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Scotch whisky prices unveiled: the influence of age, alcohol content, and distillery reputation

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Abstract

This paper examines the impact of age, alcohol content, and distillery reputation on Scotch whisky prices through a hedonic pricing model. Using data from The Whisky Exchange, we analyze the key determinants of price variations. The findings reveal a non-linear relationship between age and price, with older whiskies commanding exponentially higher values. Similarly, whiskies with higher alcohol content and those from renowned distilleries achieve premium prices. These three factors are particularly significant for collectible bottles, offering valuable insights for consumers and investors alike.

We thank the reviewer for their helpful comments. All remaining errors are our own.

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1. Introduction

What makes one bottle of Scotch whisky worth thousands while another sells for just a fraction? In the whisky market, age, alcohol content, and distillery reputation are often viewed as key factors driving price differences (Page, 2019). However, the exact mechanisms through which these characteristics influence price are complex and not always linear. This paper aims to explore how these factors—age, alcohol content, and distillery reputation—shape Scotch whisky prices, focusing on collectible bottles through the use of a hedonic pricing model.

A hedonic pricing model (Rosen, 1974) is a revealed preference method of valuing the attributes of a product by analyzing the prices consumers are willing to pay for different combinations of these attributes. This approach allows us to quantify the individual and combined effects of various factors on the price of Scotch whisky.

Several studies have addressed the role of these variables in whisky pricing. For instance, Detweiler (2016) shows that while age correlates with higher prices in some cases, this relationship is not universal across all single malt whiskies. Conversely, Moroz and Pecchioli (2020) find that rare and collectible whiskies tend to exhibit a strong positive price relationship with age, especially for older bottles. The consumer survey conducted by Chivas Brothers (2010) also highlights the importance of age statements, with 86% of respondents indicating they are willing to pay a premium for whiskies that display age. This suggests that age is a key indicator of perceived quality for consumers, but its impact on price requires further exploration. In addition to age, alcohol content plays a significant role in consumer preferences and, consequently, pricing. Hylta and Lundqvist (2016) demonstrated a positive correlation between alcohol percentage and price in the Swedish market for single malt Scotch whiskies. Higher alcohol content is often associated with premium offerings and perceived as an indicator of richer flavors and higher quality. Lastly, distillery reputation has been shown to significantly influence whisky prices. Moroz and Pecchioli (2020) demonstrated that whiskies from renowned distilleries command higher prices, even after controlling for other variables like age and alcohol content.

Building on this existing research, this paper contributes to the literature by offering a detailed analysis of how these key factors—age, alcohol content, and distillery reputation—interact to influence Scotch whisky prices. Using a hedonic pricing model, we quantify the individual and combined effects of these variables. Unlike previous studies, we incorporate interaction terms to account for the complex relationships between these attributes. By doing so, this study provides valuable insights for distillers, investors, and collectors who seek to understand the factors driving whisky pricing, particularly in the premium and collectible markets.

2. Data and method

The dataset used in this study was obtained from a single marketplace, *The Whisky Exchange* (<https://www.thewhiskyexchange.com/>), and includes detailed information on 409 Scotch whiskies. The Whisky Exchange is one of the largest and most reputable online whisky retailers, making it an ideal data source for analyzing market trends and price determinants in the Scotch whisky market. The key characteristics collected for each whisky include its name, alcohol content, price, region of production, distillery, and type. Although expert ratings were not available, previous research suggests that such ratings are not essential for determining whisky

prices. As noted by Moroz and Pecchioli (2021, p.86), *"the quality rating is not a powerful predictor of investor ask prices, especially when controlling for distillery and bottler reputation."*

The descriptive statistics (Tables 1-A to 3-A and graphs 1-A to 5-A) are presented in Appendix 1 provide an overview of the characteristics of the 409 Scotch whiskies analyzed. These data come from The Whisky Exchange, one of the largest and most reputable online whisky markets, making it a reliable source for analyzing market trends and price determinants.

