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HEDONIC PRICE OF WINE AT RETAIL MARKET IN COSTA RICA

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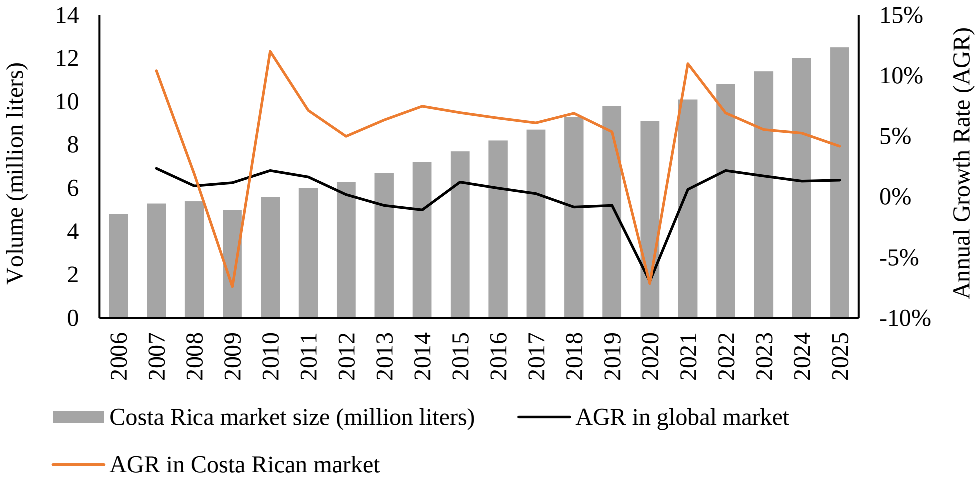
Abstract:

In Costa Rica, the consumption of wine has increased as an increasingly frequent beverage option during meals and celebrations, it has also been consolidated as part of a gastronomic culture that, in addition to enjoyment, is considered to have high properties for the health when consumed in moderate amounts. Due to the growth of the local wine market and changes in preferences, as well as the need to generate information in this field, this research aims to determine the attributes that influence the retail price of wine in Costa Rica. An econometric approach was used to model hedonic price behavior. The results showed that the price of wine is significantly affected by attributes such as origin, packaging characteristics, type of grape, market segment and type of supermarket where it is purchased.
Keywords: *Consumption, econometrics, forecasting, hedonic pricing, market research.*
JEL Codes: *D12, D46, C21, C51, C52.*

1. Introduction

The world wine market has shown slow growth in recent years, with annual growth rates (AGR) ranging from -6.97% to 2.35% between 2006 and 2021 (Figure 1) (Euromonitor, 2022).

Costa Rica registers more attractive growth rates than the world market. In 2021, annual growth was 11% and 10 million liters of wine were traded in the Central American country (Euromonitor, 2022). However, these growth rates are particular in years of recovery after overcoming events of declining wine consumption that could be attributed to changes in consumption preferences for staples, such as those that occurred in 2009 and 2020 due to the side effects of the global food crisis and the Sars-CoV 19 pandemic (Figure 1).



Source: Own study with data from Passport (2022).

Figure 1. Annual Growth Rate and Size of Wine Market in Costa Rica and Worldwide

Despite moments of decline in the local market, growth has been gradual at stable positive rates. The market growth is attributed to the prestige that wine consumption has gained among Costa Rica's middle and upper classes, the relationship with the moderate consumption and enjoyment concept, as well as the variety of brands available and accessible prices for different market niches (Cobo, 2019; The Nation, 2017). Regarding the type of wine, the Costa Rican consumer prefers red wine (82%) more than white (15%) and the price seems to be the most determining factor in the purchase intention (Cobo, 2019).

Local market conditions translate into a compound annual growth rate (CAGR) of 5.8% between 2006 and 2021, substantially higher than the world market CAGR (0.04%). In addition, Costa Rican market forecasts indicate that approximately 12.5 million liters will be traded in 2025, 24% more than in 2021 (Euromonitor, 2022).

Regarding the collateral effects of SarsCov-19 pandemic, some economic decisions (e.g., confinement and closure of restaurants) led to greater sales opportunities for wine brands and increased daily consumption as an accompaniment to food and tasting (Montero-Soto, 2021).

