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Reclaiming Your Competitive Advantage

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RECLAIMING YOUR COMPETITIVE ADVANTAGE

THESIS

A thesis submitted in partial
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ABSTRACT OF THESIS

RECLAIMING YOUR COMPETITIVE ADVANTAGE

The Kentucky Distillers Association announced that over 10 million barrels of bourbon are aging across the commonwealth. In 2020, Kentucky distillers purchased 17 million bushels of corn, 75% coming from Kentucky farmers (KDA, 2020). That is, 65% of corn grown in Kentucky remains in the state to be used in Kentucky bourbon whiskey distillation. There is no shortage of support from the distilling industry for American agriculture and the Kentucky economy. In the same, American wine production is a dynamic sector in the United States economy, accounting for $276.07 billion in economic output or around 1.28% of GDP.

Whether you are new to the alcoholic beverage industry or have experience, producers seek new ways to increase the premiumization of their products at the retail level. Labeling allows for clear product differentiation. Due to the lack of available research to distilleries on premiumization through product labeling, our research aims to compare methodology and results from wine industry related research, to the labels found on bourbon whiskey bottles. Producers can display important characteristics of the product to potential consumers. Utilizing a nationally representative retail scanner data set containing over 650,000 unique UPC and 7,000 brands of wine and whiskey products, we investigate the price premiums in the two industries for the various labels from 2017-2020. Example labels include, but are not limited to, estate, reserve, organic, varietal, location, single barrel, and bottled-in-bond.

The retail scanner data set also contains information about the purchase price, store type, and location. A hedonic pricing model and a demand model is employed for each industry to evaluate each sector's price premiums by label type. The hedonic pricing framework will estimate the product's monetary value based on label's characteristics.

Results from this research will provide wine and whiskey producers with a stronger understanding on product differentiation and price premiums or discounts they should expect depending on how they distill or ferment their products. Through the evaluation of the long history of product differentiation in the wine industry, we will offer new insights to help whiskey producers establish themselves among a rapidly expanding and competitive market.

KEYWORDS: Price Premiums, price analysis, whiskey market, wine attributes, labeling characteristics

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April 21, 2023

RECLAIMING YOUR COMPETITIVE ADVANTAGE

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Chapter 1 Introduction

Wine production has a rich history dating back several thousand years B.C., uncommonly known to be first found in Chinese culture. In 2021, world wine production, excluding juices and must, was estimated at 6.8 billion gallons. Italy, France, Spain, and USA mark the four largest wine producing countries with a combined 56.7% of total world production [IOVWIO(2022)]. Across the world, different regions are known to grow grape varieties native to their land. For instance, the purple-skinned Sangiovese grapes are indigenous to Tuscany, Italy and are used for the renowned Chianti red wine. In France, one of the most notorious wine regions is Bordeaux, producing 15% of total production in France. This area produces some of the world's finest wines from Merlot and Cabernet grape varieties.

In 2021, California produced approximately 650 million gallons of wine, representing 84% of total wine production in the U.S. [WINEINSTITUTE(2021)]. Napa County is a highly respected wine producing region. In 2020, this county had 43,521 acres bearing wine grapes [CDFA(2021)]. In the state of California the leading wine-type grapes are Chardonnay and Cabernet Sauvignon. Other wine producing states include Washington, New York, and Oregon.

A common term used in the wine industry is micro-climate. Micro-climates describe small areas within a vineyard that have different growing conditions. This subtle variation refers to temperature or humidity. The differing climates is a common characteristic of the top producing regions for wine grape production. The change in climate affects the time in which grapes ripen and the resulting wines.

In the wine industry using a name-place on a label denotes the geographic pedigree of a wine, such designation is called an Appellation of Origin. American Viticulture Areas (AVA) are federally-recognized wine producing geographic regions within the

United States. In France, these designated areas are called Appellation d'Origine Contrôlée (AOC). There are approximately 360 AOC in France and nearly 270 AVA in the U.S. Using a name-place tells the consumer what they are drinking and the wine's true location of origin. A similarly regulated label in the wine industry is 'estate-bottled'. This tells the consumer that the company that grew the grapes also made and bottled the wine. Other labels include reserve, vintage, and vineyard.

The whiskey industry shares commonalities to wine in their approach to labeling products. Due to each product being luxury goods, both producers seek to bring attention to the quantity of the product. Additionally, the global presence, marketing structure, and production process resemble that of wine. These underlying commonalities make for validated comparisons between price premiums via labeling.

There are several types of whiskey produced throughout the world. Most notable are Scotch, Irish, Rye, Bourbon, and Japanese whiskey. The spelling of whisk(e)y can indicate the point of origin. For instance, Irish whiskey is spelled with an 'e' compared to Scotch whisky which is spelled without. Key producing regions include North America, Europe, Asia-Pacific, and Latin America, Middle East and African (LAMEA). This spirit has endured centuries of evolution and the first distillation of whiskey can be traced back to 1000 A.D. in Scotland or Ireland. As the spirit moved into North America, taxes on whiskey became an important component of presidential campaigns. Now, in 2021 the estimated global market value of whiskey was $59.8 billion and is forecasted to experience compounded annual growth of 6.12%. By 2027, the global market value is estimated to be worth $86.1 billion ([IMARC(2021)]).

The whiskey specific to the United States is bourbon. Though the bourbon is unique to America, the state of Kentucky dominates all states by producing 95% of the world's supply. This state has an estimated $9 billion in economic output each year. The industry hasn't always flourished, a 13 year Prohibition and repercussions of war hampered early growth in the 1900's. Though the industry didn't age over night, it

now actively supports American agriculture and generates millions of dollars annually into the Kentucky economy. The rapid growth in demand for distilled spirits has given distillers an overflowing incentive to expand. In response, the American industry has experienced more than 360% increase in production since 2000 [KDA(2020)]. The continual expansion has created thousands of jobs and opportunities that stretch far beyond the commonwealth. However, distillers are still left searching for innovative ways to separate themselves in this competitive market.

Distinguishing your product from others in this environment can determine your market position and help piece together the puzzle of an efficient marketing strategy. Distillers attempt to understand the underlying internal and external factors affecting price to make these educated decisions. Similar to transitioning from conventional to organic production, distillers too must weigh the cost and benefit of adopting a new production style. This can be done by identifying expected price premiums for various styles of bourbon whiskey. By comparing current price to the observed market premiums, distillers are able to make adjustments and streamline their marketing scheme. The leading label designations in the bourbon industry include small batch, single barrel, and bottle in bond.

Distillers are also interested in discovering how consumers value certain styles of bourbon whiskey. Producers begin predicting consumer behavior by observing the relationship between consumption, style and price. In addition, distillers can benefit from research revealing the relationships of preference to age, income, or number of adults in a household. In an equally important manner, this research serves as a pillar for the continual economic growth that is accomplished through new legislation. Government administrators utilize this research to make smart, educated decisions such as increasing investments into the industry and lobbying for the removal of harmful tariffs on foreign exports to strengthen the global market.

In today's world, transparency of products give consumers incentives to pay more.

For instance, purchasers take pride in knowing that their earnings are spent on products sourced from sustainable practices and distinguished criteria. We see this in the food industry and more relevantly speaking in the wine industry. Higher prices are associated with exclusively labeled wines such as 'estate bottled' or 'estate grown'. These labels convey viticulture consistency. Estate wines tend to be higher quality with a higher price to match. The lack of such label in the bourbon industry leaves a void in an unexplored market for one of Kentucky's most featured products. The need for an established premium product such as estate labeled whiskey will help secure Kentucky bourbon's reputation and its core values while helping it achieve sustainable growth.

Hence, the 'estate-bottled' premium observed in the wine industry is estimated and used to make inferences about the potential of an 'estate-bottled' whiskey. Single-origin whiskey brings light to locally sourced grain and whiskey that is produced and bottled in its entirety onsite of the distillery. This research concentrates on a hedonic model for wine and bourbon whiskey in the U.S. The model will supply impacts on price of labeling characteristics such as style, state of origin, and bottle size. Other statistical modeling include consumer demographics to uncover the willingness to pay by the consumer given various attributes such as age, income, or education level. The first chapter of this paper introduces each industry, giving a glimpse of the global growth, regional insights, and common terminologies. The second and third chapters will address previous literature, discuss the hedonic price model, analyze the data, and discuss the respective premiums. The fourth chapter of this paper will conclude and compare the premiums observed in both the wine and whiskey industries.

Chapter 2 Wine Labeling

2.1 Introduction

Wineries seek to maximize profits by differentiating their wine from their competitors by carefully selecting inputs and altering production methods. The general process for wine making includes harvesting grapes, crushing, fermenting, pressurizing, filtration, aging, and bottling (figure 2.2). In the alcoholic beverages market, differentiation can be as simple as targeting specific consumer tastes, preferred ingredients, or style. This separation or alteration can be translated to value-added perceived by the consumer. Price is another differentiating factor of a product, a more costly bottle of wine is often associated with higher quality. The higher cost at retail is commonly a direct reflection of additional cost of furthering stages of production or increasing input requirements. In the wine industry, value-added can be achieved through vintage labeled wine which indicate a desirable year in which all the grapes where harvested. Estate-bottled wines indicate viticulture consistency and are often perceived as higher quality due to the production standards that must be upheld in order to use the label. Thus, price premiums associated with vintage and estate-bottled wines tend to be higher compared to other less input intensive wines [Daniel(2017)].

The wine industry encompasses similar characteristics to bourbon whiskey. In context of market structure, there are several components that align for the two perfectly competitive products. There is no single company holding substantial market share, the industry output is standardized, the products are homogeneous, and there are many buyers and sellers. Aside from market structure characteristics, the two products have underlying commonalities such as fermentation process and barrel aging. Each product can be blended or single malt/varietal styles. The two industries share similar pricing tiers including economy, premium, super premiums, and ultra

premium (figure 2.1). The resemblance between these two industries make for validated comparisons in competitive advantages through price premiums that one may have over another.

Economist across the globe have conducted analysis for the internal and external factors affecting price of wine. Existing literature identifies the amount consumers are willing to pay based upon how the wine or spirit was produced, where it was distilled or fermented, and when this process took place. [Dahl(2019)] takes a look at the impact characteristics of wine have on price through hedonic modeling. This report determines the impact explanatory variables such as origin, taste segment and colour segment have on average price. The population of interest in her study were Swedish consumers. Dahl determines that on average, wines originating from France are 5.51% more expensive per litre. The above-average price is likely due to the long standing reputation of masterful wine production in France. The econometric methods used in this study indicate the taste segment with the highest relative impact was austere and variegated with 24.01% relative impact on price. However, results suggest that all taste segments in this study effect the price in mostly an insignificant manner. Dahl states that sparkling wines, on average, are more expensive and have a relative impact of 42.75% on price. Other literature observes older consumers in Poland with an established economic status are the most loyal and unbothered by the point of sell, even if it means a higher price, [Trestini et al.(2020)Trestini, Stiletto, and Stranieri]. Additional research from [Dahl(2019)] suggest a weak relationship between distribution level and price of wine. A key assumption for hedonic price modeling is that the data must derive from a free market. By delving into the Swedish market for high alcoholic beverages, Dahl addresses how the monopolistic tendencies within this market may hinder the effectiveness of the hedonic model. The early applications of this method is observed by [Rosen(1974)] which utilizes the method to determine price factors of housing attributes. Common variables regressed against housing price

include external appearance, presence of fireplace, number of bathrooms [Can(1992)]. The contribution of this research explains how buyers and sellers determine market equilibrium.

Optimizing profits can be done by reviewing the expected price premiums for given production adjustments. Wine or spirit marketers are able to evaluate price and position their product to streamline their marketing strategy. Research conducted by[Bombrun and Sumner(2003)] assesses premiums relating to label designation, grape variety, vintage, and appellation. Results illuminate the respective weights various attributes have on the market price of wine in California. The preferred method of approach for this analysis was hedonic modeling.

Grape varieties observed in this study include Merlot, Cabernet Sauvignon, and Chardonnay representing all varieties in the data by 17.4%, 28.8% and 42.3% respectively. The inclusion of grape variety as an independent variable aims to describe the relationship between variety of grape to the price. Results show that grape varieties such as Chardonnay, Zinfandel and Cabernet have an insignificant impact on price relative to Merlot wines, assuming ceteris paribus (holding all else constant). Obtaining the highest premium are wines derived from Pinot Noir grapes. These grapes are expected to have 9.9% impact and an estimated $1.47 premium on price. Another label descriptor given to select wines is vintage year. This specifies the year in which the grapes were harvested. Vintage wines can vary in style and quality, and generally sell for more. Growing conditions vary year to year which effect quality, therefore influencing consumer decisions. [Bombrun and Sumner(2003)] observes six vintage years and their respective prices. The highest observed premium relative to 1995 was in 1997 with a $2.18 premium and 13.7% impact.

