THE HEDONIC PRICE FOR WHISKY: DISTILLER'S REPUTATION, AGE AND VINTAGE

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Abstract: Using an original dataset hand collected on an online trading platform specialized in whisky investment, this article aims to estimate the main determinants of price differences for whiskies. We find strong evidence that distiller's reputation, age of whisky and vintage affect positively the price. Other findings include a negative effect for independent bottling (*i.e.* not in-house by the distiller) and a positive "collector" effect for bottles identified as "extremely rare" by the website.

I.   Theoretical Background and Literature Overview

Prices can be used by producers and other sellers as signals to inform consumers about the quality of their products. Indeed, under given market conditions, a producer may sell its product at a higher price to signal a higher quality (Milgrom and Roberts 1986, Bagwell and Riordan 1991, Landon and Smith 1998, Mahenc and Meunier 2003). This pricing behavior can be observed in the case of experience goods, as defined by Nelson (1974), whose quality cannot be evaluated before purchase, such as food products for example. Such a price policy requires for the producer to benefit from a reputation, individual and/or collective, who can then sell at a premium above the production cost that can serve the function of compensating the producer for the investments committed in reputation (Shapiro 1983).

As wine can be considered to belong to the category of experience goods (Ali and Nauges 2007), the issue of reputation has been a major one in the literature concerning wine economics. Several works attempted to determine the way reputation determines the willingness-to-pay of a consumer for a given wine, be it the individual reputation of a producer or the collective reputation of a vineyard (Landon and Smith 1998; Costanigro, McCluskey and Goemans 2010; Castroiata and Delmastro 2014). More globally, a significant part of this literature has attempted to determine the variables explaining the prices of wine, resorting to the methodology of hedonic analysis (Rosen 1974), which considers a good as a set of characteristics or attributes

and its value as a function of the characteristics. Indeed, the issue of the determinants of price is a major one for a wine producer, as the price positioning of a given bottle requires an accurate identification of its value (Oczkowski, 2010).

Several papers of this literature distinguish two sets of characteristics for wine, differentiating objective with sensory attributes (Lecocq and Visser 2006), or respectively extrinsic with intrinsic attributes (Oczkowski and Doucouliagos 2014). So-called intrinsic or sensory attributes refer to all the characteristics of wine that are related to the tasting experience, including variables such as aroma, visual aspect and gustative properties. So-called extrinsic or objective attributes include characteristics that are taste-independent such as the grape variety, climatic conditions, the reputation of wine, producer or region or expert ratings. For the following part of our argumentation, we will resort to the terminology adopted by Oczkowski and Doucouliagos (2014). The hedonic prices analyses developed in wine economics have enabled a better understanding of the impact of each of these variables on the price of wine. For a global overview of this literature, see Fogarty (2003) and Estrella Orrego, Defrancesco and Gennari (2012).

If wine has received a significant attention for hedonic pricing analysis, it does not seem to be the case for whisky. Indeed, our research enabled us to identify only one paper (Page 2013) including a hedonic analysis of whisky prices. Page (2013) uses retail whisky prices to study the market conditions that induce distillers to produce multiple ages of whisky. His results show no significant link between a distillery's size and its ability to influence market prices and he suggests that distilleries may develop such an influence through brand recognition, but his works do not study this topic. If this specific issue deserves to be studied, we consider yet globally whisky to be particularly interesting for hedonic pricing analysis for three main reasons. The first one is that whisky, as wine, lends itself to hedonic price analysis because of the substantial attribute variation in available whisky products. Indeed, the production of whisky is worldwide, with distillers located in Scotland, Ireland, United States, but also more recently in several other countries such as Japan, India, Australia, Sweden or France and includes a diversity of sub-categories of products, such as bourbon, rye whiskey, cask strength, etc. (Murray, 2018). The second one is that whisky lends itself to investment behaviors and with significant rates of return. Indeed, whisky is nowadays considered as an investment opportunity by individual as well as institutional investors with a rate of return that exceed those of fine wines and even gold (Rare Whisky 101, 2016 and 2017): on the period 2015-2017, the rate of return of vintage single malt whiskies was equal to 102,23 % whereas it was equal to only 10,2 % for gold. The third one is that whisky possesses specific attributes, compared to wine, that can probably enable a better understanding of some of the mechanisms ruling the price determination of several spirits, including wines, and so contribute to the literature in wine economics. More precisely, the main interest of whisky compared to wine is that it's not a living substance whose intrinsic characteristics depend on time and climatic conditions. The intrinsic characteristics of whisky can be said to be time-independent for two main reasons.

