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The Economic Analysis of the Barolo Wine

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WHITE PAGE

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ABSTRACT

Which factors do you think drives the market price of wine? The vintage climate? The sensorial characteristics? The wine brand? The present study analyzed the main factors which influence the final price of the Barolo wine.

A sample of 509 Barolo wines was collected through the Wine Spectator website database, and compared to the qualification of main Italian wine guides. The obtained variables - sensorial, reputation, among others - were submitted to a linear regression comparison. The reputational characteristics show to be the most influential factor under the wine final price.

The sensorial characteristics of structure (*std*) and long taste (*lgt*) were not significant, obtaining a 9% approximation of effect on the final price of the wine. The objective variable with greater representativeness was the denomination present in the bottle label (*den*), which presented an influence of approximately 20%. The most significant results were obtained through the reputation of wines and producers, being the largest one belonging to the guide Gambero Rosso 2018, with 60% effect on price, the dependent variable. Finally, the qualitative score attributed by the Wine Spectator website was shown to be more relevant for wines with values ≥ 90.

Differently from what was expected, the reputational characteristics of wines and their producers are more important and decisive in the final price than the sensorial ones.

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INTRODUCTION

When one thinks in the wine product, immediately envisions its great importance in the history of civilization, as well as its importance in different cultures. The first vineyards date from 7000 to 5000 BC, and the first writings on wine production are found in the series of Gilgamesh poems, dating from 1800 BC. Both the Bible and the Talmud, the sacred book of the Jews, refer to the presence of this great product. As the years go by, many viticulture techniques have been improved, but many others have undergone few changes, as in the case of barrels, which were invented in 200 AD, and are still used today in much the same way. Just as the techniques of cultivation and production were shaping the current needs, the wine economy, especially after the Second World War, began to shape as the consumer market evolved and became more and more demanding.

The Barolo wine, as well as other important wines, presents a long history, which began in the Neolithic era, and during the years was developing, but only after the year 1787 it came to gain notoriety as an important wine. In the XIX century its fame already surpassed the Italian borders, being considered one of the best wines in the world, receiving the designation of "the wine of the kings, the king of the wines".

From the 60s, with all their fame and notoriety, the producers began to suffer from the quantity of wines titled as Barolo, but which did not present the same characteristics, and especially the same quality, as the "originals". Consequently, the Barolo market suffered a fall in its prices, causing damages to the real wineries producing this wine. In order to solve this problem, a controlled designation of origin was created, which guaranteed the quality and provenance of the wines called Barolo. Soon after, with a more rigid control, the controlled and guaranteed designation of origin was created.

However, even with the safety of the DOCG designation, farmers suffered, and still suffer, from the climatic effects that change every year and directly affects the quality of the vintages. These variations are often identified in the sensorial characteristics of wines, i.e. the concentration of tannins, component balancing, aroma and long taste. These climatic variations can result the fall in production, and even to the drop in the prices, due to the fall in the quality of a given vintage.

Currently, Barolo is one of the most produced wines in Italy, being a large part destined for export, mainly to the USA. Its market value, in the last year, showed an

increase of approximately 8%, being considered one of the most expensive wines in Italy and in the world.

In relation to the economic market, many people question what, in a general way, moves the final wine market price. Many refer to the set of climatic factors, which influence the sensorial characteristics, together with the method of production as the main determinants of the price. But the question that is made at the moment is if they are in fact the main drivers of the prices in the consumer market.

Exploring this idea, this study will analyze other possible factors, such as the importance of a label with the "Barolo" denomination, and whether the consumer's willingness to pay is connected to the taste that is present in a wine of a given vintage.

In the course of the chapters, data from the Italian wine market, as well as from Barolo, the characteristics of the last vintages and an econometric analysis will be exposed, in order to discover the true drivers of the prices of this great and important wine.

