of Excellence®, where the scrutiny applied to participating beans is the most rigorous in the industry [15] Winning auction prices can reach values up to forty times higher than market rates, with most of the proceeds going directly to the farmer [16].

During the auction, quality attributes are evaluated through cupping: the process of grinding, roasting, brewing, and finally tasting the coffee. Cupping is conducted by expert international judges. The evaluated attributes include aroma, flavor, acidity, body, cleanliness of the cup, mouthfeel, and sweetness. These components contribute to a score of 100, with coffees scoring above 86 points advancing to the Cup of Excellence® auction [17]

The sophistication of the global specialty coffee market has spurred academic interest in understanding the factors that determine the price of this product in international auctions such as the Cup of Excellence®. Hedonic pricing models have been widely used to estimate the value buyers assign to a product based on its various attributes, whether material or symbolic [18]. Therefore, this type of analysis becomes relevant in the context of Cup of Excellence® auctions, serving as a platform for recognizing high-end coffees.

Academic interest is evidenced in studies on hedonic pricing, such as the work by [19], who analyzed over two thousand auction observations from 2004 to 2015 across eleven producing countries. The study applied econometric models to evaluate both sensory attributes (such as flavor profile, body, acidity, aftertaste, and aroma) and symbolic attributes (such as botanical variety, processing method, altitude, certification, and country of origin) on final sale prices. The results showed that although material attributes are important in determining a coffee score, final prices are strongly influenced by symbolic attributes and the context of the sale, including the market, the number of coffees auctioned, or the reputation of the coffee's origin.

Another study in Central America by [20] focused on El Salvador. Using Cup of Excellence® data from 2015–2020, the author found that attributes such as the Geisha variety, African bed drying, and anaerobic processing significantly increased the price per pound of coffee in auctions. Such work highlights the importance of market preference information regarding Salvadoran coffee.

Despite the relevance of these studies, a significant academic gap still exists regarding systematic analyses of the attributes that influence price formation in Central American specialty coffee auctions. This gap is especially relevant given that countries such as Honduras, Guatemala, El Salvador, Nicaragua, and Costa Rica have historically played leading roles in the differentiated coffee market [21]. Furthermore, since 2016, there have been no updated regional analyses using recent data that reflect the evolution of the coffee market and the preferences of international buyers.

Despite progress in literature, significant knowledge gaps persist regarding the determinants of specialty coffee prices in Central America. Hedonic pricing approaches have proven valuable for agricultural markets in general 22], but specialty coffee presents a unique case where symbolic attributes, such as origin or variety, interact strongly with measurable sensory attributes to influence price formation [23]. Addressing these gaps is critical for producers and institutions seeking to improve competitiveness in international markets.

In this context, the importance of this study lies in three key areas. First, it updates knowledge about coffee market preferences by incorporating recent data and expanding the geographical scope of analysis. Second, it helps identify coffee attributes that buyers value most, information that is crucial for specialty coffee producers seeking to adapt their production or post-harvest practices. Finally, it contributes to the academic literature on hedonic pricing for agricultural products, focusing on a time period and regional scope that has been explored little.

Thus, this study contributes not only to the academic need for updated information but also to the practical needs of the Central American coffee sector, which depends on reliable data to face the challenges of a highly competitive, evolving, and demanding market.

Therefore, the general objective of this study is to identify the impact of the attributes evaluated in the Cup of Excellence® auction to guide the achievement of higher coffee prices. The specific objectives are to conduct a hedonic price analysis of Central American specialty coffee auctions from 2016 to 2024 and to identify the specialty coffee attributes preferred by buyers and associated with higher prices in Central American auctions.

II. METHODOLOGY

A. Hedonic Pricing Model
The modeling of hedonic prices involves a separate market valuation of a good or service based on its attributes. This approach uses the systematic variation in prices attributed to the characteristics of goods to determine the willingness to pay for such features [24].

B. Data
The dataset used for this study was compiled from the participating coffees in the Cup of Excellence® auctions held in five Central American countries: El Salvador, Honduras,

Nicaragua, Costa Rica, and Guatemala, covering the years from 2016 to 2024. The sample size includes 1,191 coffees from this period. The data were collected from the official Cup of Excellence® website and transcribed into a Microsoft Excel file. The variables evaluated in this study are: "price per pound," "auction year," "score," "producing country," "variety," and "processing method."