Indeed, firstly, if we consider the case of wine, its production, both in terms of quantity and quality, depends on climatic variables. Several works studied the impact of this set of variables on the price of wine (Ashenfelter, Ashmore and Lalonde, 1993; Byron and Ashenfelter, 1995; Chevet, Lecocq and Visser, 2011). For example, Ashenfelter, Ashmore and Lalonde (1993) observe for Bordeaux wines a positive effect on price of winter rain and temperature and a negative effect of rain in the harvest and pre-harvest period. Haeger and Storchmann (2006) observe, for some American wines, that prices are mainly determined by temperature and precipitation and the works of Chevet, Lecocq and Visser (2011), studying two centuries of data from the archives of a Bordeaux château find that the influence of temperature on prices has become stronger. This literature enables us to understand one of the impacts of the vintage

variable on the price of wine: different vintages of the same producer can be sold at different prices only because of the distinctive climatic conditions characterizing these respective vintages. Indeed, in the case of wine, a given vintage is associated with a given set of intrinsic characteristics. This is not the case for whisky. A Lagavulin 16 years bottled in 2010 and a Lagavulin 16 years bottled in 2018 can be expected to share identical intrinsic characteristics: in both cases, it is a Lagavulin 16 years. The production process of whisky is such that its intrinsic characteristics do not depend on the climatic variables related to the period of its production (Bringhurst and Brosnan 2014), i.e. do not depend on the vintage.

Secondly, wine is a living substance in the sense that its intrinsic characteristics change through time once it is bottled. As Jaeger (1981) explains it, the maturation process of wines extends beyond the bottling day, potentially lasting between 20 and 40 years for some red wines, and with a proper age for consumption which cannot be anticipated but only discovered through experimentation. Consequently, the price of a wine partly depends on its maturing potential (Jones and Storchmann 2001). This characteristic of wine explains the fact that wine can be purchased to be stored, either to be consumed once it has aged, or to be sold at a higher price (Krasker 1979; Jaeger 1981; Burton and Jacobsen 2001; Ashenfelter 2008), expecting in the latter case that the wine will get a collector value (Byron and Ashenfelter 1995). This phenomenon of maturation for wine explains the existence of a market for young wines and a market for mature ones (Wood and Anderson 2006; Ashenfelter 2008) with potential investment behaviors similar to those we can observe in some markets for collectibles such as art (Burton and Jacobsen 2001; Lucey and Devine 2015; Aytaç, Hoang and Mandou 2016). Nevertheless, if investment behaviors are also observed on the market for whisky, they cannot be identical to those observed on the market for wine. Indeed, an investor in wine, and so does the consumer, may expect, for a given bottle, a change through time in its intrinsic characteristics due to the maturation process of wine. An investor in whisky will not have the same expectations because once bottled, the intrinsic characteristics of a whisky do not change (Page 2013; Mitchell 2014): a bottle of Lagavulin 16 years purchased in a given year remains years later the same bottle of Lagavulin 16 years, without any change.

Both these differences between wine and whisky lead us to consider differently the variables of age and vintage for these two respective products. As such, a hedonic analysis of whisky prices can enable a better understanding of the impact of some specific extrinsic characteristics on the prices of both whisky and wine. Thus our article makes numerous contributions to the literature. Firstly, it extends the scope of hedonic pricing analysis of whisky by considering variables that may matter for investors. Secondly, it can enable whisky producers to position more efficiently the price of their products and whisky investors to anticipate more accurately the rate of return of their investments. Thirdly, it can contribute to the literature in wine economics by providing new insights on the impact of some extrinsic characteristics on products prices.

This article proceeds as follows. Section II gives a brief account of the two different sets of characteristics that can be used to characterize a whisky, *i.e.* intrinsic and extrinsic characteristics, which enables then a better understanding of the data used in this article. Section III provides a description of the data. Section IV reports the empirical analysis. Section V offers a few summary remarks.

II.   Whiskies: Intrinsic and Extrinsic Characteristics

The characteristics of a whisky, as a spirit, can be subdivided in intrinsic and extrinsic characteristics as it has been done in the literature for wine. Concerning intrinsic characteristics, it is possible to identify similarities between the way to describe the tasting characteristics of a

wine and those of a whisky. That's what can be assumed by comparing the information provided about a wine in an edition of *Guide Parker des Vins de France* with the information provided about a whisky in an edition of the *Jim Murray Whisky Bible*. This point could be discussed more deeply but as it was explained previously, the aim of this article is not to focus on this set of characteristics. Concerning extrinsic characteristics, several attributes can describe a whisky (see Murray 2018), but we can arbitrarily identify three sets of extrinsic characteristics, with one set related to the producer, another one to the geographic origin and a last one concerning the production process. We use this arbitrary subdivision even if we know that in some cases, the geographic origin and the production process are linked. For example, a bourbon is produced with at least 51 % of corn and is necessarily made in United States. A scotch is necessarily made in Scotland and aged in used barrels. We choose yet to adopt this subdivision for two reasons. The first one is to enable, in the following part of the article, a better presentation of the data. The second one is to enable us to compare our results to some obtained in the literature for wine economics on the basis of a similar theoretical background.