1 THE WINE MARKET

The Wine Market, as a whole, is characterized by its complexity and heterogeneity, throughout the wine spinneret. From its raw material, the grape, to the commercialization[1], the different characteristics between the markets and companies, make of this sector, a great point of studies and analyzes.

A study of Etienne Montaignen and Alfredo Coelho[2] identified 4 fundamental factors that differentiate one wine maker from the other. First, producers can be differentiated as to the degree of specification, and they may be dominant or secondary. The second factor refers to the structure of producing farms, where there are two groups of division: professional vine farms[3] and small commercial viticulture, being the latter group usually connected to small commerce, with the purpose of family sustenance Thirdly, the reference is made to the degree of vertical integration in the wine production chain. And finally, a regional location[4].

The growing number of new competitors in the wine market has led producers to rethink new strategies, from the implementation of new technologies in grape plantation and wine production, to new forms of marketing, to a better consolidation in the market. Old farmers are having to leave the current comfort zone, brought with their long years of experience, and draw new plans and strategies, so that the various external factors do not affect them in the competitive world market. Among these factors, the meteorological is one which directly affects the quality of the vintage; the economic and political factors, that can influence at national or global level, depending on the consumer market that the company wishes to attend.

[1] The wine chain, in Southern European countries, is tradittionally known as the wine *filière*. This approach is adopted in the past by the agricultural and food sector, and still used in the current days.
[2] Structure of the producing side of the wine industry: Firm typologies, networks of firms and clusters. (2012)
[3] Montaignen and Coelho divided this group of farms in another four different groups: viticulture with employees, family viticulture, individual viticulture and viticulture as a complement.
[4] One of the relevant points that the geographic location implies, for example, are the control bodies: in Italy they are theprotection consortium.

1.1 THE CHARACTERISTICS OF THE ITALIAN WINE MARKET

When one thinks of wine, Italy always appears as market leader, either for its great numbers or for its exquisite quality. Analyzing the latest consolidated data for the year 2016, Italy was the world leader in production, with 50 million hectoliters. Export, in turn, was historic, with a 3% increase in its numbers, being 5.2 billion.

The domestic economic contribution amounts to almost 10 billion euro, and generates work for more than 1.3 million people. According to a research made by Coldiretti[5], for each harvested grape, there are 18 sectors of the industry that are activated: from the glass to bottles and glasses, to the cork work for the corks; with transport, tourism, food, bioenergy and others. The consumption of wine in Italy, until the middle of the 20th century, was characterized by being part of the daily routine of the people, being produced almost exclusively for the sustenance and the accompaniment for the Italian meals. However, this scenario changes from the 60s.

In 1963, the Controlled Designation of Origin (DOC) was instituted, where all the wines were submitted to a chemical-physical control and an organoleptic examination, and on April 8, 2010, the Controlled and Guaranteed Designation of Origin (DOCG), a category attributed to wines already referred to as DOC for at least 10 years. After this change, the consumption of wine was no longer just part of the daily life of the Italians, but came to be rushed in a more accurate way. This new niche of consumers brought to the market a demand for wines of a higher quality than previously produced which, consequently, increased the value of the wines. Even this change having been a major step in the wine world, those who drank wine daily, without perhaps having the same detail as the new consumer group, continued in the Italian wine scene. The presence of these two distinct groups of consumers led to the existence of two types of wines: one of low quality and price, accessible to those who consumed wine daily and without considerable refinement in the palate; and the another type of wine followed DOC standards and a line of high quality, but which had a higher value.

From the 80's the Italian wine market showed a warming in its numbers and this was the consequence of several factors, but the most significant was the investment and more intensive use of technology. Added to the technological advance, the greater

[5] Coldiretti is an Organization of agricultural entrepreneurs at national and European level.

agrarian knowledge of the vineyards and techniques of cultivation, have brought to this sector a higher quality in its production and, consequently, a high in its values. Even though this evolution is considered a cultural change in the wine area, the knowledge and experience that the producers acquire over the years is still considered key to a successful wine market.