It is important to highlight that for the variable "producing country," five levels were analyzed: El Salvador, Honduras, Nicaragua, Costa Rica, and Guatemala. El Salvador was used as the reference level due to its long-standing coffee history and being one of the first Central American countries to participate consistently and prominently in the international Cup of Excellence® competition, starting in 2003 [25]. This positions it as a regional benchmark. Additionally, it has a strong institutional framework surrounding coffee, led by the Salvadoran Coffee Council and organizations like PROCAFE, which has allowed it to maintain a consistent presence in highly valued international lots.

For the "variety" variable, five levels were analyzed: Pacamara, Bourbon, Caturra, Geisha, and Others. Bourbon was set as the reference level, being the most frequently occurring variety. For the "processing" variable, four levels were used: Washed, Natural, Honey, and Anaerobic. Anaerobic was selected as the reference level, being the most frequent processing method.

C. Data Processing

The public dataset from the Cup of Excellence® was cleaned using Microsoft Excel. The information was transcribed into an organized grid, and data was standardized to avoid issues during analysis. Variables such as average harvest altitude or purchasing companies, although present on the website, were excluded due to being too extensive, incomplete, or having too few observations. The variety variable was modified by grouping all varieties with very few observations into a single category called "Others." Finally, all categorical variables used in this study were converted into dummy (binary) format.

D. Empirical model

The natural logarithm of the price per pound was modeled as a function of the previously discussed independent variables. The empirical model is expressed as follows:

$$\text{LN(Price per pound)} = \beta_0 + \beta_1(\text{Score}) + \beta_2(\text{Auction year}) + \beta_3(\text{Honduras}) + \beta_4(\text{Guatemala}) + \beta_5(\text{Nicaragua}) + \beta_6(\text{Costa Rica}) + \beta_7(\text{Pacamara}) + \beta_8(\text{Caturra}) + \beta_9(\text{Geisha}) + \beta_{10}(\text{Others}) + \beta_{11}(\text{Washed}) + \beta_{12}(\text{Honey}) + \beta_{13}(\text{Anaerobic}) \quad (1)$$

Where "score" refers to the final cupping score the coffee received, "auction year" is the year the coffee was sold and evaluated, and Honduras, Guatemala, Nicaragua, and Costa Rica are coffee-producing countries in Central America with origin denominations. Pacamara, Caturra, and Geisha are coffee varieties produced in the region. "Others" is a group of less common coffee varieties such as Bernardina, Kenya, Kenya-SL28, SL28, among others. Washed, Honey, and Anaerobic refer to the post-harvest processing methods used for coffee.

To interpret the coefficients, the following formula was applied:

$$\left(e^{\beta_i} - 1\right) * 100 \quad (2)$$

This formula was used to perform the anti-logarithmic transformation of the numerical coefficients into percentages, allowing the results to be interpreted in terms of percentage changes. By using a multiplicative model with the dependent variable in logarithmic form, the interpretations of the results represent the percentage increase or decrease in the dependent variable for a one-unit increase in the independent variable [26].

E. Model Diagnostics

To assess the validity of the regression assumptions, a series of diagnostic tests were applied. First, heteroscedasticity was examined using the Breusch–Pagan test. Additionally, the influence of individual observations was analyzed using Cook's distance. To account for potential heteroscedasticity, heteroscedasticity-robust (HC) standard errors were computed. Finally, bootstrapped standard errors with 1,000 replications were estimated to further validate inference without relying on parametric assumptions.

F. Statistical Software

Microsoft Excel was used for data cleaning and manipulation, and the model estimation was performed using JASP version 0.18.1.0.

III. RESULTS

The results of the model are presented in four parts. First, descriptive statistics of the variables included in the model are shown, including frequency, mean, standard deviation, and minimum and maximum values. Second, the results of the hedonic price model are presented, along with the respective analysis and discussion. Third, the model diagnostics are analyzed and discussed as well. Finally, an overall synthesis of the mentioned parts.