If we consider the set of variables related to the producer, we can assume that the reputation of a distiller may affect the price of its bottles, as the reputation of a château may affect the price of a wine. We can make the same assumption concerning the geographic origin and the effect of the reputation of a given area on the price of a bottle, as it has been identified with vineyards in the case of wine. For whiskies, the geographic origin can be described in terms of national countries and in the specific case of whiskies originating from Scotland, i.e. scotch whiskies as defined by the Scotch Whisky Regulations 2009 of the U.K. law system, in terms of protected localities (Campbelltown and Islay) and protected regions (Highland, Lowland and Speyside), as it is the case for the vineyards of the French wine. Concerning the production process, several variables can be used to describe a whisky, related to the kind of cereal used (wheat, corn, rye, etc.), which can then enable to distinguish single malts, single grains, blended malt, bourbon, rye whiskey, etc., its age, which define the numbers of years it has been aged in an oak barrel before being bottled, the number of barrels, which can enable to differentiate single casks from other whiskies, the kind of barrels, with some whiskies that are "finished" in sherry casks, Burgundy wine casks, etc.

III.   Data

Data collection

The present work is based on the data provided by the website www.worldwhiskyindex.com. We chose to collect the data from this specific website for two major reasons. First, this online trading platform is specifically intended to single malt scotch whisky investors (as explained on its homepage) and displays all the relevant extrinsic characteristics that an investor may focus on, as indicated in the Rare Whisky 101 Annual Investment Reports (2016, 2017). Indeed, the website registers a diversity of information for a given bottle, including the name of the distillery, the name of the whisky, the kind of whisky, some characteristics of its production process (non-chilled filtered, colored and cask strength), the name of the bottler, knowing the distillery can bottle its whisky on its own or sell the cask to an independent bottler, the presence of the bottler personal signature on the bottle, the alcohol content by volume, the website engagement to guarantee the originality of the bottle, the type of packaging, if any, the volume of the bottle (in liters), the age of the whisky, knowing that some whiskies can be no age statement whiskies, the year it has been distilled, the year it has been bottled, and the ask price, *i.e.* the selling price proposed by its owner for a given bottle (and not the effective price resulting from a transaction between the owner and a buyer). When the age of the bottle was missing but

that years of distilling and bottling were provided, we chose to attribute an age to the whisky by deducing it from the two latter variables. Additional remarks can be provided for some bottles, indicating characteristics such as the existence of different packages, a commemorative edition, the existence of a possible damage, etc. Moreover, some bottles can be attributed by the website a label "Extremely Rare" when the available stock is significantly limited and that they are identified as more scarce. The second reason we chose this website is that this is the only one to our knowledge which references such a great number of bottles in its database, what lets us gather a sufficient number of observations (with no missing data) to perform analyses.

We collected a first sample comprising 510 observations of only one kind of whisky (single malt), produced by distillers located in Islay, one of the two protected localities of Scotland, and all the data have been collected between January 15th and January 30th 2018. The data were collected on a relatively short period so as to avoid significant price movements and we chose to consider only the bottles of the distillers located in Islay as it is the locality which has possessed the greatest number of distilleries with both the oldest distillery, Bowmore created in 1779, and the most recent one, Kilchoman created in 2005. Moreover, Islay is the locality of one closed distillery, Port Ellen, whose bottles – some of which are offered on the website – may see their prices explained by a specific collector effect. As such, it offers the greatest variability to study potential effects on prices linked to the reputation of distilleries and lets us control at the same time for potential collective reputation effects of specific locations as for vineyards. After accounting for missing data, we obtained a final sample comprising 278 observations. The relevant variables included are described in the table 1 below. The upper part reports the variables used in our base model, the middle part reports variables linked to the production process and the other relevant variables provided by the site are resumed in the lower part. We chose to compute the variable "vintage" as a quantity variable (the number of years since the whisky has been bottled) rather than in dummies (for each year) for the reason that, as mentioned before, we do not expect any impact of specific climatic conditions of a given year on whisky characteristics. Moreover, we do not consider other characteristics such as possible damages since only a misprint on the label of the bottle is mentioned for 2 observations in our final sample.

Insert Table 1 – about here

Summary statistics

The table 2 reports descriptive statistics for our dataset across distilleries. On the whole sample, more than a half (53.96%) of whiskies have been bottled by an independent bottler. 60.43% of bottles are cask strength whiskies, 48.20% come from a single cask, 54.32% are non-chilled filtered whiskies and 47.10% are natural colored whiskies. 88.13% of bottles are guaranteed by the website to be original, 15.11% are personally signed by the bottler and 0.72% (only 2 bottles from the distillery Laphroaig) are attributed the label "Extremely Rare". The most represented distillery is Port Ellen and the less represented is Kilchoman, with 51 and 8 observations respectively. Moreover, Kilchoman exhibits the less aged whiskies, with an average age of 5 years, versus 21 years for the whole sample.