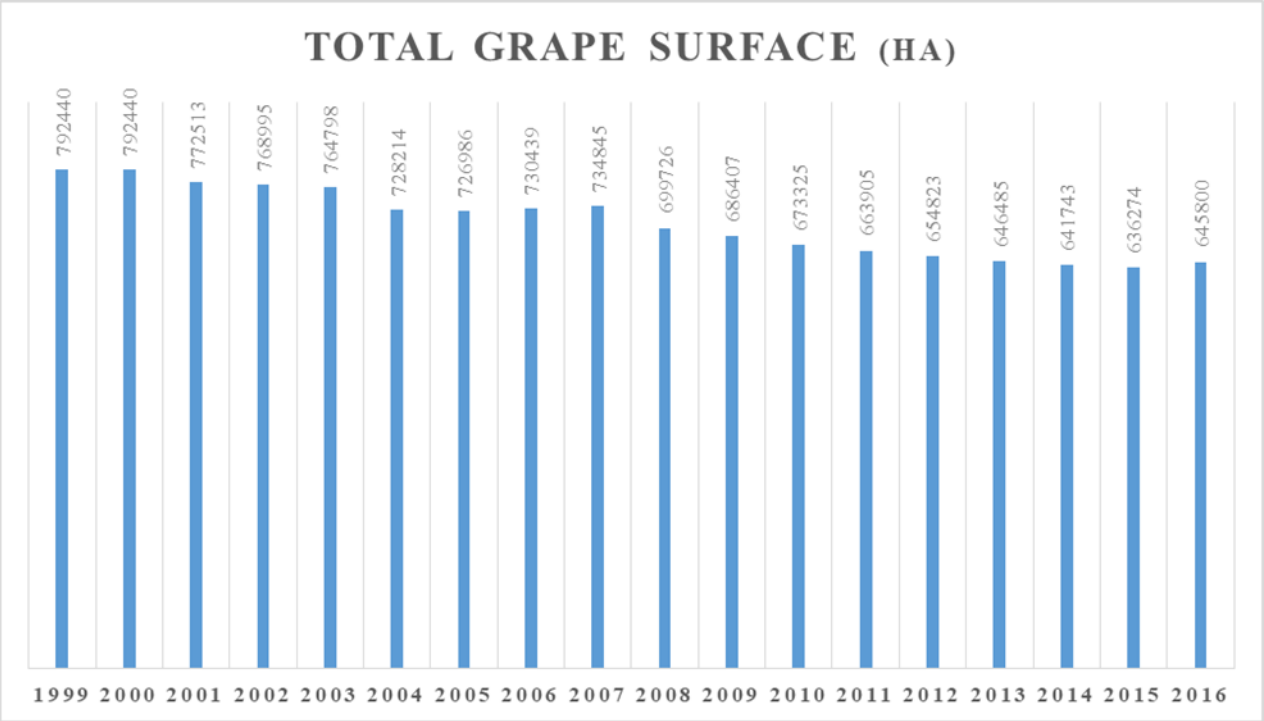
1.2 PLANTATION AND WINE PRODUCTION

Italy is the world leader in the production of different types of wine. The diversification of its planted vineyards leads the italian to differentiate from the other market, presenting from low-cost wines to prestigious wines in the wine world.

As mentioned previously, the Italian wine sector presented a great change from the 1980s, and it is possible to note it through the graph of figure 3, where the number of wine production reached its maximum historical peak. Meteorological factors, including the amount of rainfall and temperature, are the main drivers and responsible for the quantity and quality of grapes harvested each year.