The alcohol content of the whiskies ranges from 40% to 63.1%, with a modal value of 46% (Table 1-A). As shown in Graph 1-A, the majority of whiskies have an alcohol content around 46%, with a relatively symmetrical distribution. This concentration around the mean suggests that consumers and producers prefer moderate alcohol levels, although variations exist to cater to specific preferences. A higher alcohol content is often associated with richer flavors and better-quality whiskies, which can influence prices.

The prices of the whiskies vary significantly, ranging from £21.40 to £9,199.95, with a mean of £169.09 and a standard deviation of £581.61 (Table 1-A). Graph 2-A, which presents a histogram of windsorized prices, shows that the majority of prices are concentrated below £200, with a few very high prices. This substantial price variability reflects the diversity in whisky characteristics, such as age, alcohol content, and distillery reputation. High prices are often associated with rare and collectible whiskies, which is consistent with the findings of Moroz and Pecchioli (2020).

The age of the whiskies ranges from 3 to 48 years, with a mean of 12.43 years and a standard deviation of 8.04 (Table 1-A). Graph 3-A shows a notable concentration around 3 years and another around 12 years. This bimodal distribution suggests two distinct market segments: younger whiskies, often intended for more immediate consumption, and older whiskies, often considered collectible items. Age is a key indicator of perceived quality and rarity, which significantly influences prices.

The whiskies come from all six main Scotch whisky production regions: Campbeltown, Highland, Island, Islay, Lowland, and Speyside. Speyside and Highland are the most represented regions, with 25.67% and 22.74% of the whiskies, respectively (Table 2-A). Graph 4-A illustrates this distribution, showing that Speyside and Highland dominate the market, likely due to their reputation for producing high-quality whiskies. The region of origin can influence consumer preferences and, consequently, prices.

A total of 134 distilleries are represented in the dataset. The most represented distilleries include Ardbeg, Glenfiddich, Seaweed, Balvenie, Bruichladdich, Johnny Walker, Laphroaig, The Macallan, and Tobermory. The strong presence of these renowned distilleries suggests that their reputation plays a crucial role in price determination. Well-established distilleries can justify higher prices due to their renown and the perceived quality of their products.

The majority of the whiskies are single malts (87.53%), followed by blended whiskies (7.58%), blended malts (3.42%), and grain whiskies (1.47%) (Table 2-A). This dominance of single malts reflects their popularity and perception as higher-quality products. Single malts are often associated with more complex flavors and better quality, which may explain their larger market share.

The vast majority of whiskies (97.5%) are non-organic, reflecting standard production practices in the whisky industry. Organic whiskies represent a niche market, but their impact on prices is not significant in this study.

The descriptive statistics and graphs provide a solid foundation for understanding the characteristics of Scotch whiskies and their price variations. The data show significant diversity in terms of alcohol content, age, region of production, distilleries, and types of whisky. These variations are crucial for the subsequent analysis of price determinants using the hedonic pricing model. The descriptive results will guide the regression analysis by identifying key variables that influence Scotch whisky prices.

We apply a hedonic pricing model, following Rosen (1974), to analyze the factors that influence the price of Scotch whisky. This model assumes that the price of a product is determined by both its internal characteristics and external factors. In this context, we use the natural logarithm of the price as the dependent variable, which allows for a more linear relationship between the price and the explanatory variables.

The regression equation we estimate is as follows:

$$(1) \ln p_i = \sum_j \beta_j X_j + \varepsilon_i$$

Where p_i is the price of a Scotch whisky, X_j is an explanatory variable: alcohol content, age, age squared, single malt, region of appellation, distilleries, and interaction variables, and ε_i is a random variable.

3. The drivers of the Scotch whisky price

To estimate the determinants of Scotch whisky prices, we have tested only multivariate equations. Including multiple explanatory variables provides unbiased estimates by isolating the independent effect of each factor (age, alcohol content, reputation, etc.). Interaction terms in multivariate models reveal how variables combine to influence price, offering a deeper understanding. A holistic approach ensures no key factors are overlooked, leading to more accurate conclusions. This study exclusively employs multivariate hedonic pricing models to obtain unbiased estimates, account for interactions, and provide a comprehensive analysis of whisky prices. This approach allows us to reason in a bivariate manner while holding all other factors constant, leading to more precise and meaningful insights.