Insert Table 2 – about here

The figure 1 provides the distribution of ask prices across distilleries. We can clearly see differences on the graph. Two distilleries are distinguished from other with higher prices: Bowmore, the oldest one in the sample (established in 1779) and Port Ellen, the only closed one, as mentioned above, with an average price of €1455.88 and €1424.59 respectively. At the opposite, Kilchoman exhibits the lower prices (€119.00 on average).

In figures 2 and 3, we plot the distribution of ask prices by whisky age and vintage and the respective regression line for each. It appears that the ask price increases in age of whisky and age of bottling in a similar manner. Although this trend could have been expected for whisky age, it is pretty surprising that its vintage seems to have also a positive impact on the price of bottles, given the arguments advanced before. A possible explanation is that a sort of collector effect affects the price asked by investors for the oldest bottles but this finding needs further investigation which is the purpose of the next section.

IV.   Empirical Model and Estimation

The empirical model

We use a log-linear regression model that has been traditional in most hedonic regression studies. We employ three different specifications: the base model with only variables for distilleries, whisky age and vintage, and two more elaborate specifications by adding the variables linked to the production process and the other variables provided by the website. Almost all the explanatory variables have been presented as dummies, except whisky age, vintage and alcohol by volume which are quantity variables. The dependent variable is the ask price, which means that our hedonic analysis only considers the supply side, which is a method that has been already employed in hedonic wine price estimations (for an explanation of the relevance of this approach, see Oczkowski (2015) (2013)). The base empirical model is as follows:

$$\log Ask\ Price_i = \alpha + \beta X_i + \varepsilon_i \qquad (1)$$

Where *Ask Price* is the price of the bottle *i* and X_i the vector of explanatory variables related to distillery (dummies), age and vintage (quantity variables). The residual ε_i is assumed to be independently and identically distributed. The elaborate version of the model can then be augmented by adding production process variables and other relevant variables to equation (1).

Estimation results

The table 3 reports the results from the regression analysis for the different model specifications. The reference distillery is Ardbeg. In model 1, we merely include the different distilleries as dummies and variables for age and vintage. In model 2, we add the dummies related to the production process and a dummy indicating if the whisky has been bottled by another bottler or by the distillery itself. Model 3 is similar to model 2 except we replace the latter variable by bottler fixed effects (the reference is "distillery"). In model 4 and 5, we use all variables and packaging fixed effect (the reference is "none") without and with bottler fixed effects respectively.

The parameters for age and vintage are positive and significant (at the 1% threshold) in all the specifications, confirming their positive impact on ask price even if we control for the other relevant variables. In other word, all other things being equal, the older the whisky and its bottling, the higher the price. In model 2, only two variables related to the production process are significant: *cask strength* and *other bottler*, with a positive and negative parameter respectively, meaning that proprietary bottling (*i.e.* by the distillery itself) without diluting

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appear to be valuable characteristics for investors. Notice that parameters for bottler fixed effects (not presented) used in the model 3 are significant and negative for 25 bottlers over 35 (only one is positive and significant: "Speciality Drinks") and that only the parameter for *other bottler* remains significant in the full model 4. In this model, parameter for *signed* is also significant indicating *a priori* a negative effect on price, but we can notice that the parameter becomes insignificant in model 5. In fact, almost all the signed bottles are bottled by an independent bottler (88%) and the majority by the same one, "Whisky Talker" (81%), thus this variable captures a part of the bottler effect, what can explain its negative impact. Concerning the distilleries, only whiskies distilled by Port Ellen appears to benefit from a premium (compared to Ardbeg), given that its parameter remains significant and positive in all models. This finding suggests the existence of a collector effect, supported by the results obtained for the parameter of *rare* variable in models 4 and 5. On the contrary, we find negative and significant parameter in all models for *Bruichladdich* and *Caol Ila*. Finally, although we could have also expected a negative parameter for *Kilchoman* as it is the most recent distillery in the sample with the lowest average ask price, the parameter remains insignificant in almost all models (except in model 1, at the 10% threshold only), suggesting that when we control for age, vintage and other characteristics, Kilchoman whiskies are not significantly cheaper than other whiskies distilled in Islay and thus do not distinguish from other distilleries in terms of reputation. Finally, we can notice that the type of packaging has mixed effects on price (not presented in the table), being positive and significant when it is a sophisticated packaging such as a gift box, a luxury wooden box, a red velvet box or a wooden frame and negative for more simple boxes and cartons.