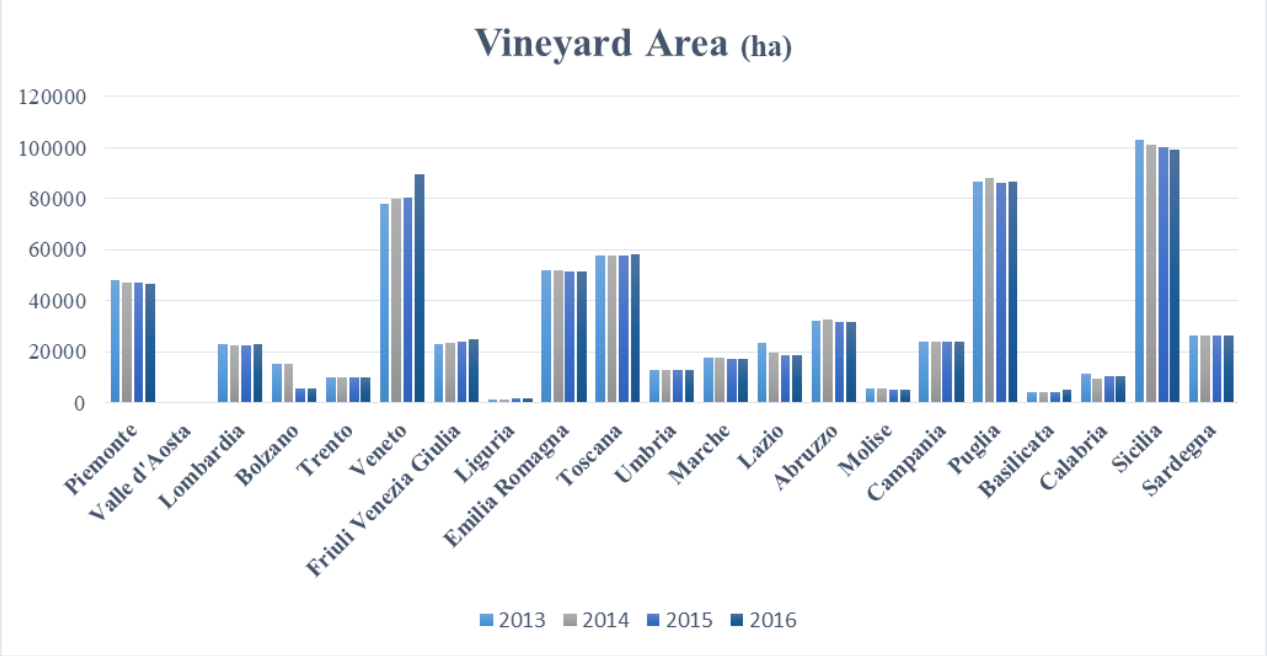
The graphs in Figures 1 and 2 refer to the total planted area and the number of areas used per region, respectively. The total area planted in Italy has presented a low fall over the years, but compared to 1999, it presented a reduction of approximately 145000 ha.

Figure 1: *Vitiated Areas in Italy*



Source: Vino in Cifre

Figure 2: *Inventory of production potential in Italy*



Source: Vino in Cifre

From figure 2 its is possible to conclude that the area used for the vineyards has been showing a constant reduction in certain regions, such as Bolzano, Lazio, Calabria