Notice that the sample consists of cross-sectional data, meaning observations were collected at a specific point in time without any temporal order. Each observation is independent of the others, with no sequential structure. Therefore, autocorrelation is generally not a concern, as there is no time-based relationship that could induce correlation among the residuals. However, since heteroscedasticity issues can arise with this type of data, the standard errors have been corrected using White's robust standard errors. This method accounts for heteroscedasticity by adjusting the standard errors of the estimated coefficients, ensuring that statistical inferences, such as hypothesis tests and confidence intervals, remain valid. By using White's correction, we mitigate the risk of biased standard errors, which could otherwise lead to misleading conclusions regarding the significance of explanatory variables.

The six models tested reveal that age, alcohol content, and distillery reputation are consistently significant factors in determining Scotch whisky prices. Interaction terms included in the final model further enhance its explanatory power, indicating complex interdependencies between these variables (see Table 1 for standardized coefficients). The regressions with non-standardized coefficients are presented in Appendix 2. Standardized coefficients allow for a direct comparison of the effects of different variables on whisky prices.

The explanatory power of the models, measured by the adjusted R^2 , is relatively high, indicating that the included variables explain a significant portion of the variation in whisky prices. The adjusted R^2 values range from 62.7% for the base model to 73.6% for the most comprehensive model, which includes interactions between variables. This indicates that factors such as alcohol content, age, age squared, and single malt status collectively account for a significant portion of the price variability. However, there are likely other factors not captured by this model, such as marketing strategies. These could also influence whisky prices.

The results across the six models show that age², alcohol content, and distillery reputation play a significant role in determining the price of Scotch whisky. However, the significance of some variables, particularly single malt status, varies depending on the model specification. The inclusion of interaction terms in the final models enhances the explanatory power, highlighting the complexity of the relationships between these factors.

- Age² is consistently significant in all models where it is included, reinforcing the idea that the relationship between age and price is non-linear. This suggests that while aging increases whisky prices, the effect accelerates beyond a certain point.
- Alcohol content is also a highly significant determinant in most models, showing that higher alcohol percentage is positively correlated with price. This supports previous findings that consumers and collectors attribute higher value to stronger whiskies.
- The inconsistent significance of Single Malt across models suggests that its effect is not directly linear and may be absorbed by other correlated factors such as distillery reputation, alcohol content, or interaction effects.
- The inclusion of a variable capturing the effect of large distilleries significantly improves model fit, with distillery reputation showing a highly significant effect. This confirms that whiskies from well-known producers command a premium, independent of age or alcohol content.
- The effect of regional origin, however, is less robust, except for Island, suggesting that distillery brand strength matters more than broader geographic origin.
- Models 2 and 6 introduce interaction terms, revealing more nuanced relationships. The interaction between alcohol content and Single Malt status suggests that high-alcohol whiskies are valued more when they are also single malts. The Age * Single Malt interaction shows that aging has a stronger effect on price for single malts compared to blended whiskies. Age* Large Distilleries indicates that well-established producers benefit more from aging effects than smaller ones, reinforcing the importance of reputation in the aging premium.