Historically, wine has also been linked to a healthy lifestyle due to its antioxidant, anti-inflammatory and lipid-regulating effects (Smith, 2020). Changes in consumption habits have also encouraged local demand for less processed beverages produced in an environmentally friendly way, such as organic and vegan wines (González, 2021; Martínez-Álvarez et al., 2021).

Although wine consumption is of particular importance in Costa Rica, the local market depends on imports, mainly because the climatic conditions are not ideal for the grapes production for wine, so local companies have tried to tropicalize the drink with blackberries, strawberries and cape gooseberries (Fernández, 2016).

For the above reasons and the importance of having accurate information for the local market, this research aims to determine the attributes that influence the retail price of wine in supermarkets in Costa Rica through a hedonic pricing model. The findings will be useful for marketing management, the promotion of wine business and the improvement of consumers' decision-making process according to their needs and opportunities.

2. Literature Review

Consumers make their purchases based on consumption preferences, in order to satisfy their needs based on the characteristics offered by the goods and services available in a market (Cerda et al., 2010; Troncoso & Aguirre, 2006b).

These characteristics affect the price and are understood as the value that consumers attribute to the qualities that differentiate goods from similar ones, limited by a budget and the available supply (Troncoso & Aguirre, 2006a).

The hedonic price function analyzes the relationship between the prices of a given good respect to its most visible and relevant attributes or characteristics (Rosen, 1974; Troncoso & Aguirre, 2006a).

Hedonic pricing is based on the fact that the characteristics of a good are not homogeneous and assumes that the value is decomposed from its attributes, i.e., it refers to an intrinsic value that is not normally considered in the market price (Jansson & Axel, 2000; Rosen, 1974). Therefore, the main objective of the hedonic pricing method is to determine the attributes that explain the good price and the weighted valuation given to each one (Rojas, 2007).

The hedonic price function can be obtained with an econometric approach through the Ordinary Least Squares (OLS) method and commonly uses dummy variables to characterize the qualitative attributes of the good. This method has been widely used with approaches to environmental analysis, real estate valuation and the agri-food sector, by researches such as Aragón et al. (2018), Das et al. (2017), Gracia & Pérez (2004), Méndez et al. (2021), Ogwang & Wang (2003) and Paniagua et al. (2021).

Regarding its application in the wine market, in Australia it was shown that premium wine prices were explained by six attributes: storage potential, grape type, origin, harvest type, producer size and quality; the latter represented the greatest impact on wine prices (Oczkowski, 1994).

For the French market, it was determined that objective attributes in wines from Bordeaux had more influence on price than sensory attributes, since consumers were mostly guided by the description on the bottle labels (Combris et al., 1997). Similar research conducted for Australian wines marketed in the United King market indicates that the information available on the label, such as vintage year, origin, importer and variety, influenced the wine prices (Steiner, 2004).

Other researches such as Areta (2015), Lutzeyer (2008) and Perza (2010) also used the hedonic price approach in red and white wines in South Africa, wine of Catalan origin in Spain and Spanish wine in the United States of America, respectively. The findings of Lutzeyer (2008) determined that quality and vintage year were the attributes that most impacted the red wine price, while the white wine price was affected by vintage year and the ratings given in trade magazines.

Some independent variables including bottle type, vintage year, grape variety, implementation of environmentally friendly production systems and origin designation, were validated by Perza (2010) in a hedonic price model. The last variable mentioned should be highlighted, as it presented a positive relationship indicating that wine prices increased when supported by an origin designation.

A common variable for these case studies is the wine's degree of aging, which in the case of U.S. market was classified as highly influential on the price of Spanish wine, in addition to other attributes such as positioning in high-priced market segments, quality and preference for red wines over white and rosé wines (Areta, 2015).

3. Methodology

An econometric approach was used to model the hedonic behavior of wine prices in two retail supermarkets in Costa Rica.

A sample of 672 price observations of individual products was used, which were collected from the supermarkets' official online stores in October, 2021. The data sample is cross-sectional, without discrimination between brands and presentations available for red, white and rosé wines, (no promotional packages or discounts were included). It should be noted that the information available to the public in online stores is the same as that presented in physical stores.