A. Descriptive Statistics

TABLE I
SUMMARY STATISTICS

Variable	N	X̄	σ
Price per pound (USD)	1190	22.57	23.82

(LN) price	1190	2.81	0.70
Score	1190	88.63	1.47
Auction year	1190	2020.19	2.58
Producing Country			
El Salvador	238	20.00	0.40
Honduras	246	20.67	0.40
Guatemala	271	22.77	0.42
Costa Rica	255	21.42	0.41
Nicaragua	180	15.12	0.35
Variety			
Pacamara	202	16.97	0.37
Bourbon	61	5.12	0.22
Caturra	50	4.20	0.20
Geisha	344	28.90	0.28
Other	436	36.63	0.36
Process			
Anaerobic	37	3.10	0.17
Natural	302	25.37	0.43
Washed	583	48.99	0.50
Honey	215	18.06	0.38

Using the variables "price per pound," "auction year," "score," "producing country," "variety," and "processing," the model explained 66.8% of the behavior of the natural logarithm of price (R^2) and showed a coefficient of variation (C.V.) of 14.19%.

B. Hedonic Model Results

TABLE II
MODEL RESULTS

Modelo	Coefficients	p-value		Percentage Change
Intercept	-46.57	< .001		
Auction Year	0.011	0.028	**	1.11
Score	0.306	< .001	***	35.80
Producing Country				
Honduras	0.203	< .001	***	22.51
Nicaragua	-0.112	0.019	**	-10.60
Guatemala	0.345	< .001	***	41.20
Costa Rica	0.22	< .001	***	24.61
Variety				
Caturra	-0.116	0.115		-10.95
Geisha	0.316	< .001	***	37.16
Pacamara	0.009	0.874		0.90
Other	-0.047	0.386		-4.59
Processing Method				
Washed	-0.126	0.093	*	-11.84
Honey	-0.09	0.22		-8.61
Natural	-0.045	0.552		-4.40
R^2	0.668			

Note. *, **, ***, denote significance at the 0.1, 0.05, and 0.01 levels, respectively.

Regarding the "auction year" variable, the model suggests that for each additional year the auction occurred, the price per pound of coffee increased by an average of 1.11%. This growth indicates a progressive increase in the willingness to pay for specialty coffee over time. Additionally, rising global demand, driven in part by increased consumption in countries like China, has placed further upward pressure on prices.

For the "score" variable, it was found that for every additional point in the final cupping score, the average price per pound increased by 35.80%. As noted by [20], considering that scores typically exceed 80 points, the score a coffee receives in the Cup of Excellence® competition is an important factor producers should consider.

The third variable in the regression is the "producing country." The reference level for this analysis was El Salvador. The percentage differences between countries and their respective coefficients represent the average change in comparison to El Salvador. Coffee produced in Honduras is associated with an average price per pound that is 22.51% higher than that of El Salvador. In contrast, Nicaragua showed a negative coefficient, meaning that the average price per pound is 10.60% lower than El Salvador. Meanwhile, Guatemalan coffee is associated with an average price that is 41.20% higher than that of El Salvador, the largest positive and significant effect among all countries, indicating strong market positioning in terms of quality or preference. Lastly, Costa Rican coffee obtained prices that were, on average, 24.61% higher than Salvadoran coffee. The country of origin has a significant differential effect on the price per pound in auctions, with Guatemala and Honduras showing the most positive and significant impacts. As [27] mentions, after the decline of coffee as the main export product, each Central American country transitioned to different alternative crops, which led to differentiated market valuations. Countries like Honduras and Guatemala established agro-export structures based on crops such as bananas and African palm, strengthening their participation in global value chains. In contrast, El Salvador faced greater challenges in adapting to this new model due to its limited land base and less diversified production, which influenced the lower valuation of its agricultural products in international markets. This historical disparity helps contextualize current differences in the perception and valuation of coffee by country of origin.

The "variety" variable showed different results across levels. Bourbon was used as the reference variety in the analysis. Caturra showed a negative coefficient, meaning that, on average, the price per pound for this variety is 10.95% lower than that of Bourbon. On the other hand, the Geisha variety showed a positive coefficient, indicating that its average price per pound is 37.16% higher than Bourbon. Although there was not a large percentage change, Pacamara showed a positive coefficient, meaning that its price per pound is 0.90% higher than Bourbon on average. Lastly, the "Other" category, which includes various less common coffee varieties also had a negative coefficient, indicating that the price per pound is, on average, 4.59% lower than that of Bourbon. As highlighted by [28], different coffee varieties possess unique traits in flavor, aroma, and disease resistance, all of which influence their market valuation. Factors such as plant

genetics, growing conditions, and consumer preferences determine the demand and price of each variety. This combination of genetic and environmental factors contributes to the differentiated valuation of coffee varieties in the global market.