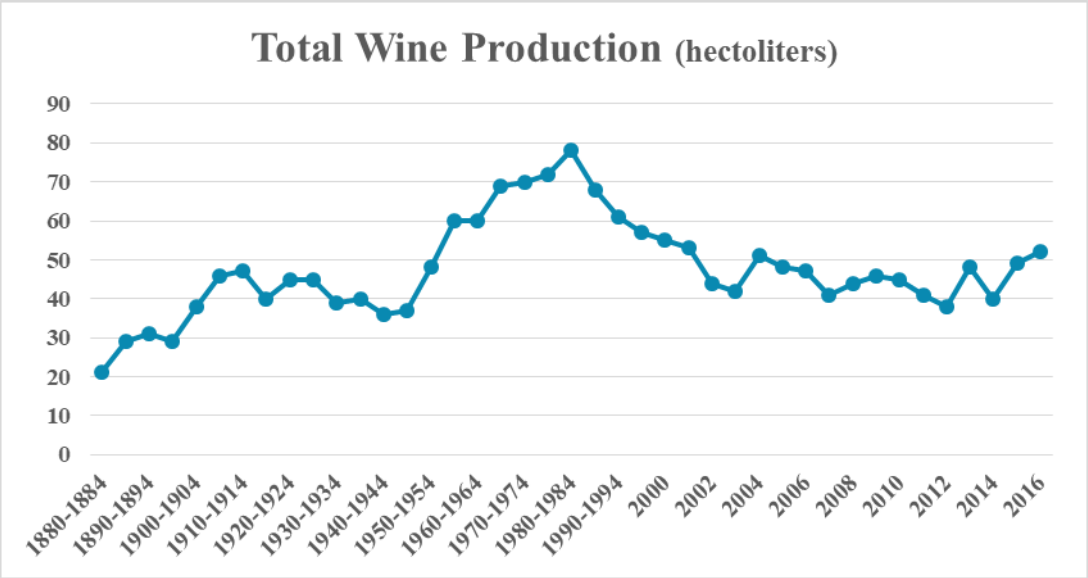
and Sicily, but in contrast to other regions showed a growth, as for example in Veneto and Friuli Venezia Giulia. One possible explanation for this increase is the phenomenon of Prosecco and grey Pinot, which comes together showing greater adhesion in the markets.

In 2016 was put in practice the new legislation, the regulation (Ue) n. 1308/2013, regarding the planting of new vineyards. On January 1, the planting rights system was abolished, which was characterized by strict control over the cultivation of new vineyards, due to the fact that wine producers, who wanted to plant new vineyards, had to buy the rights from another producer who had the grape already planted. One of the consequences of this model was the gradual decline of the area planted in Italy.

This new system, which remains in force until December 31, 2030 (the regime is transitory), is characterized by the fact that the authorizations can no longer be marketed, that is, for the planting of a new vineyard, the producer must have a authorization, which in turn, will be linked to a reserve (in the measure of 1% of the national productive potential), which will be renewed every year. In Italy the quota of authorizations will be approximately 6400 hectares per year.

In the wine sector, this change was very well accepted, mainly because it does not bring the bureaucracy that normally follow the new rules in Italy. In an interview, the president of the Italian Wine Union, Domenico Zonin, praised the creation of the new decree, since the wine sector presented several critical points about the plantations, and also pointed out that probably the percentage of 1% defined for the vineyards, will be not enough, given the fall that Italy has presented in recent years. According to Zonin, this new regulation will led Italy to not lose its productive potential.

Figure 3: *Total Wine Production in Italy in hectoliters from 1880 until 2016*



Source: Various sources

The figure 3 shows a historical comparison in the Italian wine production. As mentioned earlier, production reached its peak in the 1980s, but then continued steadily down until 2002, where peaks and valleys are now present, with the clime being the main responsable for these numbers.

By making a more detailed analysis of the data of 2016, the quantity relative to the harvest is between 0 and 2%, more than the one of the year 2015, being possible to observe in table 1 the values of production of these years. The low rainfall and the good temperature range favored the harvesting of the regions of Central-Nord and Sardegna. However, the regions of the South Center were considerably affected by the heavy rainfall, irregular for the time; the producers who managed, together with their enology team, to overcome these anomalies, succeed to keep their numbers relatively unchanged.[6]

Generally speaking, the vintage of 2016 was considered of great quality for those wines that were able to benefit from the clime, especially that of the months of September and October; the date of the harvest was returned to normal, considered that in 2015, thanks to the increase in temperatures, the grapes matured early, anticipating the harvest date of the grapevines.