Label designation refers to the nature in which the product was created. Case in point, the label 'estate-bottle' wine is legally regulated and indicates 100% of the wine making making process is owned or controlled by the winery. This particular

label conveys a specific message to the consumer like certain viticulture practice and higher quality. Although Sumner's results do not indicate a significant premium for "estate-bottled" wines, there is a 12.7% impact on price and estimated $2.09 premium for vineyard designated wines. That is, at least 85% of the grapes used come from the designated vineyard [Bombrun and Sumner(2003)].

In the same, labeling that designates a specific region the wine was produced is called an appellation of origin. Well-known registered wine producing regions often bring higher price such as NAPA Valley, [Taplin(2011)]. NAPA Valley, California has an outstanding reputation and is often used as a control variable to compare against other high performing wines, [Berríos and Saens(2015)]. Wineries producing in NAPA Valley may expect a price premium of $5.99 and impacting price by nearly 61%, [Bombrun and Sumner(2003)]. Registered place-names convey unique connotations to consumers such as production methods or grape varieties. This study incorporates an unusual explanatory variable, tasting score, that are derived from a notable California news release, *Wine Spectator*. Sumner's research distinguish expected price premiums for higher rated wine compared to those that are not. As one may assume, the higher the tasting score, the higher the observed price difference was for a one unit increase in score ($.83).

Organic wine must meet certain specifications to ensure both the growing of the grapes and their conversion to wine meet the standards set forth by the USDA organic certification. As with other USDA organic products, organic wine must be made without using prohibited substances or genetic engineering [McEvoy(2013)]. Wine can be made with organic grapes, but if other ingredients having genetically modified traits such as yeast, it can not be labeled as an organic wine. The demand for organic products in the agricultural industry has seen an overall positive trend. Research has found that consumers lie at each ends of the spectrum when it comes to organic wine preferences. A number of purchasers may perceive organic wine as

lower quality, whereas others are willing to pay a premium
[Boncinelli et al.(2021)Boncinelli, Dominici, Gerini, and Marone]. This choice experiment determines that Italian wine consumers on average do not prefer organic wines, though a niche market has been identified. Furthermore, this study finds that the majority of consumers in this sample were not affected by the organic attribute.

This study contributes to existing literature by expanding the capacity in which the hedonic model is utilized. Few economist have conducted an examination of the price of wine as a function of it attributes, furthermore fewer have utilized the impact of wine labeling attributes and made inferences to bourbon whiskey characteristics. The lack of such empirical research addressing the price of wine prompts the necessity of further examination. This study observes the actual sale price and incorporates consumer scanner data to estimate the true price premium instituted among domestic and international brands. Additionally, the empirical model employed in this paper accounts for the traits of wine that are directly observed by the consumer on the label. This provides insights to where producers may emphasis certain components of their marketing schemes that other areas of research have yet to assess.

2.2 Data

The data used in this study comes from Nielsen's consumer scanner data where we obtain the sale price of wine from 2013-2020. The data set contains purchasing information such as the store type and transaction region. Information about the consumer includes, but are not limited to, household income, race, relationship status and household size. The data set is compromised of the sale price of wine, the size of bottle, UPC description, and bottle type. UPC, or Universal Product Code, is a unique 12 digit number assigned to a product. These codes are used worldwide to easily track items. The bottle type has separate classifications such as glass or box.

Each UPC has a unique set of variables available for econometric analysis. These

include grape variety, color, style, region and consumer demographic variables. The highest purchase price for 750ml bottle of wine was $475 and the average price of $6.83 (table 2.1). Three prominent grape varieties found in this data set are Cabernet Sauvignon, Merlot, Pinot Noir where market share for the grape varieties can be found in figure 2.3. The style variable denotes the origin of wine such as California, Washington, Oregon, and wines without any name place on the bottle. In the wine industry, common terms used to describe certain aspects of the wine include reserve, estate, and vineyard. Each of these names typically convey to the consumer higher quality. When the specific name of the vineyard is found on the bottle this means that the grapes used in the wine were grown only by the specified vineyard. In this data set we are able to identify when the vineyard where the grapes where made on the bottle. In special cases, one winery will producer several different wines only distinguishable by the name of vineyard on the label. There are four state variables regressed in the hedonic model including California, Washington, Oregon, and 'Others' which indicates the remaining 47 states. The market share for each state is shown in figure 2.4. There are regions within states that are known across the world for producing premier quality. The market share for various regions regressed in the hedonic model is seen in figure 2.4. Price is regressed on organic labeling variable as well. In this data, we observe 540 wine purchases that are certified organic by the USDA. Among the 458,544 purchases, 458012 of these are not organic products as seen in the lower portion of table 2.1.

The consumer scanner data consist of more than 250,000 households. An independent variable included in this research model derived from the consumer is 'household income'. This variable denotes the income for the entire household and each income level is placed in subsets starting at an income level $5,000 increasing at two, three, five, ten and thirty thousand dollar increments with incomes $i \geq$ $100,000 and $i \leq$ $5,000 each to one subset. Independent variable 'race' consist of four races: White,

Black, Asian and Hispanic. 'Marital Status' is another descriptor derived from consumer data. Participants are given the option to choose single, married, widowed, or divorced. Lastly, 'household size' is given a number one through nine where nine can mean nine or more members.

2.3 Methods

There are two econometric models employed to capture 1) the price premiums of wine and 2) the willingness to pay by consumers. A simple hedonic price model is the first method used for this study to regress unit price of wine as a function of grape variety, color, style, and region. Our methodology seeks to evaluate n bundle consisting of various attributes which are described completely by numeric values. This particular model takes a set of characteristics as a function of themselves to determine their affect on price seen in wine characteristic evaluations [Outreville and Fur(2020)] and [Dahl(2019)]. The hedonic equation used to estimate the price premiums of wine given various traits is shown in *Equation* 1 below.

$$lnP_{icst}^{Wine} = \beta_0 + \beta_1 X_{icst} + \zeta_c + \theta_s + \tau_t + \epsilon_{icst}$$

(*Equation* 1): Wine Hedonic Price Model

The dependent variable, wine price, found in the equation above is log-transformed. Log transformation is utilized in several econometric applications where monetary interpretations are necessary [Ellis(2020)]. The use of this modification in the dependent variable enables for the interpretation of percentage increase (decrease) in wine price for a change in the wine attribute [Ford(2018)]. In this case, we use log-price to interpret the dependent variable as a percentage change in dollars per milliliter.

Several attributes in this study are represented as binary variables. As seen, to incorporate 'reserve' as a style variable in the model it must be given a numeric

value so that it is unique from other style variables and can be multiplied by the β coefficient which results in a positive or negative preference. This model allows for the independent variables to be inputted into this equation while holding all other factors constant. The ability to hold other variables constant gives an accurate prediction of the specific attributes found on a bottle of wine. In *Equation* 1, dependent variable is interpreted as the predicted price of wine given a bottle i in a county c and state s during period t.

$$P_{icst}^{Wine} = \lambda_0 + \lambda X_{ict} + \delta Z_{ict} + \zeta_c + \theta_s + \tau_t + \epsilon_{icst}$$

(*Equation* 2): Wine Demand Model

The second model (*Equation* 2) identifies consumer preferences by extending *Equation* 1 with the consumer demographic variables represented by δZ_{ict} as previously done in [Dröes et al.(2019)Dröes, Bourassa, and Hoesli]. By incorporating these variable we are able to estimate trend of the consumer willingness to pay based upon the purchases of wine. In *Equation* 2, the subscripts denote a bottle i in a county c and state s during period t.

Fixed effects are commonly used when utilizing panel data where we observe a single person and their attributes multiple times. The fixed effects that are incorporated in this model are county c, state s, and time t. The inclusion of fixed effects in the model allows us to control for variation in price across space and time. This enables for a more accurate prediction of whether there is a relationship between individual characteristics and the response variable.

2.4 Results

Table 2.3 shows the hedonic results for the Nielsen's consumer scanner data from 2017-2020. The table reveals the percentage increase or decrease in the price of

wine. Wine grapes grow in a variety of regions across the world and certain grape varieties reflect a price premium or discount in resulting wine. Each grape variety in this regression is directly compared to the reference variable 'other' which includes all other grapes not listed in the table. Of the ten grape varieties in this analysis, wine made from Sauvignon Blanc, Chardonnay, and Riesling obtain the three highest percentage impacts on price per milliliter. The price of Sauvignon Blanc wines is 35.0% higher than the "other" varieties of wine, holding all else constant. Chardonnay and Riesling wines are 27.2% and 29.7% higher than the "other" wines respectively, holding all else constant. The grape varieties with the largest discounted percentages compared to "other" grape varieties are Syrah with -44.0% and Merlot with -20.0% impact on price.

Other grape varieties to have greater than 10% positive impacts on price are Pinot Noir, Zinfandel, and Pinot Grigio with 21.1%, 11.5%, and 11.4% respectively. These impacts are also per milliliter on price of wine independently from each other and compared to "other" wines. Cabernet Sauvignon and Muscat have less than 10% positive impacts on price with 1.3% and 8.3% respectively.

The color of wine tells consumers the age, grape variety, density of flavor, and acidity. In this research we regress the price of wine on the colors red, white, blush. Red wines are typically made from Pinot Noir and Cabernet Sauvignon. The price of red wine is estimated to be 47.6% higher compared to "other" colors of wine which are colors not identified as red, white, or blush, holding all else constant. Chardonnay, Sauvignon Blanc, and Riesling are popular white wine grapes. The price of white wine is 12.4% higher per milliliter than "other" wine colors. Blush wines have a predicted 8.9% higher impact on price. White Zinfandel or white Merlot grapes can be sourced for blush colored wines.

In table 2.3, results can be found for price premium for price as it is regressed on three wine styles; reserve, estate, and vineyard. Wines with the reserve mark on the

bottle result in a 8.9% increase in price per milliliter relative to the "other" wines that do not have a label designation or the style is outside the scope of the three styles that price is regressed on. A wine label with the specified vineyard indicating the location to which the grapes were sourced is discounted on average 26.0% per milliliter compared to "other" wines. The highest impact of the three label designations are labels containing the word estate indicating a specific single-origin. Estate labeled wines receive a 34.6% increase in price per milliliter when compared to wine with no label designation or outside the scope of these three styles, holding all else constant.

The region in which the wine is produced is found on the label on the bottle. This type of label designation is regulated and referred to as an appellation of origin. Table 2.3 exhibits the regression results representing three states and five sub-regions. The region of Sonoma in California obtains a 71.7% impact per milliliter when compared to all "other" regions outside the scope of the five chosen for this model. Napa Valley, also a region of California, is predicted to influence price by 107.1% compared to "other" wine producing regions.

In Washington state, the region of Columbia Valley unveils a 38.2% impact per milliliter compared to "other" regions across other states. Walla Wall is also a well know wine producing region in Washington state and is estimated to impact price per milliliter of 131.3%. The last region included in this econometric model is Willamette of Oregon. This region receives a percentage impact of 84.6%, relative to "other" regions throughout the United States.

The organic wine commands a considerable price premium which is consistent with other literature surrounded organic production. Wines that are certified organic by the USDA receive a 39.3% premium per milliliter when compared to wines that are not certified organic.

Table 2.4 shows results for the demand model which includes consumer demographics as an extension to the hedonic equation. A positive 0.034 coefficient is

estimated for household income. All classifications of marital status receive positive estimates of 3.0%, 2.3%, and 3.7% and the reference variable for this category is widowed. Household size is negative at -0.019%. Education for both male and female variables also take positive coefficients of 0.023% and 0.031% respectively. However, male and female age variables hold negative are deemed negatively related to price.

2.5 Discussion

The regression coefficients for grape variety are estimated based upon the sale price of wine and the given attributes. The interpretation for wine grapes is that certain varieties will result in higher or lower sale prices of wine. By observing the sale price of wine from 2013-2020, it uncovers that on average Sauvignon Blanc has the highest positive impact on price than all other varieties in the United States. That is, this variety will cost 31.5% more per milliliter when compared to 'other' varieties. Among the top four white wine grapes produced in California (90,000-16,000 acres), the highest wine producing state, Sauvignon Blanc has the third lowest total acreage in production and second highest non-bearing acreage behind Chardonnay (2021). That is, for grapes produced in high quantity, there may be an assumption of previous cultural or pest problems and a stage of replanting of vines as result. This alludes to an increased price of Sauvignon Blanc grapes in addition to high demand among wine purchasers and a higher price at retail. Secondly, this variety is experiencing a shift marketing in Napa Valley and Sonoma of California with higher price tags to match [Hunt(2022)].