Finally, regarding the "processing" variable, various levels were evaluated using Anaerobic as the reference category. The "Washed" process had a negative coefficient, meaning that coffees processed this way were, on average, valued 11.84% lower per pound compared to Anaerobic processing. The "Honey" process also had a negative coefficient, with an average price per pound 8.61% lower than the reference. The "Natural" process also showed a negative coefficient, meaning that the average price per pound was 4.40% lower than that of Anaerobic processing. The differentiation in valuation, as Puerta [26] notes, stems from the various coffee fermentation processes that are evaluated through sensory analysis of cup profiles, assessing attributes such as aroma, flavor, body, and acidity. This approach allows for product differentiation in the market, adding greater value to specialty coffees that exhibit more complex sensory profiles appreciated by consumers.

C. Model Diagnostics

Regarding Heteroscedasticity and Robust Standard Errors, the Breusch–Pagan test indicated the presence of heteroscedasticity in the residuals, suggesting that the assumption of constant error variance is violated. To address this issue, heteroscedasticity-robust standard errors were computed. The main findings of the model remain unchanged, with the variables score, Geisha variety, and country of origin (Guatemala and Honduras) retaining strong significance. However, the robust estimation slightly increased standard errors, leading to marginal reductions in significance for weaker predictors such as Washed processing. This reinforces the importance of reporting robust inference to ensure reliability of the results.

The analysis of Cook's distance values showed that no single observation exceeded the conventional threshold of 4/n, suggesting that no data points exerted disproportionate influence on the regression results. This indicates that the estimated coefficients are not unduly driven by extreme cases in the dataset.

Bootstrapped standard errors based on 1,000 replications were estimated to provide an additional robustness check. The results were consistent with both conventional and robust estimations. For instance, the coefficient for Geisha remained positive and highly significant ($\beta \approx 0.316$, bootstrapped SE= 0.041, p < 0.001), and the positive impact of Guatemala as a producing country was confirmed ($\beta \approx 0.323$, bootstrapped SE= 0.045, p = 0.049). These results indicate that the model's conclusions are stable and not sensitive to distributional assumptions.

D. Overall Synthesis

The results obtained in this study confirm the importance of the attributes involved in the sale of coffee in Central American specialty auctions, specifically in the Cup of Excellence®. The information generated contributes to the existing literature by highlighting both similarities and differences, thereby enriching the body of knowledge in this segment of the coffee market.

Comparing results, it is observed that the final score a coffee receives has a positive and significant impact on auction prices [20]. This reflects consistent price behavior for specialty coffee in El Salvador between 2015 and 2020. Furthermore, the findings also align with the model proposed by [19], who identified that material attributes, especially fruity, sweet, and floral flavors are highly valued by buyers and are associated with higher scores and, in turn, higher prices.

Another highly influential attribute is the coffee variety. This study revealed that Geisha and Pacamara varieties earn higher price premiums [20], emphasizing the importance of the Geisha variety in El Salvador. Likewise, [19] documented how prestigious coffee varieties with associated attributes are outstanding for capturing higher prices at auction.

The study also aligns with the contrast between material and symbolic attributes. Across multiple analyses, it is shown that while sensory attributes determine the cupping score, symbolic attributes such as origin, variety, or processing method exert a greater influence on price due to their inherent reputational value. This coincides with the findings of this study, which show higher returns associated with recognized varieties and countries of origin.

By comparing this information, the study helps to close the academic gap. For instance, in comparison to studies such as [30], which focused on Colombia and Ethiopia, and research by [31] on regionally differentiated analysis, this study identifies patterns unique to the Central American coffee market.

IV. Conclusions

The hedonic price analysis applied to specialty coffee auctions in Central America between 2016 and 2024 made it possible to identify the attributes that significantly influence the price paid per pound. The econometric model showed that intrinsic characteristics such as cupping score, variety, and processing method have a statistically significant impact on price. Physical attributes like cupping score and coffee variety, particularly Bourbon, are highly valued in the market. These variables showed a positive and significant association with prices, confirming their relevance to buyers in these auctions. It was also found that commercial attributes, such as country of origin and cupping score, had a greater impact on willingness to pay. Coffees from Guatemala achieved higher prices, indicating a clear differentiation based on origin and the producer's reputation. The temporal analysis revealed a positive trend in the maximum prices paid per pound

throughout the 2016–2024 period, despite some annual fluctuations. This behavior suggests a growing appreciation for specialty coffee in international markets, as well as a greater willingness to pay for differentiated attributes.