Table 1. The results

	Regression Results – Dependant variable : LN Price					
	Standardized coefficients – *** :<1% ; ** :<5% ; * :<10%					
	Robust standard deviations corrected by White's method					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Alcohol Content	0.198***	-0.214	0.192***	0.183***	0.190***	-0.067
	(0.030)	(0.143)	(0.029)	(0.028)	(0.026)	(0.122)
Age	0.199**	-0.367***	0.220	0.135		-0.406***
	(0.086)	(0.136)	(0.179)	(0.164)		(0.112)
Age²	0.595***	0.745***	0.572**	0.639***	0.762***	0.755***
	(0.226)	(0.138)	(0.225)	(0.211)	(0.075)	(0.119)
Single Malt	0.077*	-1.271***	0.054	0.087**	0.085**	-0.818**
	(0.041)	(0.386)	(0.038)	(0.037)	(0.036)	(0.337)
Main Distilleries				0.229***	0.249***	0.107
				(0.034)	(0.037)	(0.068)
Alcohol Content * Single Malt		1.263***				0.777**
		(0.423)				(0.366)
Age*Single Malt		0.559***				0.516***
		(0.105)				(0.091)
Age*Main Distilleries						0.149**
						(0.073)
Campbeltown			0.022		0.039	
			(0.027)		(0.027)	
Highland			-0.059		0.016	
			(0.036)		(0.030)	
Island			-0.065***		-0.057**	
			(0.024)		(0.025)	
Islay			0.032		-0.031	
			(0.036)		(0.035)	
Lowland			-0.020		-0.008	
			(0.019)		(0.015)	
Speyside			-		-	
Other			-0.060		-0.035	
			(0.039)		(0.033)	
Observations	409	409	409	409	409	409
R²	0.627	0.681	0.638	0.679	0.683	0.736
Adjust R²	0.624	0.676	0.629	0.675	0.675	0.731

These findings underscore that whisky pricing is not simply a sum of independent factors but rather the result of complex interdependencies. This is particularly relevant for distillers,

investors, and collectors, as it suggests that maximizing whisky value requires a strategic combination of aging, branding, and product positioning in the market.

3.1. The role of age

Age is a central variable in determining whisky prices in our multivariate hedonic regression. The results show that age has a positive and significant effect in all models, with standardized coefficients ranging from 0.295 to 0.332. This indicates that as whisky ages, its price increases. However, the effect of age is non-linear, as evidenced by the significant quadratic term (Age^2), which captures the accelerating price increase as whiskies get older. This exponential relationship is particularly pronounced for whiskies older than 30 years.

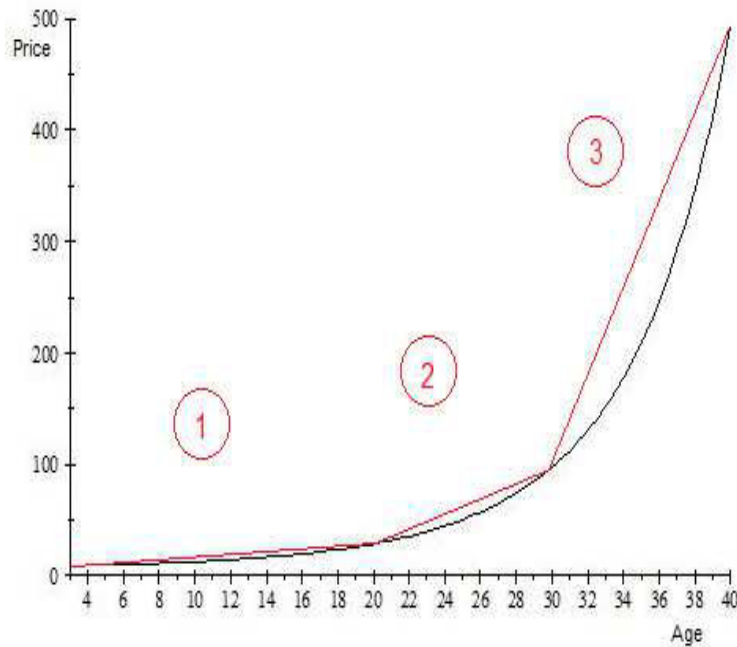
The equation representing this relationship is as follows:

$$(2) \quad p = e^{2.118} e^{0.022age} e^{0.002age^2}$$

In (2), the coefficients are non-standardized (see Appendix 2), meaning they reflect the effect of each variable in its original unit of measurement. This allows for direct interpretation of the impact of age on price, without adjusting for differences in scale across variables.