[6] Information derived from the Assoenologi website

Table 1: *Production Wine by Region*

Production of wine							
(hectoliters)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Piemonte	2.683.000	2.366.000	2.580.000	2.402.000	2.467.000	2.549.000	1.910.000
Lombardia	1.313.000	1.222.000	1.301.000	1.424.000	1.410.000	1.473.000	960.000
Trento	1.113.000	1.210.000	1.362.000	1.029.000	1.230.000	1.213.000	1.030.000
Veneto	8.710.000	7.740.000	9.148.000	8.281.000	9.733.000	10.145.000	8.110.000
Friuli Venezia Giulia	1.267.000	1.281.000	1.173.000	1.367.000	1.872.000	1.856.000	1.480.000
Emilia Romagna	6.455.000	6.273.000	7.396.000	6.958.000	7.382.000	7.857.000	5.890.000
Toscana	2.495.000	2.098.000	2.657.000	2.778.000	2.825.000	3.025.000	1.660.000
Marche	741.000	918.000	1.039.000	916.000	959.000	956.000	670.000
Lazio Umbria	1.205.000	2.002.000	2.472.000	1.972.000	2.461.000	2.284.000	1.250.000
Abruzzo	2.283.000	2.443.000	2.728.000	2.273.000	2.985.000	3.948.000	2.760.000
Campania	1.726.000	1.542.000	1.644.000	1.183.000	1.613.000	1.286.000	1.030.000
Puglia	5.777.000	5.338.000	5.908.000	5.430.000	7.931.000	9.636.000	6.740.000
Sicilia	4.823.000	5.169.000	7.282.000	4.539.000	6.248.000	6.042.000	4.230.000
Sardegna	486.000	503.000	638.000	746.000	794.000	804.000	440.000
Others*	1.628.000	969.000	933.000	790.000	816.000	1.064.000	740.000
Total	**42.705.000**	**41.074.000**	**48.261.000**	**42.088.000**	**50.726.000**	**54.138.000**	**38.900.000**

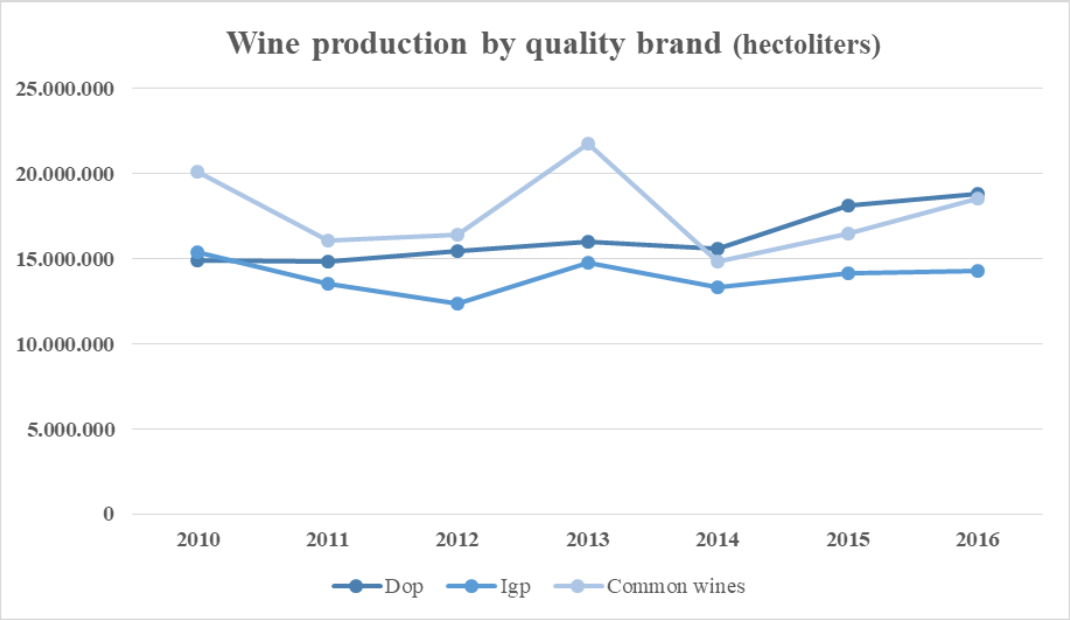
*Valle d'Aosta, Liguria, Molise, Basilicata, Calabria