The application of diagnostic tests strengthens the validity of the findings. Although evidence of heteroscedasticity was detected, the use of robust and bootstrapped standard errors confirmed that the key determinants of coffee prices, namely cupping score, country of origin, and Geisha variety, remain robustly significant. Moreover, the absence of influential observations provides further confidence that the results are not driven by extreme values. Taking together, these robust checks enhance the reliability of the hedonic pricing estimates presented in this study.

V. RECOMMENDATIONS

Conduct the same study with a longer time span and include data from other countries around the world. Then, compare the results to assess whether the same trends exist across global regions. Add new, highly relevant variables to the dataset and estimate a new model. These new variables could include coffee farm certifications, the number of coffees participating in each auction, auction buyers, and production lot size. Consider the interrelationships between variables or include second-degree elements in the model.

REFERENCES

[1] S. Topik, C. Marichal, and Z. Frank, *From Silver to Cocaine: Five Centuries of Latin American Economic History, 1500–2000*. Mexico City: Fondo de Cultura Económica and El Colegio de México, 2017. https://www.researchgate.net/publication/334008289

[2] Statista, "Leading coffee exporting countries worldwide in 2023," 2024. https://es.statista.com/estadisticas/1287900/principales-paises-exportadores-de-cafe-a-nivel-mundial/

[3] Instituto Hondureño del Café (IHCAFE), *Final Report: Coffee Export Summary 2019–2020*, Tegucigalpa, Honduras, 2020. https://www.ihcafe.hn/wp-content/uploads/2021/08/INFORME-FINAL-Resumen-CIERRE-EXPORTS-2019-2020-3.pdf

[4] International Coffee Organization. World coffee consumption. ICO, 2021. https://doi.org/10.18174/ico.2021.04

[5] Ponte, S. The "Latte Revolution"? Regulation, markets and consumption in the global coffee chain. World Development, 30(7), 1099–1122, 2002. https://doi.org/10.1016/S0305-750X(02)00032-3

[6] Grand View Research, *Coffee Market Size, Share & Growth Report, 2030*, 2024. https://www.grandviewresearch.com/industry-analysis/coffee-market

[7] Bacon, C. Confronting the coffee crisis: Can Fair Trade, organic, and specialty coffees reduce small-scale farmer vulnerability in northern Nicaragua? World Development, 33(3), 497–511, 2005. https://doi.org/10.1016/j.worlddev.2004.10.002

[8] Jena, P. R., & Grote, U. Changing institutions to protect livelihoods: Certification schemes for coffee. Ecological Economics, 70(2), 230–240, 2010. https://doi.org/10.1016/j.ecolecon.2010.06.008

[9] F. M. Vargas, "Coffee production and sustainability: A rural development perspective," *Revista UNIMAR*, vol. 38, no. 1, pp. 91–102, 2020. https://revistas.umariana.edu.co/index.php/unimar/article/view/1543/pdf

[10] Davis, A. P., Gole, T. W., Baena, S., & Moat, J. The impact of climate change on indigenous Arabica coffee (Coffea arabica): Predicting future trends and identifying priorities. PLoS ONE, 7(11), e47981, 2012. https://doi.org/10.1371/journal.pone.0047981

[11] Specialty Coffee Association (SCA), "Coffee standards." \[Online]. Available: https://sca.coffee/research/coffee-standards

[12] J. P. Sánchez Delgado, *The Impact of Fair Trade on the Quality of Life of Coffee Growers in Villa Rica District, Oxapampa Province [Undergraduate thesis, Pontificia Universidad Católica del Perú], 2020. https://tesis.pucp.edu.pe/repositorio/handle/20.500.12404/20203

[13] Giovannucci, D., & Potts, J. Seeking sustainability: COSA preliminary analysis of sustainability initiatives in the coffee sector. International Institute for Sustainable Development, 2008. https://doi.org/10.35188/unu-wider/2008/467-2

[14] Valkila, J. Fair Trade organic coffee production in Nicaragua—Sustainable development or a poverty trap? Ecological Economics, 68(12), 3018–3025, 2009. https://doi.org/10.1016/j.ecolecon.2009.07.002