The Syrah grape variety on average is discounted to other grape varieties by 39.9% per milliliter. According to the 2021 final grape crush report, this variety had the lowest purchase price per ton in Sonoma County at $100 however in Napa county, it was the highest among all lowest sell points per ton and throughout the years remained mid-level price per ton [USDA(2021)]. The variation in price makes it

difficult to pinpoint why specific grapes have a distinct reflection in price. However, growing conditions have shown to significantly influence wines grapes and resulting wines such as alcohol content, body, tannin, and acidity, even if varieties remain the same [Wyatt(2015)]. Further more, Syrah grapes are commonly used. Regardless, results show on average which variety of grape wineries can expect a higher or lower price through grape selection.

The results of this research indicate red wine is superior to other colors, receiving highest marks with a positive impact of 50.2% on price. Red wine is known to possess health benefits over alternative colors [Das et al.(2010)Das, Mukherjee, and Ray] and [Tsang et al.(2005)Tsang, Higgins, Duthie, Duthie, Howie, Mullen, Lean, and Crozier]. The color of wine may indicate age, grape variety, cues of flavor, and production practice desirable to wine connoisseurs. In 2021 red wine grapes accounted for the largest share of quantity crushed at 2,031,242 which is 11.5% higher than 2020. White wine grapes experienced only a 0.6% increase in volume from 2020 with 1,600,508 tons. White and red wine grapes both take greater than 20% gains in price per ton in 2021 from 2020. The average price of red wine grapes were higher than that of wine with $1,071.69 and $674.98 respectively. Due to higher production and increased price per ton, a connection can be made between the high quantities of production, high purchases prices, thus higher average sticker prices at retail. As expected white wines have considerably less impact on price (20.9%). Blush or rosé wines are made with red wine grapes and are fermented with the skins in shorter time than red wines. Rosé is simply less popular than white and red wines thus the average price is slightly less than white.

There are several labels that are explicitly found on a bottle of wine, our data allows for the regression of three. In the United States, reserve labeled wine is used to convince consumers of enhanced quality and prestige. There are no legal regulations on what makes a bottle reserve. However, in Europe, the terms “Reserva” or

"Riserva" indicate the wine is made under particular standards, likely referring to the time in which it was spent in the barrel [Vinifera(2006)]. The positive impact on price of 9.0% does support the concept of higher quality and higher price. As previously mentioned, estate-bottled wine combines the growing of the grapes and wine-making process. This term is regulated by the Alcohol and Tobacco Tax and Trade Bureau of the U.S. Treasury Department (TTB). When the term estate is used explicitly on the bottle it is accounted for in the regression. The presence of this term give a 34.6% impact on price. For instance, if a given bottle of wine without the estate term is $6.83 and a separate bottle with the same characteristics has the estate term will be estimated $9.17. Though it varies from winery to winery, price premiums are commanded for labels including the 'estate' term [Daniel(2017)]. Likewise, when the vineyard of where the grapes where grown is found on the labeled, a discounted price of 26.0%. One conclusion from this result maybe that vineyards will reduce the price of their bottles in the wine shop at the vineyard to reduce competition from business partners.

There are several factors that affect the level of impact location has on price such as geographical differences in costs, demand, and supply. We have discovered a steady relationship of higher average prices when a name place is included on a label. Previous literature indicates that when the name of store is favorable, the strength of price increases for perceptions of quality and value while it diminishes for perceptions of sacrifice ([Dodds(1991)].

California has the highest number of wineries in the country with 4,501 in 2018. Justifiably the state is top in wine production and in level of economic impact [WineAmerica(2018)]. However, since they possess nearly six times the number of wineries than Oregon (793), it is likely that the market for California wine is flooded with lower than average priced wine therefore regression indicated the explicit name of California is significantly lower than Oregon. This research discovers that Oregon

wines obtain approximately 3.5x the percentage impact on price per milliliter. In the same, Washington also has considerably less wineries (792) and produces a 5% of wine than that of California.

The preceding notion of great American wines lie in regions such as Napa and Sonoma county. The name place Napa gives the highest premium to wine with 100.7% increase in price per milliliter. Washington state's leading wine producing region is Walla Walla Valley. The explicit name of this region is estimated to increase price per milliliter by 92.6%. Highly touted regions give individual wineries price their product higher than their competitors simply due to the premier quality, desirable origins, and relative scarcity. Walla Walla is know to have the highest concentration of wineries in the state and home to some of the oldest wineries. The rich history and notable wines give the region a lofty premium. The trend of higher priced wines hold true to Willamette Valley, however Columbia Valley is slightly discounted when compared to other regions. Factors such as consumer loyalty and price competition within a state or region may incentive wineries to discount price.

Businesses aim to invest time towards improving business models and operations in response to the concerns of climate change and overall sustainability. Organic production has claimed a significant premium in the agricultural industry as seen in dairy and eggs [USDA(2016)]. Organic wine receives a considerable premium of 39.3% per milliliter. The average price that consumers paid for a 750 milliliter bottle of wine is $6.83 for all income levels. If the the organic premium estimation is applied to this average purchase price we estimate $2.68 premium. For comparison, the milk industry experiences approximately a $3.19 premium per gallon at the retail level .

The demand model including consumer demographics supports wine as a luxury good. As expected, a positive coefficient for the house hold income variable indicates an increases in income will result in higher willingness to pay. Results reveal preferences to wine among White, Hispanic and Asian consumers over Black. In Chinese

culture, wine is highly valued in social and communication setting, in literature, medical care, and politics. Due to the long history, results support Asian consumers to have the highest willingness to pay. Preferences among marital status does not vary among single, married, and divorced consumers indicating the willingness to pay, still significant, but little to no variation. One may consider the increased occurrence of other expenses as more people are present in a household a result in less willingness to purchase higher priced wine. Other conclusions such as an increase in both male and female education levels reflects higher willingness to pay for higher priced wines. This may be due to higher education levels are able to understand the monetary value of increased quality.

2.6 Chapter Two Tables & Figures

Table 2.1: Wine Variable Frequencies and Total Percentages

Grape Variety	Frequency	Percent
Cabernet Sauvignon	75339	16.38
Chardonnay	68994	15.00
Merlot	41876	9.10
Pinot Grigio	35064	7.62
Zinfandel	33131	7.20
Muscat	31146	6.77
Pinot Noir	24338	5.29
Sauvignon Blanc	13367	2.91
Riesling	12867	2.80
Syrah	5057	1.10
others	118894	25.84
State	Frequency	Percent
California	297160	64.59
Washington	22157	4.82
Oregon	2731	0.59
Others	138025	30.00
Specific Region	Frequency	Percent
Columbia Valley	13772	2.99
Sonoma	8655	1.88
Napa	3447	0.75
Willamette	670	0.15
Walla Walla	34	0.01
Others	433495	94.22
Organic	Frequency	Percentage
Certified Organic	540	0.12
Not Organic	458012	99.88

Table 2.2: Summary Statistics For Wine Variables

	Mean	SD	Min	Max	Expected Sign
l_unit_price_ml_final	-4.89	0.61	-11.51	-0.46	+
Unit Price (750 ml)	6.83	4.95	0.01	475.00	+
Cabernet Sauvignon	0.16	0.37	0.00	1.00	+
Chardonnay	0.15	0.36	0.00	1.00	+
Merlot	0.09	0.29	0.00	1.00	+
Muscat	0.07	0.25	0.00	1.00	+
Pinot Grigio	0.08	0.27	0.00	1.00	+
Pinot Noir	0.05	0.22	0.00	1.00	+
Riesling	0.03	0.16	0.00	1.00	-
Sauvignon Blanc	0.03	0.17	0.00	1.00	+
Syrah	0.01	0.10	0.00	1.00	+
Zinfandel	0.07	0.26	0.00	1.00	+
Color $\sim$ red	0.52	0.50	0.00	1.00	+
Color $\sim$ white	0.37	0.48	0.00	1.00	+
Color $\sim$ blush	0.11	0.32	0.00	1.00	-
Reserve	0.02	0.15	0.00	1.00	+
Estate	0.01	0.11	0.00	1.00	+
Vineyard	0.09	0.28	0.00	1.00	+
California	0.64	0.48	0.00	1.00	+
Washington	0.05	0.21	0.00	1.00	+
Oregon	0.01	0.08	0.00	1.00	-
Sonoma	0.02	0.14	0.00	1.00	+
Napa	0.01	0.09	0.00	1.00	+
Columbia Valley	0.03	0.17	0.00	1.00	-
Walla Walla	0.00	0.01	0.00	1.00	+
Willamette	0.00	0.04	0.00	1.00	+
Organic	0.00	0.03	0.00	1.00	+
House Hold Income	$50,000-$59,999	3.11	1.00	14.00	+
White	0.86	0.35	0.00	1.00	+
Black	0.08	0.26	0.00	1.00	+
Asian	0.03	0.16	0.00	1.00	+
Hisp	0.06	0.23	0.00	1.00	+
Single	0.11	0.31	0.00	1.00	-
Married	0.71	0.45	0.00	1.00	+
Divorced	0.12	0.33	0.00	1.00	-
Household Size	2.25	1.08	1.00	9.00	-
Male Head Education	3.48	2.10	0.00	6.00	+
Female Head Education	4.09	1.61	0.00	6.00	+
Male Head Age	5.86	3.53	0.00	9.00	+
Female Head Age	6.71	2.74	0.00	9.00	+

Table 2.3: Wine Hedonic Model

	Dependent variable:
	Log Price ($ per ML)
Cabernet Sauvignon	0.014***
	(0.003)
Chardonnay	0.273***
	(0.004)
Merlot	-0.199***
	(0.003)
Muscat	0.084***
	(0.003)
Pinot Grigio	0.115***
	(0.004)
Pinot Noir	0.213***
	(0.004)
Riesling	0.298***
	(0.005)
Sauvignon Blanc	0.352***
	(0.006)
Syrah	-0.440***
	(0.007)
Zinfandel	0.116***
	(0.004)
Red (Color)	0.475***
	(0.028)
White (Color)	0.124***
	(0.029)
Blush (Color)	0.089***
	(0.029)
Reserve	0.090***
	(0.006)
Estate	0.346***
	(0.006)
Vineyard	-0.260***
	(0.003)
Sonoma (CA)	0.717***
	(0.005)
Napa (CA)	1.072***
	(0.011)
Columbia Valley (WA)	0.383***
	(0.004)
Walla Walla (WA)	1.314***
	(0.084)
Willamette (OR)	0.846***
	(0.015)
Organic	0.393***
	(0.016)
Constant	-5.508***
	(0.052)
Observations	460,073
R-squared	0.307
County FE	YES
State FE	YES
Year FE	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.4: Wine Demand Model

	Dependent variable:
	Log Price ($ per ML)
Cabernet Sauvignon	0.003***
	(0.003)
Chardonnay	0.257***
	(0.004)
Merlot	−0.187*
	(0.003)
Muscat	0.092***
	(0.003)
Pinot Grigio	0.109***
	(0.004)
Pinot Noir	0.190***
	(0.004)
Riesling	0.287***
	(0.005)
Sauvignon Blanc	0.321***
	(0.005)
Syrah	−0.433***
	(0.007)
Zinfandel	0.116***
	(0.004)
Red (Color)	0.500***
	(0.032)
White (Color)	0.159***
	(0.032)
Blush (Color)	0.143***
	(0.032)
Reserve	0.105***
	(0.006)
Estate	0.325***
	(0.006)
Vineyard	−0.237***
	(0.003)
Sonoma (CA)	0.682***
	(0.005)
Napa (CA)	1.020***
	(0.011)
Columbia Valley (WA)	0.361***
	(0.004)
Walla Walla (WA)	1.271***
	(0.083)
Willamette (OR)	0.803***
	(0.015)
Willamette (OR)	0.803***
	(0.015)
Organic	0.359***
	(0.016)
White	0.028***
	(0.005)
Black	−0.011***
	(0.005)
Asian	0.120***
	(0.007)
Hispanic	0.030***
	(0.004)
Single	0.037***
	(0.004)
Married	0.032***
	(0.004)
Divorced	0.022***
	(0.004)
Household Size	−0.019***
	(0.001)
Male Education	0.023***
	(0.001)
Female Education	0.030***
	(0.001)
Male Age	−0.023***
	(0.001)
Female Age	−0.013***
	(0.000)
Constant	−5.958***
	(0.057)
County Fixed Effects	YES
State Fixed Effects	YES
Year Fixed Effects	YES
Household Characteristics	YES
Observations	460,073
R^2	0.347

Note: ( ) are Robust Standard Errors. Significance levels: * 90%, ** 95%, *** 99%