The variables used are supported by a previous literature review and include: wine price, market segment, region of origin, type of packaging, type of grape and point of sale. Specifically, the market segment (MS) was categorized with the frequency distribution and the grape type (GP) variable was classified with respect to wine price (WP) with a mean separation test in a unrestricted complete randomized design (Areta, 2015; Combris et al., 1997; Lutzeyer, 2008; Oczkowski, 1994; Perza, 2010; Steiner, 2004). The mean difference test used was DGC, proposed by Di Rienzo et al (2002), in the software InfoStat 2020e. Table 1 describes the variables mentioned.

Table 1. Description of Variables Used for Wine Hedonic Price Model in Costa Rica

Code	Variable	Type	Expected Effect	Description
WP	Wine price	Quantitative		Wine price in dollars per milliliter (USD/ml).
MS	Market segment	Qualitative, categorical	Positive	Market segment according to purchasing power, where: 1 = low; 2 = medium; 3 = medium–high; 4= high.
SK	Supermarket[1]	Qualitative, binary	Positive	Supermarkets targeting niches with different purchasing power, where: 0 = medium and medium–high; 1 = medium–high and high.
OR	Origen	Qualitative, binary	Unclear	Groups wines from two producing regions, where: 0 = Europe, South Africa, New Zeland and Australia; 1 = America.
PK	Packaging	Qualitative, binary	Negative	Groups the package type, where: 0 = glass; 1 = Tetra Brik.
GP	Grape[2]	Qualitative, binary	Positive	Grape type used as raw material, where: 0 = type B; 1 = type A.

Notes: 1/ See table 3 to differentiate the types of grapes belonging to each group.
2/ All types of wines are available in all the supermarkets analyzed.

The general hedonic price model explains the price of i-th wine (P_i) as a function of the k-th attributes (Z) (Equation 1).

$$P_i = f(Z_{1i}, Z_{2i}, \dots, Z_{ki}) \tag{1}$$

In the hedonic price model, the mathematical expectation of the price is the sum of the attributes that compose it, so that the impact of the unitary change in each independent variable represents an underlying change in price, which is obtained through the partial derivative with respect to the attributes and its result corresponds to the willingness to pay for wine in the Costa Rican retail market. This function applied to the case study is expressed econometrically as follows:

$$WP_i = \beta_0 + \beta_1 MS_{1i} + \beta_2 OR_{2i} + \beta_3 PK_{3i} + \beta_4 GP_{4i} + \beta_5 SK_{5i} + u_i \tag{2}$$

Where WP is the dependent variable; MS, OR, EV, GP and SK are independent variables; β are fixed parameters; u is the regression residual term.

The econometric function was solved with the Ordinary Least Squares (OLS) method that minimizes the sum of quadratic residuals, applying different linear and logarithmic combinations to the variables (Gujarati & Porter, 2010). These estimations were performed with the free software Gretl 2021d, in the most updated version at the time of the research.

Although the presence of autocorrelation in the sample is not considered, the Breusch-Godfrey test was applied to rule out any spatial relationship between the residuals, the White test was also applied to contrast heteroskedasticity in large samples and Variance Inflation Factor (VIF) to rule out multicollinearity between independent variables (Equation 3) (Greene, 2003; Gujarati & Porter, 2010).

The model with the best fit was selected according to the indicators of Adjusted R^2, Akaike, Bayesian and Hannan-Quinn criteria (AIC, BIC and HQ, respectively), Mean Absolute Percentage Error (MAPE) and Theil's U. Except for the Adjusted R^2, for all other criteria it is understood that the lower the indicator, the better forecast fit the model has.

4. Results

4.1 Categorization of Market Segment (MS) and Grape Type (GP) Variables

The MS variable was categorized with the frequency distribution of wine prices (WP), for which four significant classes prevail, representing market segments with different consumer purchasing power according to low, medium, medium-high and high price (Table 2 and Appendix 1). These prices are justified by characteristics such as the quality, exclusivity and originality of the wine, the individualization of the consumer and the income available to consume.

Regarding GP variable, the grouping of wines was based on the López (2020) classification of aromatic profiles of grapes and blended wines. The wines were initially grouped into eight categories: noble grapes, noble grapes with aromatic precursor, neutral grapes, aromatic grapes, red blend, rosé blend and white blend. The eighth group includes those grapes that do not fit into the previous categories.