Graph 1 provides a representation of how the price of Scotch whisky is correlated by age, capturing both linear and non-linear relationships.

Graph 1. The price and the age



To quantify the effect of increasing the age of a whisky by one year on its price, we calculate the derivative of the price equation with respect to age:

$$(3) \quad \frac{dp}{dage} = 0.022e^{0.022age} + 0.004(age)e^{0.002age^2}$$

This derivative allows us to assess how the price changes as age increases. However, the effect of increasing the age by one year is not constant—it depends on the current age of the whisky. Since the price increase is exponential, the impact of an additional year varies according to the whisky's existing age. To better understand this variability, we can evaluate the average marginal impact of an extra year of aging using the slopes of the three lines shown in Graph 1. 4 vintages usually available (3, 20, 30, and 40 years) were selected to represent key stages in the aging process: young whiskies (3 years), mid-aged whiskies (20 years), and collectible rare whiskies (30 and 40 years). They provide a balanced representation of the dataset's distribution. Equation 2 is then used to predict the prices of whiskies aged 3, 20, 30, and 40 years. For example:

$$(4) \hat{p}_3 = e^{2.118} e^{0.022 \cdot 3} e^{0.002 \cdot 3^2} = e^{2.202}$$

$$(5) \hat{p}_{20} = e^{2.118} e^{0.022 \cdot 20} e^{0.002 \cdot 20^2} = e^{3.358}$$

The slope of the chord is so calculated:

$$\begin{aligned} \text{Slope of line 1: (6)} \quad \left(\frac{\Delta \text{price}}{\Delta \text{age}} \right) &= \frac{e^{3.358} - e^{2.202}}{20 - 3} = 1.16 \\ \text{. Slope of line 2: (7)} \quad \left(\frac{\Delta \text{price}}{\Delta \text{age}} \right) &= \frac{e^{4.578} - e^{3.358}}{30 - 20} = 6.59 \\ \text{. Slope of line 3: (8)} \quad \left(\frac{\Delta \text{price}}{\Delta \text{age}} \right) &= \frac{e^{6.198} - e^{4.578}}{40 - 30} = 39.45 \end{aligned}$$

On average, an extra year of aging increases the value of a whisky 34 times more for whiskies over 30 years old compared to those less than 10 years old. This is a significant finding, contrasting with the results of Moroz and Pecchioli (2020), who observed that each additional year of age leads to an average price increase of 1.7%. Our findings highlight the exponential effect of aging, especially for older and rarer whiskies.

The exponential impact of age highlights the dual role of whisky as both a consumable beverage and a collectible asset. As whiskies age, their rarity increases, making them attractive to investors and collectors. This phenomenon is especially true for single malt whiskies from well-reputed distilleries. The non-linear relationship between age and price provides valuable insights for investors, who can better understand how age influences the long-term value of whisky.

The interaction term between age and single malt is significant and amplifies the price effect of aging. For single malt whiskies, the coefficient of 0.559*** in Model 2 and 0.515*** in Model 6 indicates a stronger impact of age on price compared to other whisky types. This result reflects the heightened value attributed to older single malts, perceived as more complex and prestigious by consumers.