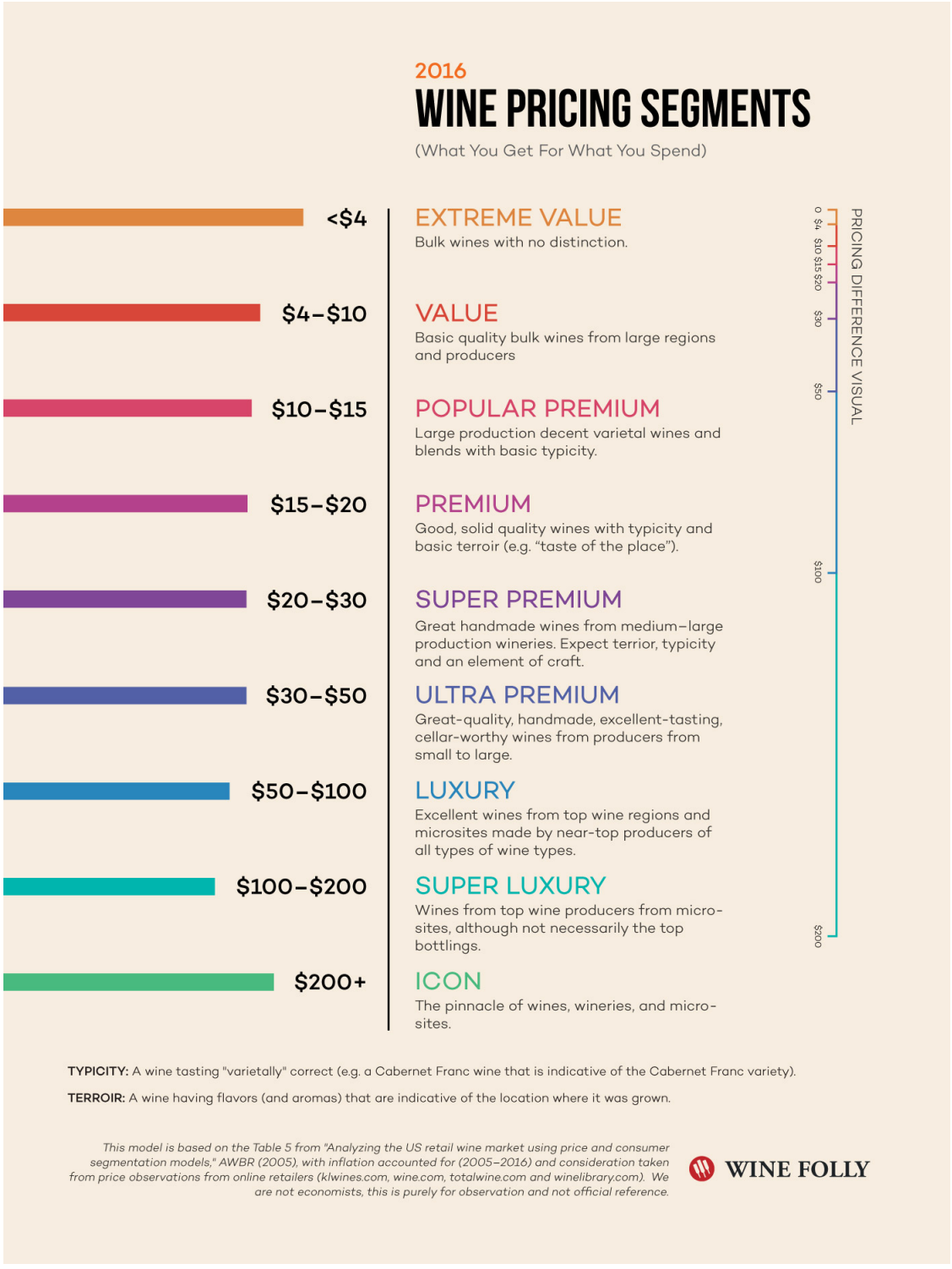

Figure 2.1: Wine Price Segments: Adopted from [Puckette(2016)]

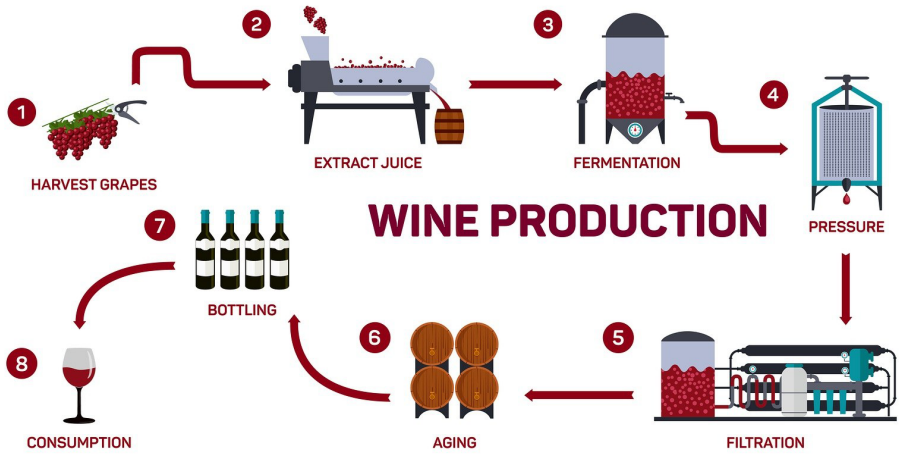

Figure 2.2: The Process of Making Wine: Adopted from [Kumar(2021)]