V.   Conclusion

The results we obtain concerning the impact of vintage on price are particularly interesting not only for whisky or other spirits that share its time-independent characteristic, such as rum, but they raise also questions for wine. Indeed, if a part of the variability of whisky prices can be explained by vintage, it is not relevant, due to the production process of whisky, to relate this variable, as it has been done in several works concerning wine prices, to specific weather conditions that would influence the production process. As such, the valuation of the older vintages of whisky remains an unanswered question that requires yet further researches. A possible hypothesis could be that investors and collectors infer from an older vintage a smaller stock of bottles and consequently, value it more. Whatever the explanation, our results raise two issues. Firstly, there's the necessity, for studies concerning wine, to disentangle a vintage effect from an intrinsic effect: a wine could be valued because of its expected intrinsic characteristics but maybe also only for its vintage, whatever its expected intrinsic characteristics. Secondly, it seems necessary to wonder about the way this variable of vintage has to be considered. Indeed, the fact that, in the case of whisky, a vintage cannot be related to a given set of specific climatic conditions leads us to suppose it's not necessarily the bottling year of the spirit that matters but rather the age of the bottle of spirit: in such a case, the older the bottle, the higher its value, whatever its bottling year. These two possible ways to define the variable vintage raise a particularly relevant issue for the literature concerning studies of wine as an investment asset (Lucey and Devine 2015; Aytaç, Hoang and Mandou 2016).

Concerning extrinsic characteristics that can impact intrinsic ones, only one in our data has a positive and significant effect: age. This result, which depends on distillers' decisions, raises the issue of the technological choices made by distillers and their impact on whisky prices. The results obtained with the other variables related to technological choices in our dataset were not significant but our data contained only a limited set of all the variables that can be involved in

the production process of whisky. There might be other variables that could impact the price of whiskies. In the case of wine, Gergaud and Ginsburgh (2008) explain that technological choices (i.e. the choice of grape varieties, the picking and selecting process, the fermentation process, etc.) affect quality significantly more than natural endowments (land characteristics, exposures of vineyards, etc.). Concerning whisky, natural endowments can be used by distillers to partly explain the intrinsic characteristics of their whiskies, such as the river which provides the water used in the distillation process or a specific geographic location enabling the distiller to store its barrels in a specific place (seaside, warm region, etc.). Our data do not yet enable us to determine if technological choices of distillers matter more or less than natural endowments of distilleries. Nevertheless, our results concerning age, added to the growing recognition of distillers located in a diversity of countries such as Japan or India, and so with natural endowments that can be supposed to be different from those of Scotland, suggest it would be relevant to study the relative impact of these endowments and of some technological choices on whisky prices. Such an analysis requires to collect more information about the distiller's factors of production, such as the kind of stills or barrels they use or the climatic conditions of the place where they store their barrels.

These technological choices can be supposed to participate to the reputation of a distiller and our results seem to indicate that investors are particularly sensitive to the distiller and its involvement in the whole production process of a bottle of whisky: that's what we can suppose when we observe the negative effect of a difference of identity between a distiller and a bottler. In other words, the production of a distillery seems to see its reputation affected by the fact that its output is bottled by an independent bottler. It would not be the case when the output is bottled by the distillery itself. A potential explanation might be that investors consider distillers can guarantee the authenticity of the whiskies they bottle whereas independent bottlers cannot provide such a guarantee as they can bottle the whiskies of several distilleries. The impact of the reputation of a producer on prices has already been observed for wine. Indeed, Haeger and Storchmann (2006), in the case of some American wines, explain that a significant part of prices is explained by the winemaker and his or her skill and reputation and Ashenfelter (2008) explains that much of the variability of mature Bordeaux wines can be explained once the producer is known. A deeper study of the characteristics of distillers might enable us to understand the determinants of their reputation and their impact on the price of their bottles. Moreover, the results we obtain concerning the impact of individual reputation raise the issue of collective reputation effects on the market for whisky, such as those observed with geographical origins (Combris, Lecocq and Visser 1997; Schamel and Anderson 2003; Roma, Di Martino and Perrone 2013) and quality classification schemes (Landon and Smith 1998) for wine. Scotland, with its protected localities and regions, would provide a relevant research area for this issue, as well as the world market with the many countries where whisky is produced.

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Table 1 – Description of Variables

Dependent Variable	Description
Ask Price	The ask price (in €) of the bottle on the WWI website at the time of data collection