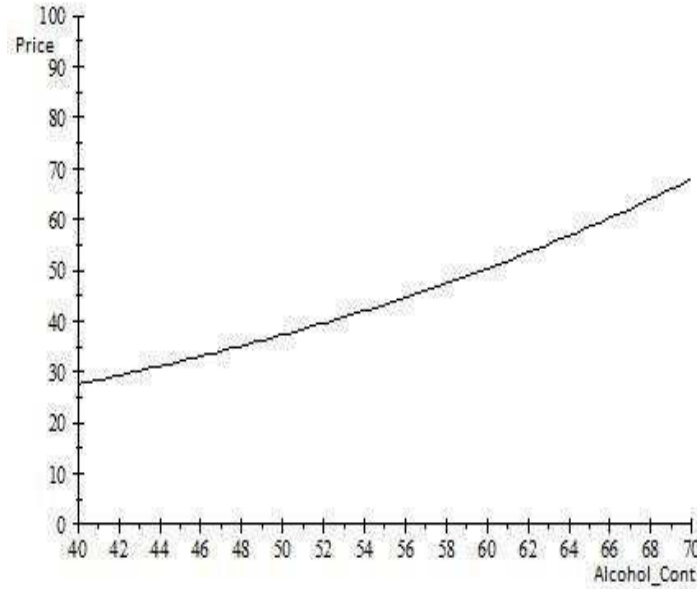
3.2. The role of alcohol content

Alcohol content is another key determinant of whisky prices. In all models, it is statistically significant, with standardized coefficients around 0.300. The relationship between alcohol content and price shows a log-linear trend, with a mild exponential increase at higher levels of alcohol content.

This relationship is represented by the following equation (with non-standardized coefficients):

$$(9) \quad p = e^{2.118} e^{0.03 \text{alcoholcontent}}$$

Graph 2. The price and the alcohol content



$$(10) \quad \frac{dp}{d\text{alcoholcontent}} = 0.03e^{0.03\text{alcoholcontent}}$$

An increase of 1% in alcohol content results in an approximate 3.05% increase in price. This may reflect consumer perceptions that whiskies with higher alcohol content are more complex or richer in flavor, thus commanding higher prices. This result is close to one of Moroz and Pecchioli (2020) where alcohol level also has a positive effect on price, with a 2.7% increase in price for each additional degree of alcohol. As observed in the data, the price growth accelerates slightly at higher levels of alcohol content, reflecting a mild exponential relationship rather than a strictly linear one. This could reflect factors such as production costs, perceived quality, and market demand for higher alcohol content beverages.

The interaction term between alcohol content and single malt is significant and has a substantial impact on whisky prices. In Model 2, the coefficient of 1.263 ($p < 0.01$) indicates that the price premium for higher alcohol content is significantly amplified for single malt whiskies compared to other types. This suggests that consumers associate higher alcohol content in single malt whiskies with superior quality or craftsmanship, leading to a disproportionate increase in price. This result aligns with the segmentation of the whisky market, where single malt whiskies hold a distinct and elevated position.

3.3. The influence of distilleries

Distillery reputation plays a critical role in whisky price formation. The reputation of a distillery can be approximated by its size, and more specifically by the number of brands or references it commercializes. Having multiple references is a strong indicator of the strength of the distillery's brand, as it reflects its market presence and ability to cater to diverse consumer

demands (Brammer & Pavelin, 2004). Aaker (1996) further emphasizes that strong brands contribute to an organization's reputation by building trust, differentiation, and perceived quality.

The size of a distillery is inherently correlated with its strategic capabilities, including marketing reach, production capacity, and brand management, which collectively reinforce its reputation. For this study, main distilleries were selected using K-means clustering based on the number of references they market (see Appendix 3). This clustering approach allows for a meaningful categorization of distilleries based on their market impact and reputation.

The results show that whiskies from renowned distilleries command a significant premium, with standardized coefficients for the distillery variable ranging from 0.172 to 0.185. This highlights the importance of individual distillery reputation, which surpasses that of regional reputation.

Distilleries such as Ardbeg, Glenfiddich, and The Macallan stand out for their ability to justify higher prices due to their renown and the increased demand for their products. On average, whiskies from these well-known distilleries enjoy a premium of approximately 18%, as noted by Moroz and Pecchioli (2020).

Distillery reputation appears to have a stronger influence than the whisky's region of origin. While some regions, such as Islay or Speyside, are associated with distinct styles, the results show that regional variables are less significant compared to distillery-specific factors. The interaction between age and main distilleries demonstrates that whiskies from well-reputed distilleries command a higher price premium as they age. The coefficient of 0.149 ($p < 0.05$) in Model 6 highlights how the reputation of a distillery can enhance the value derived from aging, further solidifying the premium positioning of such products.