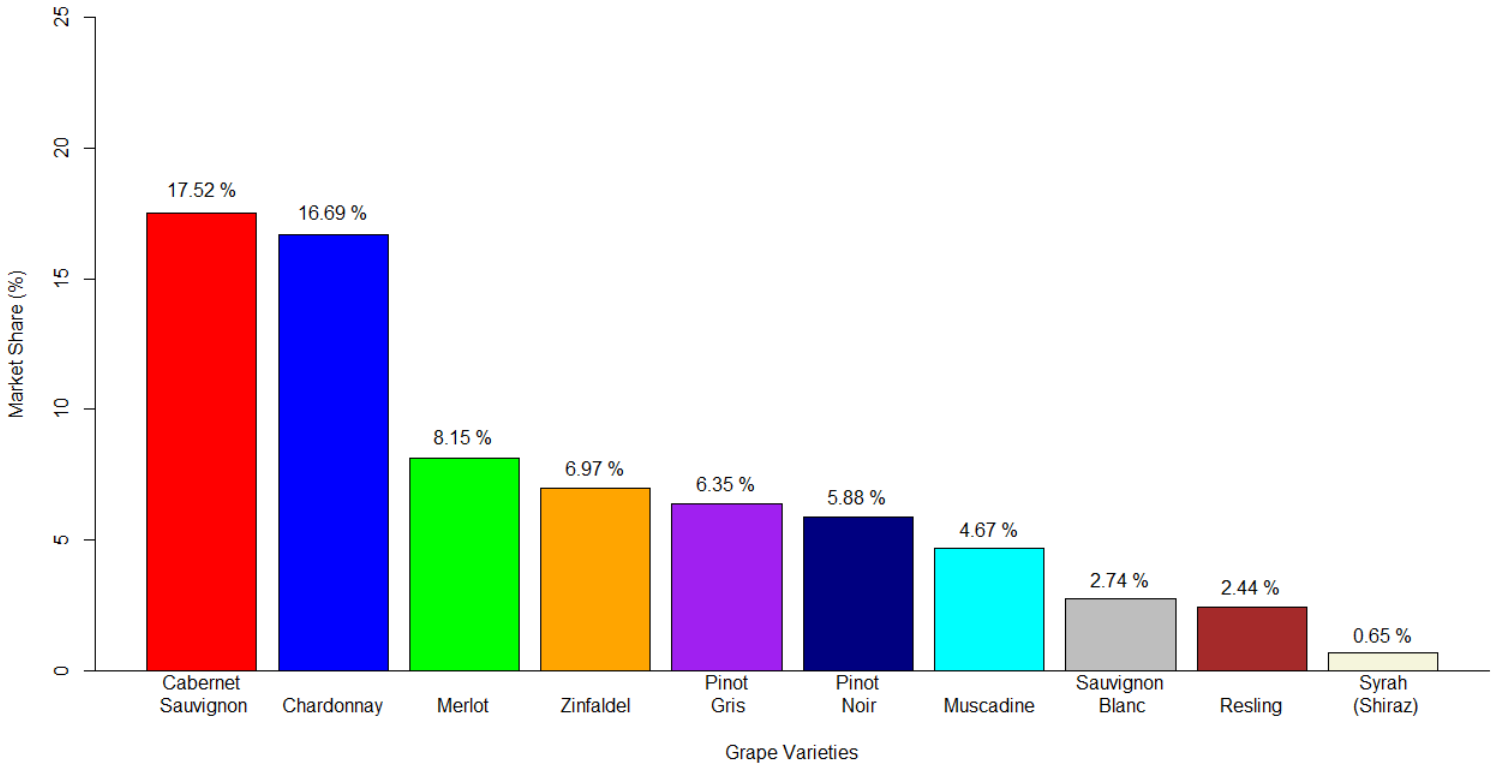

Figure 2.3: Market Share of Wine Represented by Grape Variety

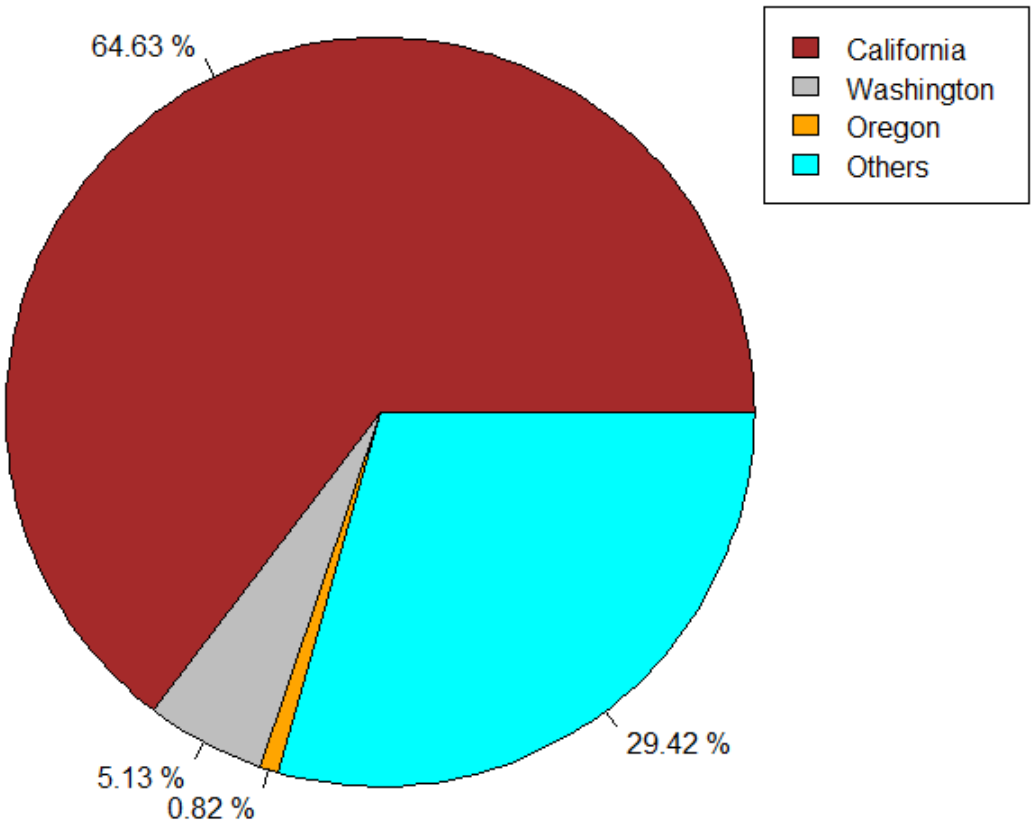

Figure 2.4: Market Share of Wine Represented by State

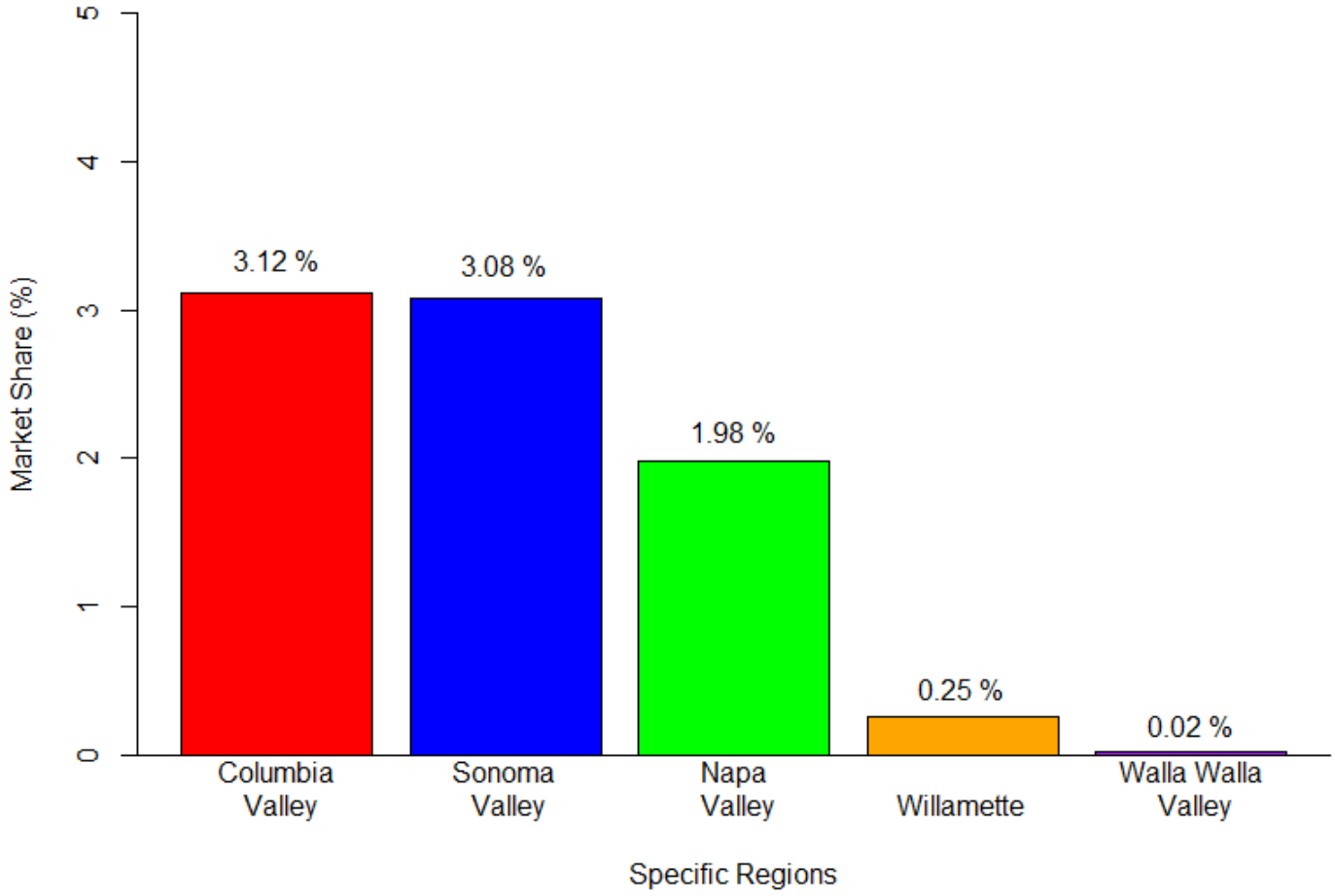

Figure 2.5: Market Share of Wine Represented by Region

Chapter 3 Whiskey Labeling

3.1 Introduction

Distilleries are producers that seek to optimize inputs to efficiently maximize profit. Producers aim to optimize profits by differentiating their product from their competitors by carefully selecting inputs and altering production methods. The general process for turning raw material in the whiskey industry include harvesting grains, malting, mashing, fermentation, distillation, maturation, and bottling (figure 3.1). In the alcoholic beverages market, differentiation can be as simple as targeting specific consumer tastes, preferred ingredients, or style that separate it from other whiskies. This separation can be translated to value-added of the product. Price is another differentiating factor of a product. A more costly bottle of whiskey is often associated with a higher quality product. The higher cost at retail is commonly a direct reflection of additional cost of furthering stages of production or increasing input requirements.

The whiskey industry encompasses similar characteristics to wine. In context of market structure, there are several components that align for the two perfectly competitive products. There is no single company holding substantial market share, the industry output is standardized, the products are homogeneous, and there are many buyers and sellers. Aside from market structure characteristics, the two products have underlying commonalities such as fermentation process and barrel aging. Each product can be blended or single malt/varietal styles. The two industries share similar pricing tiers including economy, premium, super premiums, and ultra premium (figure 2.2). The resemblance between these two industries make for validated comparisons in competitive advantages through price premiums that one may have over another.

Identifying price determinants and consumer preferences reveal subtle shifts in demand over time [Charm et al.(2020)Charm, Coggins, Robinson, and Wilkie]. This understanding stems from several areas of research within business economics such as product development, consumer study and marketing evaluations. Early applications of the hedonic framework is observed in [Rosen(1974)] which utilizes the method to determine price factors of housing attributes. Common variables regressed against housing price include external appearance, presence of fireplace, number of bathrooms [Can(1992)]. The contribution of this research explains how buyers and sellers determine market equilibrium.

Market research is becoming more prevalent in the alcoholic beverage market due to an expected 10% annual increase in size over the next several years [**?**]. One area of market research is in consumer demand amongst an array of influences. Retaliatory tariffs are known to negatively affect whiskey exports. In the 2020 the European trade war illuminated UK demand for US whiskey is highly inelastic [Muhammad and Thompson(2022)]. Results suggest that importers paid higher prices and UK will likely return to pre-trade war levels. Producers are currently seeking new ways to proactively adjust their upstream production. The intent is to continuously meet the demand of consumers as they evolve over time. Research conducted by [Bombrun and Sumner(2003)] assesses premiums relating to label designation, grape variety, vintage, and appellation. Results illuminate the respective weights various attributes have on the market price of wine in California. The preferred method of approach for this analysis was hedonic modeling. This technique allows for easily interpreted results based upon historical data. Common themes among wine related research suggest origin, distinctive labeling, and ingredients affect price in dollars and percentage impact [Dahl(2019)].

Alcohol content is a common independent variable used in hedonic analysis. A positive and significant estimate confirms that consumers are willing to pay more whiskey

with higher alcohol contents [HYLTA and LUNDQUIST(2016)].This research further identifies that Swedish consumers value the origin of whiskey and are willing to pay more for specific regions similar to wine consumers. Islay and Campbeltown receive 0.11 and 0.23 estimates respectively, indicating these regions receive a price premium compared to "other" regions that receive a penalty of -0.26. Consumers are willing to pay more for particular regions since each region is noted for specific taste. New distilleries in Sweden are able utilize significance of origin and tradition to emphasize in their marketing strategies to validate higher prices. Other variables considered in econometric modeling is the impact an independent bottler has on price [Moroz and Pecchioli(2018)]. The research of Moroz and Pecchioli indicates a negative relationship between distiller and bottler. This indicates investors are influenced by the distiller and its involvement in the whole production process of whiskey. Results show reputation is affected when an output is not bottled by the distillery, therefore price would be negatively effected. One explanation is that independent bottlers can not provide the same guarantee when output is bottled by the original distillery.

This study contributes to existing literature by expanding the capacity in which the hedonic model is utilized. Few economist have conducted an examination of the price of whiskey as a function of it attributes, furthermore fewer to none have accounted for the American whiskey. The lack of empirical research addressing the price of bourbon whiskey prompts the necessity and framework of this study. This study observes the actual sale price and incorporates consumer scanner data to estimate the true price premium instituted among domestic and international brands. Additionally, the empirical model employed in this paper accounts for the traits of bourbon whiskey that are directly observed by the consumer on the label. The results of the hedonic price model provides insights to where producers may be emphasising certain components of their marketing schemes that other areas of research have yet

to assess.

3.2 Data

The data used in this study comes from Nielsen's consumer scanner data where we obtain the sale price of over 7,000 brands of whiskey from 2013-2020. The data set contains purchasing information such as the store type and transaction region. Information about the consumer include, but are not limited to, household income, race, relationship status and household size.

The data set is compromised of the price of bourbon, size of bottle (in milliliters), and UPC description. UPC, or Universal Product Code, is a unique 12 digit number assigned to a product. These codes are used worldwide to easily track items. To narrow our search we choose to consider whiskeys that consumers are purchasing at a high volume (in dollars). We categorize the bourbon whiskeys by UPC description for market share. We analyze the top 122 of 688 available entries. Choosing the top 122 UPC descriptions represents 90% of the total market share. This enabled us to observe the sum of total price paid and the number of times consumers purchased a product under a given description. Since Nielsen's data does not directly provide style of product, we manually marked the chosen UPC by the labeling characteristic found on the bottle. We then merged the observed attributes to each UPC descriptor, allowing us to regress style as an independent variable. The 'style' variables includes seven label characteristics: distillers select, small batch, barrel proof finish, reserve, port finish, single barrel and bottle in bond). The percentage represented by each label characteristic is shown in figure (2.1). In addition to manually capturing the style, we create a brand designation for each UPC description according to the label on the bottle. Due to the proprietorship of Nielsen Data we are unable to disclose the names of brands, subsequently we have masked each brand with "Brand A", "Brand B", "Brand C", and so forth. Lastly, we created a vector that denotes the U.S. state

in which the bourbon was distilled found on the label. Each brand is associated with one of three state classifications; Kentucky, Tennessee, or other. Only two specific states were chosen to evaluate independently due to the market share possessed by Kentucky and Tennessee, 79% and 19% respectively. All other states account for 2% of market share, shown in figure (3.2). The average unit price of whiskey is .025 thus the average price of a 750 ml is $18.42 seen in table 3.1. Additionally, male and female consumers of this study averaged a high school diploma with some college education denoted by 3.815 and 3.72 respectively. Table 3.1 also indicates that average salary falls between level 11 and 12 which can be converted to salary thresholds $50,000-$59,999 and $60,000-$69,999.

The consumer scanner data consist of more than 250,000 households. An independent variable included in this research model derived from the consumer is 'household income'. This variable denotes the income for the entire household and each income level is placed in subsets starting at an income level $5,000 increasing at two, three, five, ten and thirty thousand dollar increments with incomes $i \geq$ $100,000 and $i \leq$ $5,000 each to one subset. Independent variable 'race' consist of four races: White, Black, Asian and Hispanic. 'Marital Status' is another descriptor derived from consumer data. Participants are given the option to choose single, married, widowed, or divorced. Lastly, 'household size' is given a number one through nine where nine can mean nine or more members.

Bottle sizes is another independent variable included in the bourbon whiskey models. There are seven bottle sizes that are observed from consumer purchases; 50ml, 100ml, 200ml, 375ml, 750ml, 1000ml, and 1750ml. The three most frequently purchased bottle sizes are 375ml, 750ml, and 1750ml. The observations for each bottle size is 1,952, 14,800, and 13,845 for a total of 20,597 observations across all three sizes.

3.3 Methods

There are two econometric models employed in this research to capture 1) the price premiums of wine and 2) the willingness to pay by consumers. The hedonic price model is the first method used for this study to regress unit price of whiskey as a function of location, style, bottle size, and brand. Our methodology seeks to evaluate n bundle consisting of various attributes which are described completely by numeric values. This particular model takes a set of characteristics as a function of themselves to determine their affect on price seen in wine characteristic evaluations [Outreville and Fur(2020)] and [Dahl(2019)]. Due to the various bottle sizes of bourbon whiskey that can be purchased, we conduct four models. One model for all bottle sizes, and three other models for the top three frequented bottle sizes (375ml, 750ml, and 1750ml). The general hedonic equation used to estimate the price premiums of whiskey given the various traits is shown in *Equation* 1 below.

$$lnP_{icst}^{Whiskey} = \beta_0 + \beta_1 X_{icst} + \zeta_c + \theta_s + \tau_t + \epsilon_{icst}$$

$Eq1$: Bourbon Whiskey Hedonic Price Model

The dependent variable, wine price, found in the equation above is log-transformed. Log transformation is utilized in several econometric applications where monetary interpretations are necessary [Ellis(2020)]. The use of this modification in the dependent variable enables for the interpretation of percentage increase (decrease) in wine price for a change in the wine attribute [Ford(2018)]. In this case, we use log-price to interpret the dependent variable as a percentage change in dollars per milliliter.