Source: Assoenologi

The graph of figure 4 reveals a very interesting and already mentioned data, which is the growth of consumption, and consequently of the production of more selected wines. The last numbers of 2016 show that the DOP category was the most produced, and as in the wine sales section, presents each year an increase in sales.

Although the theory of microeconomics says that the more a product is consumed, the more its price has a tendency to fall, the value of a wine is not based on the market demand, and much more for the quality of the harvest of each year, among others factors, such as location and time of aging. The direct link to the quantity of grapes harvested that year may not be quoted.

Figure 4: *Declaration of wine production by quality brand in Italy in hectoliters*



Source: Vino in Cifre

1.3 ITALY WINE CONSUMPTION

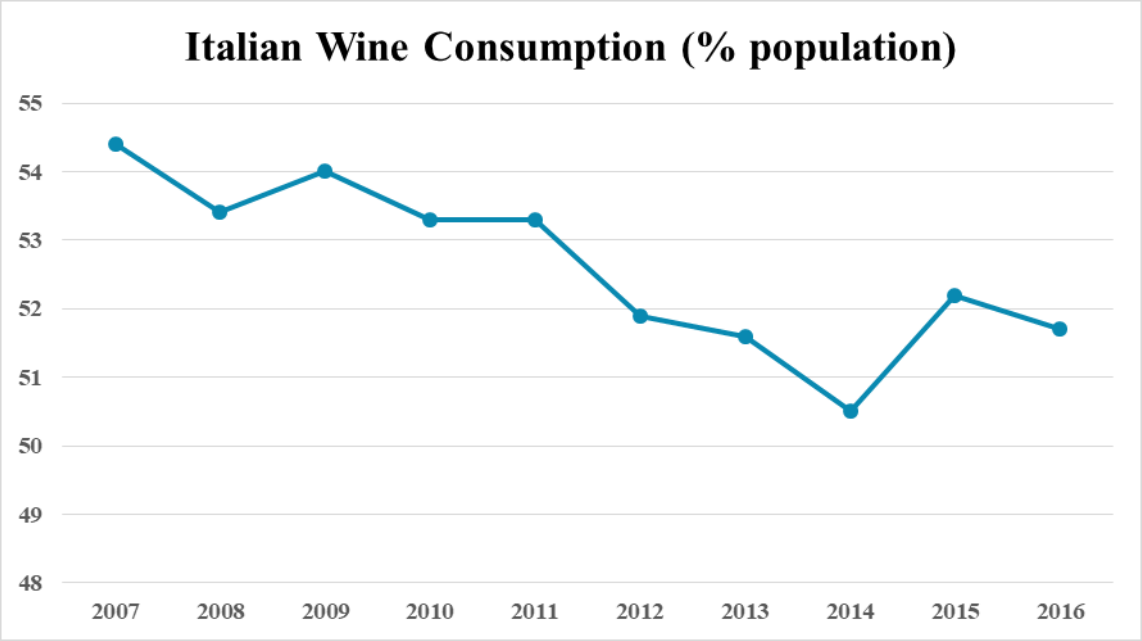
The consumption of wine over the years has been decreasing in relation to its historical past. Until the middle of the last century, wine was produced for the local and daily consumption of the Italian citizens. After the creation of the protection consortium, the wine came to be rushed more than as a simple product of the food chain. Another important factor was the growth in the production of other beverages such as beer.