Explanatory Variables	Description
Distillery Dummies	Dummy variables for each distillery (*Ardbeg*, Bowmore, Bruichladdich, Bunnahabhain, Caol Ila, Kilchoman, Lagavulin, Laphroaig, Port Ellen)
Age	The age of the whisky (*i.e.* time spend between the date it has been distilled and the date it has been bottled, in years)
Vintage	The age of the bottle (*i.e.* time spend between the date it has been bottled and the date of data collection, in years)
Bottler Dummies	Dummy variables for each bottler (Adelphi, Berry Bros & Rudd, Blackadder, Bladnoch, Bruichladdich Cadenhead, Celtic Heartlands, Dewar Rattray, Diageo, Duncan Taylor, Direct Wines, Douglas Laing, Dram House, Gordon & MacPhail, Hart Brothers, Ian Macleod, Kilchoman, Mc Gibbon, Mackillop, Murray, Mc David, Old Brothwell, S.M.W.S., Samaroli, Signatory Speciality Drinks, Speymalt, Whisky Dist., The Dormant Distillery Co Ltd, The Ultimate Whisky Company, The Whisky Agency, The Whisky Talker, Thosop BVBA, Usquebaugh society, Wemyss Malts, Whisky Tales, Wilson Morgan, *distillery*)
Other Bottler	Dummy equal to 1 if the bottler isn't the distillery itself
Cask Strength	Dummy equal to 1 if the bottle has been bottled undiluted
Single Cask	Dummy equal to 1 if the bottle comes from a single cask
Non-Chill Filt.	Dummy equal to 1 if the bottle has been unchill filtered
Natural Color	Dummy equal to 1 if the color of the whisky has not been altered
Alcohol	The alcohol content by volume (in %)
100% Original	Dummy equal to 1 if the bottle is certified 100% original by the WWI website
Signed	Dummy equal to 1 if the bottle is personally signed by the bottler
Rare	Dummy equal to 1 if the bottle is identified as "extremely rare" by the WWI website
Packaging Dummies	Dummy variables for each type of packaging (bag, box, carton, carton box, deluxe box, gift box, in wooden case with locker, leather box, luxury box, luxury wooden box, red velvet box, tin tube, tube, velvet bag, wooden frame, wooden box, *none*)

Note: this table lists the variables and their respective description. For "Distillery", "Bottler" and "Packaging" dummies, the reference used in regressions appears in italic.

Table 2 – Descriptive Statistics

Variable	Full Sample	Ardbeg	Bowmore	Bruichladdich	Bunnahabhain	Caol Ila	Kilchoman	Lagavulin	Laphroaig	Port Ellen
Ask Price (€)	925.33	560.33	1465.88	571.25	717.52	333.34	119.00	559.93	1313.22	1424.59
	(1949.34)	(655.73)	(3648.97)	(396.76)	(931.00)	(226.23)	(65.81)	(735.30)	(1396.32)	(1258.72)
Age	21.23	14.83	23.19	19.80	30.32	20.69	5.00	15.87	22.78	25.22
	(8.79)	(7.10)	(7.19)	(9.89)	(9.67)	(8.17)	(1.51)	(6.05)	(8.36)	(3.78)
Vintage	10.39	10.92	10.86	14.95	9.80	10.89	6.12	4.93	7.44	11.98
	(5.04)	(4.08)	(4.10)	(5.81)	(3.28)	(5.25)	(1.81)	(3.25)	(8.19)	(4.47)
Other Bottler	53.96%	30.56%	70.31%	15.00%	92.00%	77.14%	0.00%	6.67%	33.33%	70.59%
Cask Strength	60.43%	72.22%	40.62%	50.00%	84.00%	65.71%	37.50%	66.67%	100.00%	58.82%
Single Cask	48.20%	27.78%	75.00%	15.00%	76.00%	65.71%	25.00%	0.00%	66.67%	45.10%
Non-Chill Filt.	54.32%	72.22%	81.25%	45.00%	68.00%	37.14%	37.50%	13.33%	11.11%	50.98%
Natural Color	47.12%	19.44%	70.31%	45.00%	60.00%	40.00%	37.50%	10.00%	11.11%	66.67%
Alcohol	0.5031	0.5132	0.4926	0.4905	0.4436	0.5286	0.4964	0.5199	0.5134	0.5148
	(0.0582)	(0.0568)	(0.0495)	(0.0741)	(0.0232)	(0.0637)	(0.0577)	(0.0542)	(0.0340)	(0.0560)
100% Original	88.13%	94.44%	89.06%	80.00%	92.00%	88.57%	62.50%	93.33%	77.78%	86.27%
Signed	15.11%	02.78%	56.25%	5.00%	04.00%	05.71%	0.00%	0.00%	0.00%	01.96078
Rare	0.72%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%
N	278	36	64	20	25	35	8	30	9	51
Proportion (%)	100%	12.95%	23.02%	7.19%	8.99%	12.59%	2.88%	10.79%	3.24%	18.35%

Note: this table reports descriptive statistics for the whole sample and across distilleries. Mean (standard deviation) and proportion are displayed for continuous variables and dummies respectively. *N* is the number of observations.