Several attributes in this study are represented as binary variables. To incorporate 'small batch' as a style variable in the model it must be given a numeric value so that it can be multiplied by the β coefficient which results a positive or negative preference. The inclusion of brand in the model allows us to control for the variation

in price across the different brands possessing the same labeling characteristics. We are regressing 10 brands independently by market share and denoting them randomly until the 10th highest brand is represented. The 11th highest brand by market share is combined with all other brands. The highest brand by market share is the base variable in each model. A base variable enables us to interpret individual brands compared to the omitted. In *Equation* 1, the subscripts denote a given bottle i in period t. Consumer characteristics are modeled by adding consumer demographic variables to $Eq1$.

$$P_{icst}^{Whiskey} = \lambda_0 + \lambda X_{ict} + \delta Z_{ict} + \zeta_c + \theta_s + \tau_t + \epsilon_{icst}$$

(*Equation* 2): Whiskey Demand Model

The second model (*Equation* 2) estimates consumer preferences by extending *Equation* 1 with the consumer demographic variables as previously achieved by [Dröes et al.(2019)Dröes, Bourassa, and Hoesli]. Incorporating these variable enable an estimate for consumer willingness to pay based upon observed purchases of whiskey. In *Equation* 2, the subscripts denote a given bottle i in period t for consumer c.

Fixed effects are commonly used when utilizing panel data where we observe a single person and their attributes multiple times. The fixed effects that are incorporated in this model are county c, state s, and time t. The inclusion of fixed effects in the model allows the model to control for variation in price across space and time. This enables for a more accurate prediction of whether there is a relationship between individual characteristics and the response variable.

3.4 Results

Our data allows for hedonic as well and demand analysis to both narrow and expand the scope the research. A hedonic price model for bourbon whiskey consist of product

characteristics; distillery location, style, brands, and captures seven total bottle sizes (table 3.3). A common theme among all bottle sizes are bourbon originating from Kentucky has a higher impact on price compared to Tennessee distilleries. Bourbon whiskey made in Kentucky impacts price by -0.602% and bourbon originating in Tennessee impacts price by -0.455%. The variable that houses all bourbon observations originating from the remaining 48 states, 'Distillery Location $\sim$ Other', is the reference variable for state variables. The primary intent of omitting a indicator variable is to avoid multicollinearity in the model. Thus by omitting bourbons that originate in other states, they becomes the reference variable.

The label is the first thing customers see when scouring the shelf's and for producers, having a clearly defined product can gain themselves a competitive advantage at retail. The hedonic model for all bottle sizes (Table 3.3), identifies the degree to which labeling characteristics impact price per milliliter when compared to bourbons without specific labeling characteristics. Bourbon labeled as Distiller's Select does not have a universal standard of production and does not possess substantial impact on price. Distiller's Select impacts price by 3.1% per milliliter, compared to label designations outside the scope of those included in this model. Small batch bourbons were among labels with considerable impacts on price with 68.4% per milliliter. Barrel-Proof finished bourbon receives a 81.2% impact per milliliter on price, compared to "other" label designations. Bottled in Bond and reserve bourbon have a percentage impact of 19.0% and 42.4% respectively. Bourbons with the label designation Port Finish have the highest impact on price per milliliter with 113.7%, compared to "other" label designations. Rounding out the last of labeling designations is single barrel bourbon which signifies that the bourbon comes from a single barrel and is not blended. This bourbon is considered a premium due to the additional attention and cost to produce. The impact on price for single barrel is 87.0%.

A total of seven bottle sizes are regressed and similar to location variables, the

reference variable is 'bottle $\sim$ size50ml' . All bottle sizes are sold at discounted prices compared to 50ml bottles and bottle sizes 200ml and 375ml impact price under the 40% threshold with -21.3% and -35.7% respectively (Table 3.3). The next two highest percentages impacts for bottle size are 100ml and 750ml with -44.6% and -49.4% respectively. The largest two bottles sold on average at a discount are 1000 ml and 1750 ml. Bottle size 100ml sales an average discounted price per milliliter of -63.4%. The largest bottle, 1750ml, on average is observed to be discounted at -86.7%.

For the ten brands regressed to price in the first bourbon model we would expect certain brands to experience premiums and discounts with respect to market share (Table 3.3). The omitted variable for this model is brand "A" which ties for the most market share with brand "B". The coefficient estimate for brand "B" is 25.6%. Brands "C", "G", and "J" experience negative estimates of -20.9%, -31.3%, and -9.0% respectively. Brands "D", "I", and "K" experience both positive estimates of 57.0%, 52.6%, and 49.6% when compared to brand "A". Lastly, brands "E" and "H" experience the highest premium when compared to brand "A" with 61.5% and 77.7% respectively (Table 3.3).

The results in Table 3.4 show three separate models that only regress a singular bottle size at once; column(1) 375ml, column(2) 750ml, column(3) 1750ml. For 375ml bottle sizes, bourbon originating in Kentucky have the largest impact on price with -96.8%. There are styles that do not have an estimate, this indicates that consumers did not purchase bourbon with the style explicitly labeled on the bottle. That is, there were no purchases for reserve, port finish, bottle in bond, or small batch. However, single barrel and barrel proof finish bourbon receive 84.8% and 83.2% impact on price per milliliter respectively.

Table 3.5 shows results for the demand model which includes consumer demographics as an extension to the hedonic equation. A positive 0.6 coefficient is estimated for household income. All classifications of marital status receive positive

estimates of 3.0%, 2.3%, and 3.7%. Household size is negative at -0.8%. Education for both male and female variables also take positive coefficients of 0.1% and 0.9% respectively. However, male and female age variables hold negative are deemed negatively related to price.

3.5 Discussion

The origin of bourbon has shown to give distilleries an opportunity to gain competitive advantages. By observing the sale price of bourbon from 2017-2020, it uncovers that on average Kentucky distilleries have a higher impact on price (discount) than all other distilleries in the United States. One conclusion can be drawn by the fact that 95% of bourbon is produced in Kentucky and the volume produced among these distilleries forces them to become more price competitive. That is, since Kentucky bourbon is highly touted, individual distilleries in Kentucky must price their product at higher discount than their in-state competitors. This trend may also be true with Tennessee bourbon, though the average discounted price is lower than that of Kentucky. An important fact to note from our data is that a Tennessee branded bourbon possess extremely high market share. One may consider the high volume of sales is a direct reflection of the discounted pricing strategy to remain competitive with both in-state and Kentucky producers. Other factors such as consumer loyalty to certain brands within a state may incentive distilleries to heavily discount price. Kentucky bourbon whiskey is likely discounted for other reasons such as the cost in which it takes to distill a barrel relative to other craft distilleries. This the potential cause of this reduced price is the economies of scale in which Kentucky distilleries have employed within their operation. Economies of scales is a probable indicator to why these two states are able to price their products at a discount compared to the other 48 states. These two states are able to reduce the per milliliter cost therefore reducing the retail price while increasing contribution margins. Lastly, producers

within these two states assume considerable market share relative to the producers in the other 48 states. Small producers in other states may be focusing on niche markets within the demographics in which they find themselves. While they are still operating a profitable business, their price is unavoidably higher than Kentucky or Tennessee.

Labeling characteristics may convey certain indications to rarity, quality, or production practice. An expected theme among this research is that as cost of production increases so too will the observed premium. There are several labels that are consistent with this expectation such as single barrel, barrel proof, and port finish. The highest premium observed in the model is port finish and this production style also requires more additional inputs than any other label designation. A common production process for port finish bourbon is aging the whiskey for four to six years and then finishing the whiskey in a 60-gallon port barrel for a period ranging from six months to two years. Unlike any other style, the labor inputs required for this product doubles. In addition the time required to age this product has the potential to increase by 50-100%. other cost unique to this style is the purchase of port barrels.

On the contrary of costly production, the label designation bottle in bond is bourbon that has meet age and bottling requirements set forth by the Bottle-in-Bond Act of 1897. This style is observed to have the lowest premium when compared to a bottle without any label designation. This is still consistent with the notion of lower production cost, lower premium. Bottle-in-Bond bourbons must be distilled in one distillation season, by one distiller, aged in a federally bonded warehouse for at least four years, and bottled at 100 proof. These restrictions were given as an a tax incentive for distillers. Consumers associated this label with direct indication of the distiller's skill. Small batch bourbons typically are blended with no more than ten to fifteen selected single barrels and this standard varies (10-50 barrels). The small batch label communicates a different flavor that separates it from mainstream

products thus followed by a steady premium. Single barrel bourbons are unique just as the name indicates, a single barrel. This label observers a substantially higher premium potentially due to the fact that this label means that the bourbon is not blended (occasional blending-less than 10 barrels). Typically, the premium collected by distillers is due to the limited amount of bottles that will be sources from a single barrel (roughly 240 bottles). As a result, consumers are willing to pay more thus driving up the premium similar to port finish.

Each bottle size on average is priced a discount per milliliter when compared to the reference variable 50ml. This seem intuitive as producers in almost every industry want to incentivize consumers to buy more therefore they lower the per unit cost as quantity increases. This is largely due to the fact that fixed cost remain the same and for a given batch they are able to fill larger bottle faster than individually packaging smaller bottles. On average the largest bottle size 1750ml (1.75 liter) discounts the most per milliliter. The lowest discounted price is observed in 200ml and 375ml bottles. The relationship of increased bottle size and decrease price per milliliter can be described as volume discount pricing as seen in the beer industry [Bray et al.(2009)Bray, Loomis, and Engelen].

There are several factors that affect the level of impact a brand has on price. This study discovered a steady relationship of both higher and lower average prices occurring from one brand to another. It is expected to have high price volatility in a market so highly regulated by the government. This volatility or extreme fluctuation in price is due to producers utilizing various pricing strategies to help differentiate their product. Though price is still a reflection of production cost, consumers are strongly influenced by price regardless if they have an idea of what profit margins may be for the producer. Consumers use price as a component to measure quality, thus alluding to how willingness to pay is measured. Previous literature indicates that when the name of store is favorable, the strength of price increases for perceptions of

quality and value while it diminishes for perceptions of sacrifice ([Dodds(1991)].

In terms of our research, inferences are made in regard to the a brand that possess high market share, reference variable-brand "A" (see figure 2.1). Brand "B" shares an equivalent size of market share and prices their products on average higher than brand "A". Price competition can be explained between these two brands and would expect this relationship to change if distinctive products are compared within each brand. When comparing brands "C" and "G" to the base variable, one can expect a market leader and follower type of relationship where the dominating brands are able to use brand loyalty and marketing to establish a higher prices. Other brands compared to brand "A" such as brand "E" and brand "H" are able to capture higher prices for their product. This relationship may be due to the expansive product list larger distilleries are able to offer in the market. For example if one distillery has 4 brands and another has 25 brands. The distillery with 25 brands may offer several high-end bottles, however the average sale price for all 25 brands may be lower than that of the distillery which produces only a few high-end products.

The demand model including consumer demographics support the claim of whiskey as a luxury good. As expected, a positive coefficient for the house hold income variable indicates an increases in income will result in higher willingness to pay. Results reveal an insignificant preferences to whiskey among all races. Preferences among marital status does not vary among single, married, and divorced consumers indicating the willingness to pay, still significant, but little to no variation. One may consider as more people are present in the house hold, increased expenses occur thus less willingness to purchase higher priced whiskey. Other conclusions such as an increase in both male and female education levels reflects higher willingness to pay for higher priced wines. This may be due to higher education levels are able to understand the monetary value of increased quality. As the age of an individual increases for both male and females, their willingness to pay for more expensive wines are less likely to

occur. This seems to contraindicate the income variable due to the assumption of increased income as age increases. Nevertheless, there are several implications to be drawn with great justifications. However, there is no definitive conclusion that can be drawn due to the widespread use economies of scale, capital investments, evolving demand, and continual advancement of technology.