Table 2. Frequency Distribution of Wine Price (WP) (n = 672; k = 9)

Range			Class Mean	Absolute Frequency	Relative Frequency	Cumulative Frequency	
	<	0.012	0.006	160	23.81%	23.81%	********
0.012	-	0.024	0.187	379	56.40%	80.21%	********************
0.024	-	0.037	0.031	93	13.84%	94.05%	****
0.037	-	0.049	0.043	26	3.87%	97.92%	*
0.049	-	0.062	0.056	2	0.30%	98.21%	
0.062	-	0.074	0.068	6	0.89%	99.11%	
0.074	-	0.087	0.081	5	0.74%	99.85%	
0.087	-	0.099	0.093	0	0.00%	99.85%	
	≥	0.099	0.106	1	0.15%	100.00%	

The results of the unrestricted complete randomized design indicate that there are differences in the wine prices according to the grape type (Appendix 2 with p-Value = 0.0001). Table 3 presents the results of DGC test grouping the classification of wines into categories A and B, where the means with a common letter do not differ significantly from each other, but do differ from the others.

Table 3. DGC Test between Wine Price (WP) and Grape Type (GP) (n = 672)

Grape Type	Mean (USD Price)	n	E.E.	Category
White blend	8.83	16	2.13	B
Aromatic grapes	10.31	2	6.02	B
Other	10.73	32	1.51	B
Noble grapes with aromatic precursor	12.58	48	1.23	A
Rosé blend	13.52	48	1.23	A
Neutral grapes	15.45	3	4.92	A
Noble grapes	15.96	484	0.39	A
Red wine	16.94	39	1.36	A

4.2 Econometric Hedonic Pricing Model Selection

The initial model suggests a significant relationship between wine price, market segment and origin (Table 4). However, there is no statistical evidence that establishes a linear relationship with the packaging type, grape type and supermarket. On the other hand, the regression coefficients of PK and GP variables have a regression sign opposite to that expected and are not statistically significant, i.e., they are not attributes that explain wine price.

To model the hedonic prices, it is recommended to use nonlinear models, particularly with logarithmic transformation in the dependent variable; these expressions have shown good results due to their ability to smooth out problems of non-homoscedasticity in the regression residuals (Steiner, 2004).

As a statistical relationship of WP with the independent variables is expected, three combinations of possible functional forms were made for econometric modeling. The most significant model has a log-linear functional form (semi-elasticity with percentage growth) and forecasts 76.85% of price changes (Table 4). The indicators of forecast fit are better than the linear model (Adjusted R^2, CIA, CIB and HQ) and the prediction bias is lower (MAPE and Theil's U).

Table 4. Econometric Models of Hedonic Wine Prices (WP) in Costa Rica (n = 672)

Linear Model (WP dependent variable)					
Variable	**Coefficient**	**Standard Error**	**t-statistic**	**Probability**	
Constant	-4.1540	0.5898	-7.0440	4.67e-012	***
MS	8.4999	0.2432	34.9600	7.94e-153	***
SK	0.3250	0.3516	0.9242	0.3557	
OR	-1.0842	0.3457	-3.1360	0.0018	***
PK	0.3737	1.2193	-0.3065	0.7593	
GP	0.7499	0.6674	-1.1240	0.2616	
R^2	0.6948				
Adjusted R^2	0.6925				
CIA	3839.7140				
CIB	3866.7750				
HQ	3850.1940				
MAPE	27.7500				
Theils's U	0.5305				
Log-linear model (ln_WP dependent variable)					
Variable	**Coefficient**	**Standard Error**	**t-statistic**	**Probability**	
Constant	1.3493	0.0338	39.9500	5.44e-179	***
MS	0.5350	0.0139	38.4100	4.45e-171	***
SK	0.0421	0.0201	2.0910	0.0369	**
OR	-0.0571	0.0198	-2.8860	0.0040	***
PK	-0.7545	0.0698	10.8000	3.51e-025	***
GP	0.1004	0.3822	2.6270	0.0088	***
R^2	0.7685				
Adjusted R^2	0.7667				
CIA	-4.0852				
CIB	22.9764				
HQ	6.3954				
MAPE	8.3868				
Theils's U	0.3997				

Note: *** denotes significant at 1%, ** at 5% and * at 10%.