[15] Specialty Coffee Association of Costa Rica, "Cup of Excellence." https://sca.cr/taza-de-la-excelencia

[16] V. N. Ventura Maldonado, *Hedonic Price Analysis of Specialty Coffee Auctions in Latin America [Graduation Project, Zamorano Pan-American Agricultural School], 2022. https://bdigital.zamorano.edu/bitstreams/7d0b9a02-4e35-4012-87c9-3bc386a29681/download

[17] Alliance for Coffee Excellence, "Rules & Protocols." https://allianceforcoffeeexcellence.org/rules-protocols/

[18] Universidad Panamericana de Guatemala, "Hedonic pricing," UCIPFG. https://www.ucipfg.com/Repositorio/MAES/PED/Semana4/PreciosHedonicos.pdf

[19] T. M. Traoré, N. L. W. Wilson, and D. Fields III, "What explains specialty coffee quality scores and prices: A case study from the Cup of Excellence program," *J. Agric. Appl. Econ.*, vol. 50, no. 3, pp. 349–368, 2018. doi: 10.1017/aae.2018.5

[20] J. G. Lemus Hernández, *Hedonic Price Analysis of Specialty Coffee Auctions in El Salvador* \[Graduation Project, Zamorano Pan-American Agricultural School], 2021. https://bdigital.zamorano.edu/bitstreams/ae59102c-b205-4abc-b963-d51832ee1a4a/download

[21] Universidad Rey Juan Carlos, "External costs in economic models: Application of hedonic pricing." https://burjcdigital.urjc.es/bitstreams/609ccf16-dc86-0c23-e053-6f19a8c0ba23/download

[22] Lancaster, K. J. A new approach to consumer theory. Journal of Political Economy, 74(2), 132–157, 1966. https://doi.org/10.1086/259131

[23] Donnet, M. L., Weatherspoon, D. D., & Hoehn, J. P. Price determinants in top-quality e-auctioned specialty coffees. Agricultural Economics, 38(3), 267–276, 2008. https://doi.org/10.1111/j.1574-0862.2008.00302.x

[24] F. Vásquez, *Hedonic Price Method: Theoretical and Practical Course – Methodologies for Economic Valuation of the Environment*, Santiago de Chile, 2017.

[25] Alliance for Coffee Excellence, "Competition auction results." https://allianceforcoffeeexcellence.org/competition-auction-results/](https://allianceforcoffeeexcellence.org/competition-auction-results/)

[26] W. Mendenhall and T. Sincich, *A Second Course in Statistics: Regression Analysis*, 7th ed. Upper Saddle River, NJ: Prentice Hall, 2012.

[27] A. Segovia, "Central America after coffee: The end of the traditional agro-export model and the rise of a new model," *Rev. Centroam. Cienc.

Soc.*, vol. 1, no. 2, pp. 5–44, 2004. https://dialnet.unirioja.es/servlet/articulo?codigo=3234628

[28] J. L. Oliva, S. A. Rodríguez, and D. A. Hernández, "Characterization of coffee producers in Honduras," *Innovare: J. Sci. Technol.*, vol. 10, no. 1, pp. 39–47, 2021. https://camjol.info/index.php/INNOVARE/article/view/10649

[29] G. I. Puerta Quintero, "Influence of post-harvest processing on coffee quality," *Cenicafé*, vol. 50, no. 1, pp. 78–88, 1999. [https://biblioteca.cenicafe.org/bitstream/10778/58/1/arc050%2801%2907 8-088.pdf](https://biblioteca.cenicafe.org/bitstream/10778/58/1/arc050%280 1%29078-088.pdf)

[30] R. Teuber, "Geographical indications of origin as a tool of product differentiation: The case of coffee," *J. Int. Food Agribus. Mark.*, vol. 19, no. 3, pp. 37–58, 2007. https://ageconsearch.umn.edu/record/7866/?v=pdf

[31] R. Teuber and R. Herrmann, "Towards a differentiated modeling of origin effects in hedonic price analysis: An application to auction prices of specialty coffee," *Food Policy*, vol. 37, no. 6, pp. 732–740, 2012. [https://www.sciencedirect.com/science/article/abs/pii/S03069192120009 30](https://www.sciencedirect.com/science/article/abs/pii/S0306919212000930)