4. Conclusion

The results of this study reveal that Scotch whisky prices are primarily determined by three key factors: age, alcohol content, and distillery reputation. The effect of age is nonlinear, with prices increasing exponentially as whiskies get older. Similarly, higher alcohol content leads to disproportionately higher prices. Finally, distillery reputation plays a crucial role, surpassing the influence of regional origin.

The most comprehensive model, which includes interactions between these variables, explains about 73.6% of the variability in whisky prices, emphasizing the importance of considering these factors in combination. The results of this study offer valuable guidance for distillers, investors, and collectors. Distilleries can strategically use aging and alcohol content to position their products as premium offerings. Distilleries could use these findings to strategically manage their product lines, focusing on aging whiskies from reputable brands to enhance their value proposition. Similarly, investors can better understand the long-term value appreciation potential of older, higher-alcohol whiskies from well-known distilleries. Investors could leverage the non-linear relationship between age and price to identify potentially undervalued bottles in the secondary market.

Comparing our findings with existing studies, we observe both similarities and differences. Moroz and Pecchioli (2020) found that age has a strong positive relationship with price, especially for older whiskies, which aligns with our results. However, our study highlights an

exponential effect of aging, particularly for whiskies older than 30 years, which contrasts with their findings of a linear increase. This exponential relationship underscores the dual role of whisky as both a consumable beverage and a collectible asset, providing valuable insights for investors.

In terms of alcohol content, our results are consistent with Hylta and Lundqvist (2016), who demonstrated a positive correlation between alcohol percentage and price. Our study further reveals that this relationship is log-linear, with a mild exponential increase at higher alcohol levels. This nuanced understanding can help distillers tailor their products to meet consumer preferences for richer, higher-alcohol whiskies.

Regarding distillery reputation, our findings align with Moroz and Pecchioli (2020), who showed that whiskies from renowned distilleries command higher prices. Our study extends this by demonstrating that distillery reputation has a stronger influence than regional origin, with well-known distilleries enjoying a premium of approximately 18%. This insight is crucial for distilleries aiming to build and leverage their brand reputation to justify higher prices.

In summary, our study contributes to the existing literature by providing a detailed analysis of the key factors influencing Scotch whisky prices and their interactions. By incorporating interaction terms and using a comprehensive dataset, we offer a more nuanced understanding of the complex relationships between age, alcohol content, and distillery reputation. These insights are valuable for distillers, investors, and collectors seeking to navigate the premium and collectible whisky markets.

References

- Aaker, D. A. (1996) *Building Strong Brands*, Free Press: New York.
- Brammer, S., and S. Pavelin (2004) "Building a good reputation" *European Management Journal* **22**(6), 704-713.
- Chivas Brothers, (2010) *Consumer Survey on Scotch Whisky Preferences*, Retrieved from <https://moodiedavittreport.com/the-age-matters-chivas-bros-launches-major-consumer-campaign/>
- Detweiler, J. (2016) "Age and Price in the Single Malt Scotch Whisky Market" *Mimeo*.
- Hylta, T., and L. Lundqvist (2016) "Alcohol Content and Price in the Single Malt Scotch Whisky Market: A Hedonic Regression Approach" *KTH Royal Institute of Technology School of Engineering Sciences*.
- Moroz, I., and M. Pecchioli (2020) "The Role of Objective Characteristics in the Vintage Market: Evidence from Scotch Whiskies" *Journal of Wine Economics* **15**(3), 266-284.
- Moroz, I., and M. Pecchioli (2021) "Exploring the Relationship Between Expert Ratings and Consumer Perceptions of Whisky Quality" *Journal of Food Science* **86**(9), 3698-3707.
- Moroz, I., and M. Pecchioli (2023). "Appellation Effects and Reputation in the Secondary Market for Scotch Whiskies" *Journal of Business Research* **136**, 612-622.
- Page, I.B. (2019) "Why Do Distilleries Produce Multiple Ages of Whisky?" *Journal of Wine Economics* **14**(1), 26-47.
- Rosen, S. (1974) "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition" *Journal of Political Economy* **82**(1), 34-55.