The results obtained with the log-linear functional form are supported by the absence of collinearity between the independent variables. The VIF of all independent variables is less than 1.18 (Table 5) and according to the acceptance criterion, those variables with VIF less than 10 (VIF < 10) are not significantly related to each other and do not overestimate the β coefficients (Gujarati & Porter, 2010).

Table 5. Variance Inflation Factors (VIF) Independent Variables

Independent Variable	**Variance Inflation Factors (VIF)**	**Condition**
MS	1.1790	<10, no collinearity
OR	1.0910	<10, no collinearity
PK	1.0780	<10, no collinearity
GP	1.1720	<10, no collinearity
SK	1.1250	<10, no collinearity

In the initial model the residuals variance is not constant and there is heteroskedasticity at 1% (White test) (Table 6). Logarithmic transformation helped to correct this problem (Gujarati & Porter, 2010) and the log-linear model presents constant variance in its residuals. Likewise, there is no statistical evidence of autocorrelation between the regression residuals.

Table 6. Heteroskedasticity and Autocorrelation Test for Linear and Log-Linear Models

Model	Test	Null Hypotheses	Statistic	Probability	Condition
Lineal	White	Heteroskedasticity not present	LM = 155.5400	1.91e-25	Rejected
	Breusch-Godfrey (order 1)	No autocorrelation	LMF = 1.1616	0.2815	Not rejected
Log-lineal	White	Heteroskedasticity not present	LM = 11.1585	0.7413	Not rejected
	Breusch-Godfrey (order 1)	No autocorrelation	LMF = 0.0017	0.9669	Not rejected

4.3 Value of Wine Attributes in Costa Rica

Under the conditions established by the log-linear model, the results suggest that as the category increases in the market segments, the wine price increases 53.50%. This increase has a logical relationship with the purchasing power of the population (similar effect to the SK variable) because wines aimed at the medium-high and high segments are 4.21% higher than the medium and medium-high segments.

This change in WP is also related to pricing policies depending on the number of rival supermarkets located in a nearby perimeter, competitive conditions, inventory holding costs and even product exclusivity and services offered to the customer (Castañeda, 2012).

The OR coefficient indicates that wines of American origin are 5.71% cheaper than those from Europe and other Western countries.

Historically, Italy, Spain and France have been among the top three producers of high quality wine and market prices are relatively higher. However, pricing in Costa Rica can also be affected by factors like proximity and transaction costs. In addition, in recent decades the wine market has been involved in significant industrial change due to the conversion of vineyards in Chile, Argentina, United States of America and Uruguay, which have improved yields and competitive advantages due to the relationship quality-price (Medina-Albaladejo et al., 2014).

Regarding the packaging type, the wine price can decrease by up to 75.45% when purchased in Tetra Brik compared to glass packaging. The PK variable has the highest relative weight and its effect is consistent with expectations, as it can lead to a significant reduction in packaging, transportation and inventory management costs, although it could also threaten consumer preferences (Ramos, 2017).

In relation to grape type, the GP coefficient shows an increase of 10.04% in WP when type A wines are preferred compared to type B wines (Table 3), coinciding with Ritu et al (2018) and Angulo et al (1997). This effect is also consistent with the results of DGC test, which indicate that type A wines have a higher average price.

The final regression equation of wine hedonic price model is mathematically expressed in Equation 3. Being a log-linear functional form, its exponential expression is presented in Equation 4 and is recommended for WP forecasting.

$$lnWP = 1.3493 + 0.5350MS + 0.0421SK - 0.0571OR - 0.7545PK + 0.1004GP \quad (3)$$

$$WP = e^{1.3493+0.5350MS+0.0421SK-0.0571OR-0.7545PK+0.1004GP} \quad (4)$$

Table 7 shows the simulated retail prices in two different scenarios (A and B). The first scenario simulates the wine price aimed at a market segment with low purchasing power (MS), in supermarket of medium and medium-high category (SK), of American origin (OR), packaged in Tetra Brik (PK) and made with type B grapes (GP). In other words, the wine simulated in scenario A presents the product with the lowest possible price according to econometric results.