3.6 Chapter Three Tables & Figures

Table 3.1: Whiskey Variable Frequencies and Total Percentages

Location	Frequency	Percent
Kentucky	30500	82.79
Tennessee	5875	15.95
Other	467	1.27
Bourbon Brand	Frequency	Percent
Brand A	8117	22.03
Brand B	5827	15.82
Brand C	5053	13.72
Brand D	1943	5.27
Brand G	1829	4.96
Brand F	1126	3.06
Brand I	946	2.57
Brand E	936	2.54
Brand H	921	2.5
Brand J	633	1.72
Brand K	483	1.31
Other	9028	24.50
Bottle Size	Frequency	Percent
1.75 l	15938	43.26
750 ml	15575	42.28
375 ml	2002	5.43
1 ml	1447	3.93
50 ml	1205	3.27
200 ml	352	0.96
100 ml	323	0.88
Style	Frequency	Percent
Distillers Select	298	0.81
Small Batch	2518	6.83
Barrel Proof	278	0.75
Bottle in Bond	98	0.27
Reserve	213	0.58

Table 3.2: Summary Statistics For Whiskey Variables

Statistic	Mean	St. Dev.	Min	Max	Expected Sign
Unit Price Per ml	0.025	0.014	0.004	0.180	+
Unit Price (750ml)	18.415	10.517	2.990	135.000	+
Distillery Location $\sim$ KY	0.828	0.378	0	1	+
Distillery Location $\sim$ TN	0.159	0.366	0	1	+
Distillers Select	0.008	0.090	0	1	+
Small Batch	0.068	0.252	0	1	+
Barrel Proof_finish	0.008	0.087	0	1	+
Bottle In Bond	0.003	0.052	0	1	-
Reserve	0.006	0.076	0	1	+
Port Finish	0.003	0.052	0	1	+
Single Barrel	0.017	0.130	0	1	+
Bottle size $\sim$ 50	0.033	0.178	0	1	-
Bottle size $\sim$ 100	0.009	0.093	0	1	-
Bottle size $\sim$ 200	0.010	0.097	0	1	-
Bottle size $\sim$ 375	0.054	0.227	0	1	-
Bottle size $\sim$ 750	0.423	0.494	0	1	-
Bottle size $\sim$ 1000	0.039	0.194	0	1	-
Bottle size $\sim$ 1750	0.433	0.495	0	1	-
Male Head Education	3.815	1.712	0	6	+
Female Head Education	3.719	1.771	0	6	+
Male_Head_Age	6.565	2.944	0	9	+
Female_Head_Age	6.141	3.034	0	9	+
House Hold Income	\$50,000-\$59,999	3.368	1	14	+
Race $\sim$ White	0.850	0.357	0	1	+
Race $\sim$ Black	0.088	0.284	0	1	+
Race $\sim$ Asian	0.022	0.146	0	1	+
Race $\sim$ Hisp	0.054	0.227	0	1	+
Single	0.098	0.297	0	1	+
Married	0.752	0.432	0	1	-
Divorced	0.108	0.310	0	1	-
Household_Size	2.260	1.041	1	9	-

Table 3.3: Whiskey Hedonic Model

	Dependent variable:
	Log Price ($ per ML)
Kentucky Distillery	-0.602^{***}
	(0.015)
Tennessee Distillery	-0.455^{***}
	(0.021)
Distillers Select	0.031^{*}
	(0.017)
Small Batch	0.684^{***}
	(0.009)
Barrel Proof Finish	0.812^{***}
	(0.013)
Bottle in Bond	0.190^{***}
	(0.016)
Reserve	0.424^{***}
	(0.042)
Port Finish	1.137^{***}
	(0.017)
Single Barrel	0.870^{***}
	(0.017)
100 ML	-0.446^{***}
	(0.021)
200 ML	-0.213^{***}
	(0.021)
375 ML	-0.357^{***}
	(0.015)
750 ML	-0.494^{***}
	(0.014)
1000 ML	-0.634^{***}
	(0.016)
1750 ML	-0.867^{***}
	(0.014)
Brand “B”	0.256^{***}
	(0.015)
Brand “C”	-0.209^{***}
	(0.004)
Brand “D”	0.570^{***}
	(0.005)
Brand “E”	0.777^{***}
	(0.010)
Brand “F”	0.340^{***}
	(0.008)
Brand “G”	-0.313^{***}
	(0.007)
Brand “H”	0.615^{***}
	(0.007)
Brand “I”	0.526^{***}
	(0.007)
Brand “J”	-0.090^{***}
	(0.014)
Brand “K”	0.496^{***}
	(0.008)
Brand “Other”	-0.047^{***}
	(0.006)
County Fixed Effects	YES
State Fixed Effects	YES
Year Fixed Effects	YES
Household Characteristics	NO
Observations	36,842
R^2	0.846
Adjusted R^2	0.840
Residual Std. Error	0.204 (df = 35409)
F Statistic	135.792^{***} (df = 1432; 35409)

Note: ( ) are Robust Standard Errors. Significance levels: * 90%, ** 95%, *** 99%

Table 3.4: Whiskey Hedonic Models for Individual Bottle Sizes

	Dependent variable:		
	Log Price ($ per ML)		
	375ML	750ML	1750ML
Kentucky Distillery	−0.968***	−0.442***	−0.701***
	(0.102)	(0.016)	(0.071)
Tennessee Distillery	−0.518***	−0.201***	−0.192**
	(0.138)	(0.021)	(0.084)
Distillers Select	−0.366***	0.481***	0.827***
	(0.030)	(0.090)	(0.017)
Small Batch		0.581***	0.522***
		(0.011)	(0.020)
Barrel Proof Finish	0.831***	0.681***	
	(0.136)	(0.012)	
Bottle in Bond		0.239***	
		(0.017)	
Reserve		0.265***	0.726***
		(0.046)	(0.049)
Port Finish		0.972***	
		(0.016)	
Single Barrel	0.848***	0.712***	0.889***
	(0.096)	(0.017)	(0.040)
Brand "B"	−0.117***	0.092***	−0.101**
	(0.086)	(0.017)	(0.046)
Brand "C"	−0.232	−0.237***	−0.198***
	(0.046)	(0.008)	(0.005)
Brand "D"	0.589***	0.522***	0.570***
	(0.030)	(0.008)	(0.007)
Brand "E"	1.051***	0.793***	
	(0.023)	(0.010)	
Brand "F"	0.271***	0.316***	0.335***
	(0.042)	(0.009)	(0.014)
Brand "G"	−0.406***	−0.295***	−0.346***
	(0.152)	(0.031)	(0.008)
Brand "H"	0.592***	0.594***	0.624***
	(0.032)	(0.008)	(0.014)
Brand "I"	0.583***	0.542***	0.476***
	(0.027)	(0.010)	(0.009)
Brand "J"		−0.019	0.212***
		(0.015)	(0.024)
Brand "K"		0.488***	0.547***
		(0.009)	(0.016)
Brand "Other"	−0.169	0.123***	−0.185***
	(0.073)	(0.008)	(0.008)
Constant	−2.620***	−3.455***	−3.213***
	(0.180)	(0.096)	(0.076)
County Fixed Effects	YES	YES	YES
Year Fixed Effects	YES	YES	YES
Household Characteristics	NO	NO	NO
Observations	1,952	14,800	13,845
R^2	0.933	0.789	0.853
Adjusted R^2	0.914	0.771	0.844
Residual Std. Error	0.112 (df = 1531)	0.189 (df = 13633)	0.147 (df = 12984)
F Statistic	50.483*** (df = 420; 1531)	43.834*** (df = 1166; 13633)	87.894*** (df = 860; 12984)

Note: ( ) are Robust Standard Errors. Significance levels: * 90%, ** 95%, *** 99%

Table 3.5: Whiskey Demand Model

	Dependent variable:
	Log Price ($ per ML)
	Model 1
Kentucky Distillery	−0.592***
	(0.015)
Tennessee Distillery	−0.446***
	(0.021)
Distillers Select	0.024
	(0.017)
Small Batch	0.674***
	(0.009)
Barrel Proof Finish	0.803***
	(0.013)
Bottle in Bond	0.183***
	(0.016)
Reserve	0.419***
	(0.041)
Port Finish	1.128***
	(0.016)
Single Barrel	0.863***
	(0.017)
100 ML	−0.443***
	(0.021)
200 ML	−0.206***
	(0.021)
375 ML	−0.354***
	(0.015)
750 ML	−0.497***
	(0.014)
1000 ML	−0.635***
	(0.016)
1750 ML	−0.871***
	(0.014)
Brand “B”	0.255***
	(0.015)
Brand “C”	−0.205***
	(0.004)
Brand “D”	0.564***
	(0.005)
Brand “E”	0.769***
	(0.010)
Brand “F”	0.341***
	(0.008)
Brand “G”	−0.305***
	(0.007)
Brand “H”	0.611***
	(0.007)
Brand “I”	0.513***
	(0.007)
Brand “J”	−0.088***
	(0.014)
Brand “K”	0.483***
	(0.008)
Brand “Other”	−0.045***
	(0.006)
Household Income	0.006***
	(0.001)
White (Race)	−0.002
	(0.008)
Black (Race)	−0.007
	(0.009)
Asian (Asian)	−0.021
	(0.013)
Hispanic (Race)	−0.017**
	(0.007)
Single	0.030***
	(0.008)
Married	0.023***
	(0.008)
Divorced	0.037***
	(0.008)
Household Size	−0.008***
	(0.002)
Male Head Education	0.001
	(0.001)
Female Head Education	0.009***
	(0.001)
Male Head Age	−0.003***
	(0.001)
Female Head Age	−0.005***
	(0.001)
Constant	−2.900***
	(0.083)
County Fixed Effects	YES
State Fixed Effects	YES
Year Fixed Effects	YES
Household Characteristics	YES
Observations	36,842
R^2	0.848
Adjusted R^2	0.841
Residual Std. Error	0.203 (df = 35396)
F Statistic	136.236*** (df = 1445; 35396)
Note:	( ) are Robust Standard Errors. Significance levels: * 90%, ** 95%, *** 99%

Table 3.6: Whiskey Demand Model For Individual Bottle Sizes

	Dependent variable:		
	Log Price ($ per ML)		
	375ML	750ML	1750ML
	(1)	(2)	(3)
Distillery Location ∼ KY	−0.978***	−0.439***	−0.708***
	(0.102)	(0.016)	(0.071)
Distillery Location ∼ TN	−0.659***	−0.198***	−0.187**
	(0.138)	(0.021)	(0.084)
Distillers Select	−0.340***	0.469***	0.821***
	(0.030)	(0.090)	(0.017)
Small Batch		0.576***	0.517***
		(0.011)	(0.020)
Barrel Proof Finish	0.812***	0.676***	
	(0.136)	(0.012)	
Bottle in Bond		0.228***	
		(0.017)	
Reserve		0.264***	0.716***
		(0.046)	(0.049)
Port Finish		0.967***	
		(0.016)	
Single Barrel	0.957***	0.709***	0.875***
	(0.096)	(0.017)	(0.040)
Brand "B"	0.014	0.094***	−0.118**
	(0.086)	(0.017)	(0.046)
Brand "C"	−0.227	−0.235***	−0.193***
	(0.046)	(0.008)	(0.005)
Brand "D"	0.588***	0.521***	0.567***
	(0.030)	(0.008)	(0.007)
Brand "E"	1.035***	0.789***	
	(0.023)	(0.010)	
Brand "F"	0.249***	0.317***	0.341***
	(0.042)	(0.009)	(0.014)
Brand "G"	−0.421***	−0.292***	−0.337***
	(0.152)	(0.031)	(0.008)
Brand "H"	0.588***	0.592***	0.620***
	(0.032)	(0.008)	(0.014)
Brand "I"	0.593***	0.536***	0.467***
	(0.027)	(0.010)	(0.009)
Brand "J"		−0.018	0.208***
		(0.015)	(0.024)
Brand "K"		0.484***	0.537***
		(0.009)	(0.016)
Brand "Other"	−0.169	0.123***	−0.179***
	(0.073)	(0.008)	(0.008)
Household Income	0.007	0.002	0.003
Race ∼ White	0.034	−0.005	0.008
Race ∼ Black	−0.024	−0.007	0.042
Race ∼ Asian	0.196	0.005	−0.035
Race ∼ Hispance	0.006	−0.010	−0.037
Single	0.013	−0.014	0.010
Married	−0.017	−0.009	−0.004
Divorced	−0.031	0.007	0.026
Household Size	0.008	−0.006	−0.002
Male Head Education	−0.018	0.005	−0.003
Female Head Education	−0.002	0.005	0.015
Male Head Age	0.012	−0.003	0.001
Female Head Age	−0.009	−0.003	−0.007
Constant	−2.626***	−3.460***	−3.303***
	(0.180)	(0.096)	(0.076)
County Fixed Effects	YES	YES	YES
Year Fixed Effects	YES	YES	YES
Household Characteristics	YES	YES	YES
Observations	1,952	14,800	13,845
R^2	0.936	0.790	0.856
Adjusted R^2	0.917	0.772	0.846
Residual Std. Error	0.110 (df = 1518)	0.188 (df = 13620)	0.146 (df = 12971)
F Statistic	50.961*** (df = 433; 1518)	43.569*** (df = 1179; 13620)	88.241*** (df = 873; 12971)
Note:	( ) are Robust Standard Errors. Significance levels: * 90%, ** 95%, *** 99%		