Table 3 – Estimation Results for Log of Ask Price

| Explanatory Variables	Model									
	(1)		(2)		(3)		(4)		(5)	
Bowmore	-0.474***	(0.139)	-0.079	(0.122)	0.262*	(0.147)	-0.104	(0.133)	0.019	(0.174)
Bruichladdich	-0.469***	(0.174)	-0.558***	(0.179)	-0.485**	(0.212)	-0.704***	(0.185)	-0.881***	(0.249)
Bunnahabhain	-0.889***	(0.187)	-0.451**	(0.188)	-0.143	(0.204)	-0.598***	(0.191)	-0.249	(0.231)
Caol Ila	-0.767***	(0.123)	-0.485***	(0.108)	-0.477***	(0.121)	-0.618***	(0.123)	-0.655***	(0.124)
Kilchoman	-0.331*	(0.185)	-0.253	(0.175)	-0.045	(0.173)	-0.208	(0.221)	-0.033	(0.198)
Lagavulin	-0.114	(0.160)	-0.193	(0.171)	-0.095	(0.157)	-0.252	(0.185)	-0.142	(0.167)
Laphroaig	0.258	(0.163)	0.165	(0.146)	0.221*	(0.128)	-0.064	(0.186)	-0.174	(0.194)
Port Ellen	0.257**	(0.125)	0.529***	(0.128)	0.327**	(0.149)	0.458***	(0.136)	0.439***	(0.143)
Age	0.073***	(0.007)	0.079***	(0.006)	0.091***	(0.006)	0.079***	(0.007)	0.080***	(0.007)
Vintage	0.052***	(0.013)	0.071***	(0.010)	0.066***	(0.010)	0.070***	(0.012)	0.062***	(0.012)
Cask Strength			0.294**	(0.127)	0.299**	(0.146)	0.118	(0.123)	0.210	(0.149)
Single Cask			0.027	(0.090)	0.093	(0.115)	0.063	(0.103)	0.181	(0.117)
Non-Chill Filt.			-0.037	(0.109)	0.013	(0.126)	0.104	(0.143)	0.100	(0.149)
Natural Color			-0.128	(0.128)	-0.036	(0.146)	-0.192	(0.166)	-0.071	(0.160)
Alcohol			1.363	(1.171)	1.954	(1.370)	1.653	(1.116)	1.724	(1.404)
Other Bottler			-0.679***	(0.119)			-0.665***	(0.111)		
100% Original							-0.018	(0.121)	0.097	(0.101)
Signed							-0.476**	(0.187)	-0.130	(0.204)
Rare							0.817***	(0.278)	1.483***	(0.465)
Intercept	4.335***	(0.198)	3.382***	(0.619)	2.779***	(0.728)	3.590***	(0.664)	3.470***	(0.772)
Bottler fixed effects	No		No		Yes		No		Yes	
Packaging fixed effects	No		No		No		Yes		Yes	
Adj. R^2	56.20%		72.29%		77.40%		77.43%		82.42%	
F-value	36.54***		46.16***		19.97***		28.15***		20.10***	
N	278		278		278		278		278	