Scenario B assumes the opposite extreme, i.e., a European wine, in glass packaging, with type "A" grapes, for a consumer with high purchasing power (MS), in a specialized supermarket (SK).

Table 7. Wine Price in Two Cases with Specific Attributes

Variable	Coefficient	Simulation Scenario A	Simulation Scenario B
Constant	1.3493		
MS	0.5350	Low = 1	High = 4
SK	0.0421	Medium and medium–high = 0	Medium–high and high = 1
OR	-0.0571	America = 1	Europe and others = 0
PK	-0.7545	Tetra Brik = 1	Glass = 0
GP	0.1004	Type B = 0	Type A = 1
P per ml		0.0045 USD	0.0586 USD
P per 750 ml		3.39 USD	43.93 USD

The price forecast indicates that a consumer in Costa Rica would be willing to pay 0.0045 USD/ml for a wine with the characteristics described scenario A, which translates into a price of 3.39 USD for a 750 ml bottle (common sales unit). As for scenario B, the expected price for a wine premium bottle is 11.92 times higher and would sell for 43.93 USD (0.0586 USD/ml).

5. Conclusion

In the case of wine retail price in Costa Rica, the main results of this research indicate that it is significantly affected by five different attributes: origin region, packaging characteristics, grape type, the market segment targeted according to purchasing power and supermarket type.

These results are consistent with the growing wine consumption culture recently registered in the country, suggesting that Costa Rican consumers base their purchases on simple characteristics. However, the inclusion of independent variables was limited to a small number due to the data collection technique, the research budget and the information available in electronic media.

Part of the limitation in the use of independent variables is reflected in the Adjusted R^2 to the final model (76.67%), which could increase as other explanatory factors are incorporated, such as frequency of wine consumption, age of consumers, years of wine consumption, area of residence and sensory characteristics.

Since Costa Rica is a market in constant growth, it is recommended to use this research as a baseline, which can be expanded through the application of methods such as the contingent valuation of attributes through consumer surveys and the application of multivariate statistical techniques, which would expand knowledge about the local market and promote information to improve the decision-making process of the different economic agents.

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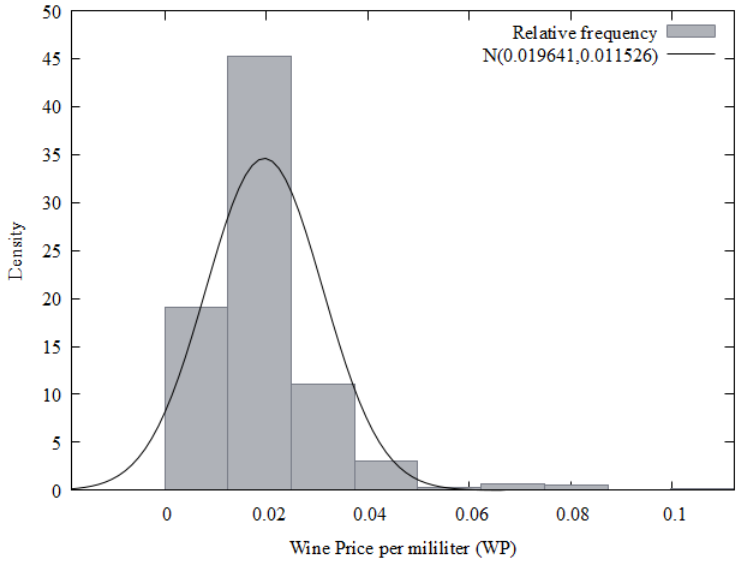
Appendix

Appendix 1. Relative Frequency of the Price of Wine per Milliliter (n = 673)



Appendix 2. Analysis of Variance (SC type III) between the Price of Wine and the Type of Grape (n = 673)

Variable	**n**	**R^2**	**Adjusted R^2**	**Variation Coefficient**	
P	673	0.04	0.03	56.10	
Source of Variability	**Sum of Squares**	**Degree of Freedom**	**Mean Square**	**F**	**p-Value**
GP	2215.27	7	316.47	4.36	0.0001
Error	48228.21	665	72.52		
Total	50443.49	672			