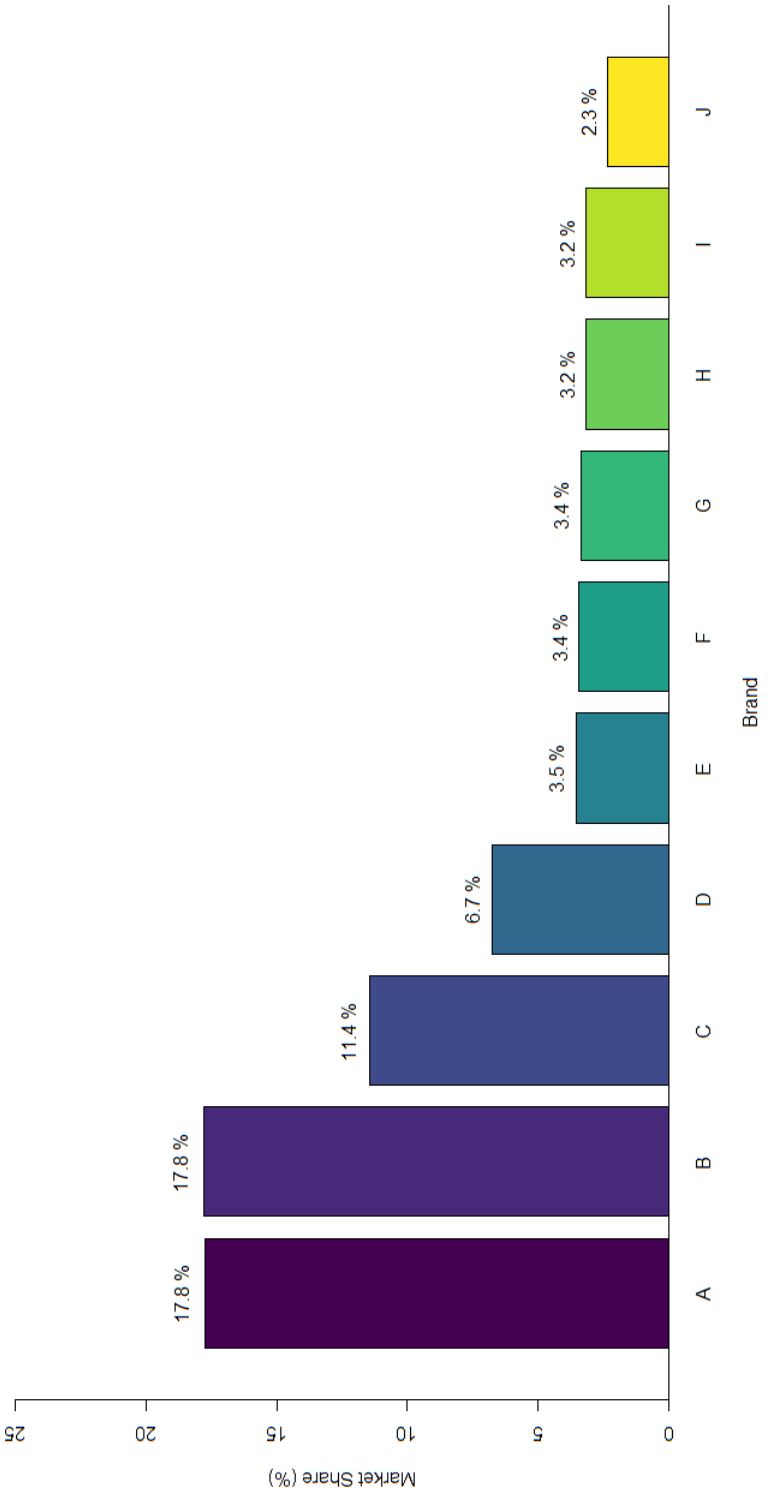

Figure 3.1: Market Share of Whiskey by Brand

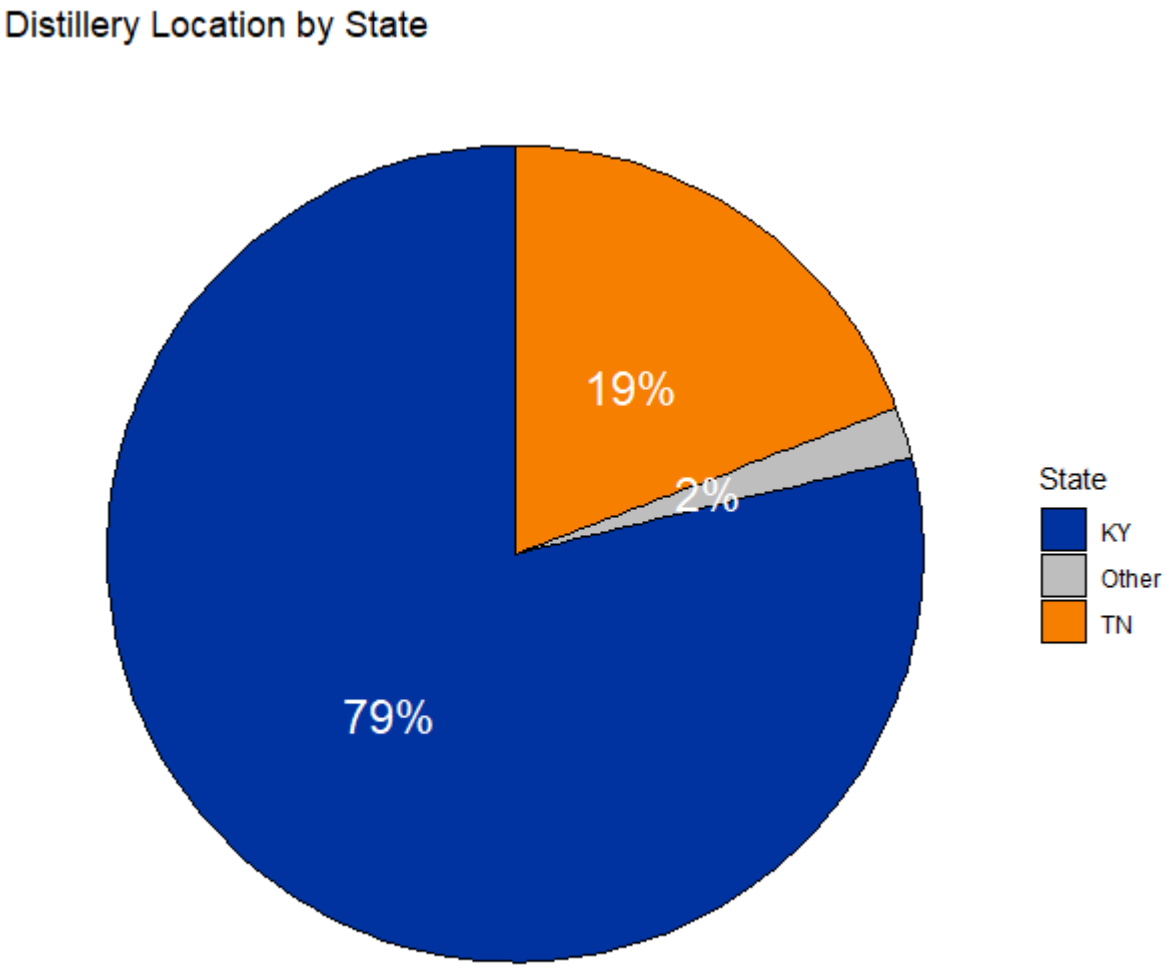

Figure 3.2: Market Share of Whiskey by State

Chapter 4 Conclusions

The bourbon industry is trending towards exponential growth and distilleries are continuously adapting to the demand of consumers. One area that producers are exploring to increase profit margins is to refine marketing strategies. Analyzing the behavior of consumer purchases through statistical modeling is a definitive way to assess trends in the market. The objective of this thesis is to analyze wine labeling price premiums and make inferences about similar whiskey labels specifically for a proposed estate labeled whiskey. The wine industry has endured centuries of evolution and possesses unique characteristics unlike any other alcoholic beverage. Wine is the closest comparison to whiskey in that they both have similar market structures, pricing segments, and labeling attributes. This econometric analysis likewise equips stakeholders with insights on willingness to pay among specific consumer demographics.

The first essay reveals wine price is heavily influenced by labeling attributes. A hedonic model was generated to estimate the price premiums of wine for various labeling attributes. This essay utilizes logarithmic transformation for price as the dependent variable. The independent variables regressed in this model included grape variety, wine color, style, and origin. Interaction variables for regions in California and Washington indicate price could be doubled in several areas such as Napa and Walla Walla regions. When 'Napa' was explicitly named on a wine bottle, a 118.0% increase in price per milliliter is expected. One conclusions is that the exceptional tradition and reputation premium wines in these regions allow for significant price premiums. Furthermore, consumers can assume a certain level of quality and taste by the region in which the wine was produced.

Red Wine leads in percentage impacts on price compared to white and blush.

Research suggest red wines are rich in antioxidants and include numerous health benefits over their counterparts. There are no grape varieties with remarkable impacts on price. However, Syrah did possess the highest impact among all varieties with an expected discounted price suggesting this variety is typically used in lower priced wines. Sauvignon Blanc grape variety originates in the Bordeaux region of France is shown to produces the highest relative percentage impact on price.

An additional equation was formed to incorporate consumer demographics. Consumer demographics were extended upon the hedonic equation as seen in [Dröes et al.(2019)Dröes, Bourassa, and Hoesli]. Conclusions to be drawn from this model include increased willingness to pay as a result of increases in education and household income. One assumption is that furthering education results in higher average incomes thus more likely to purchases higher priced wines. Additionally, higher education may also increase ones ability to associate higher quality with higher prices. One limitation to the demand model which includes consumer demographics as an extended form of the hedonic equation is that quantity purchased is not observed. This component is critical when assessing consumer demand.

The second essay addresses the observed price premiums for bourbon whiskey. A hedonic model is developed to determine the percentage impacts labeling characteristics have on price. The first regression model in this essay utilizes logarithmic transformation for price as the dependent variable. Log price is regressed on location, style, bottle size, and brand. The primary objective of the first hedonic model is to determine overall market trends for all bottle sizes as well as determine how bourbon prices are affected by each individual size bottle size.

Key takeaways from this model is that as bottle size increases, the price per milliliter paid by the consumer decreases. This negative relationship is likely due to volume pricing. Policy simulations suggest that discounts for volume-based pricing provide incentives for consumers to buy in larger volume and may lead to increased

overall consumption [Bray et al.(2009)Bray, Loomis, and Engelen]. The first model also introduces the trends among origin. Kentucky bourbon is discounted on average higher than Tennessee bourbons. One conclusion is that as the market for bourbon becomes more concentrated, consequently distilleries partake in price competition. Figure 3.2 illustrates the sizable percentage of bourbon represented by Kentucky as well as Tennessee and all other states. Significant price premiums were estimated for port finished and single barrel bourbon. Production cost for these two styles are typically higher, hence higher prices to follow. The first model accounting for all bottle sizes identifies positive impacts for notable labeling characteristics such as small batch, single barrel, and barrel proof.

To narrow the scope of the research, three of the most frequently purchased bottles size were chosen to be modeled exclusively. That is, single regressions were conducted for 375ml, 750ml, and 1750ml. The objective of three separate models is to determine whether certain characteristics have more impact from one size to another. When the origin of a 375ml bottle is Kentucky, the expected discounted price compared to other bottles of the same size is -96.8% per milliliter. Contrarily, Kentucky bourbons of 750ml in size are significantly less discounted, receiving an estimate of -44.2% confirming the assumption that the impacts of label attributes vary even amongst bottle size. The limitations of regressing specific bottle size is that several characteristics are not observed such as bottle in bond or port finish in sizes such as 375 and 1750ml.

The term estate conveys single origin wine and has several different standards throughout the world. This study assess the percentage impact of estate wine in the United States. The objective is to provide distilleries with the potential price impact of an estate labeled whiskey by assessing the impact on price for estate labeled wine. The hedonic regression results indicate estate wines receive a 33.8% per milliliter price premium. For example, a bottle with the estate label compared to one without will be approximately $8.45 higher in price. This price premium seems substantial,

however the production requirements for single origin wine can be more costly than standard production. The entire process of growing the grape to fermentation and bottling must be done onsite of the winery. If distilleries choose to adopt this label, assuming an industry standard or certification program is set forth, estate whiskey may prove to be a worthwhile investment.

This study contributes to existing literature by expanding the capacity in which the hedonic model is utilized. Few economist have conducted an examination of the price of whiskey as a function of it attributes in the United States, furthermore fewer have utilized the impact of wine labeling attributes and made inferences to bourbon whiskey characteristics. The lack of such empirical research addressing the price of bourbon prompts the necessity of further examination. This study observes the actual sale price and incorporates consumer scanner data to estimate the true price premium instituted among domestic and international brands. Additionally, the empirical model employed in this paper accounts for the traits of wine that are directly observed by the consumer on the label. This provides insights to where producers may emphasis certain components of their marketing schemes that other areas of research have yet to assess.

The hedonic model is useful for identifying the factors that affect the price of a good. However, it is less effective in determining willingness to pay. Further research may decide on other models such as a choice model or other econometric methods. This study lays the ground for work for such empirical research and the industry would benefit from such demand analysis. The potential of an labeled whiskey may rise the attention of policy makers interested in creating a set of requirements of estate whiskey similar to standards found in the estate wine.

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