Note: this table reports the results for log of *Ask Price* OLS regressions. Variables are described in table 1. *N* is the number of observations. White robust standards errors adjusted for heteroscedasticity are in parentheses. The superscripts asterisks ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Figure 1 – Distribution of Ask Prices by Distillery
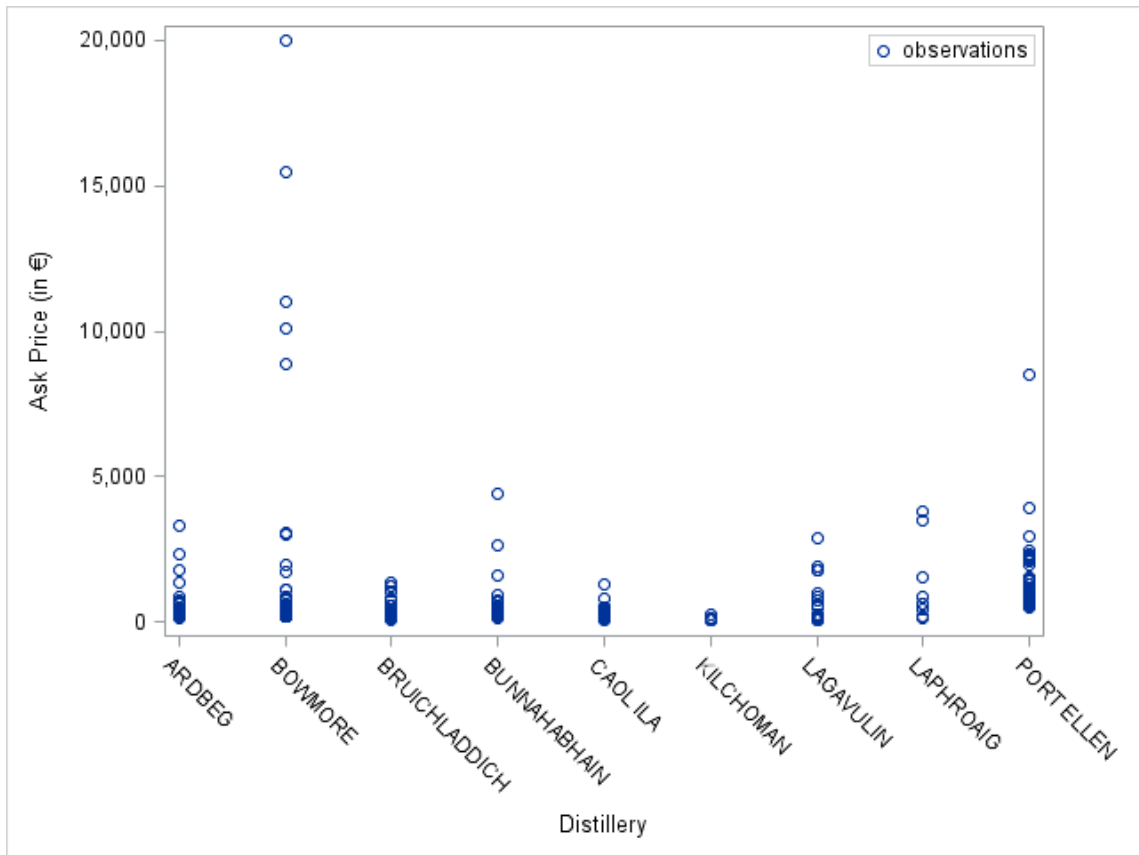
Figure 2 – Distribution of Ask Prices by Whisky Age
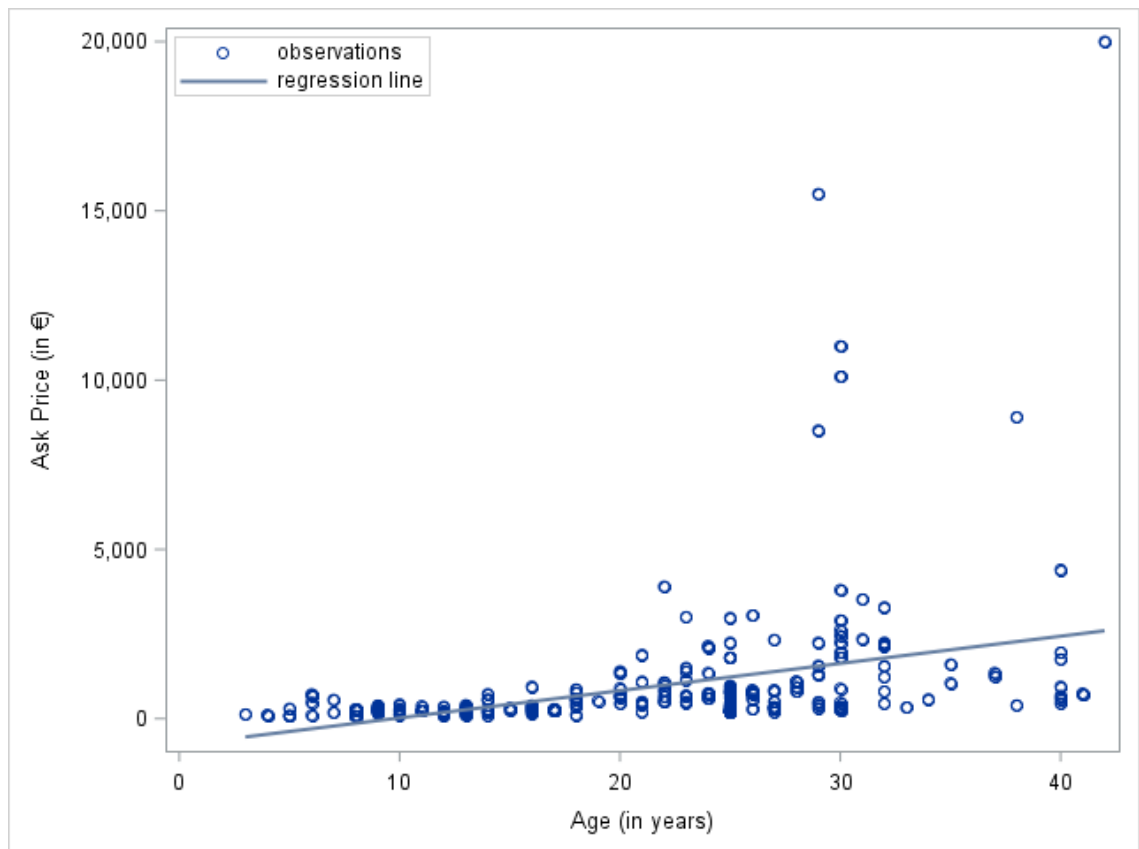
Figure 3 – Distribution of Ask Prices by Whisky Vintage