There are many reasons why this consumption has been regressing. According to an article written by Newsweek magazine, it is drinking more wine outside of Italy. One of the factors that led to this decline was the strong recession that the country has entered in recent years. Families that had their incomes reduced and jobs lost, started to consume less wine, and to redirected the amount previoulsy spent on foods, that are more relevant to the dealy consumption.

In a generalized context, the consumption has been maintaining constant during the last years, having changed the way the Italians have been consuming the wine. The decrease in consumption among young people is explained by the fact that they now see wine as a historical drink from their parents and grandparents, and end up looking for

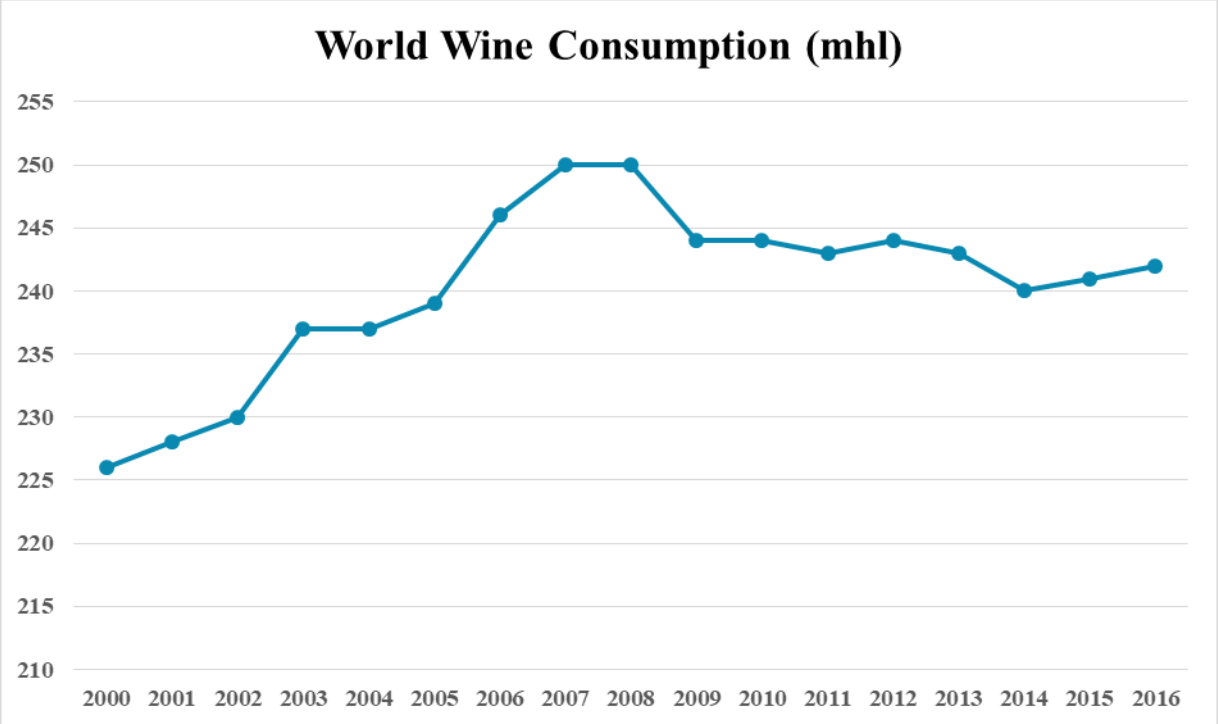
more exciting options for their eyes; coktails with a much higher alcohol percentage than wine end up being the options of choice between this niche of consumers.

Figure 5: *Italian Wine Consumption measured by the population percentage*



Source: I numeri del vino

Figure 6: *World Wine Consumption in million hectolitres*



Source: OIV

The tables 2 and 3 report another important fact: the fall in consumption among the ancient. The myth that drinking wine every day would avoide certain types of illness has been demystified with each passing year. When going through a medical appointment, those people are advised to leave the alcohol aside for the purpose of maintaining a healthier life and away from certain diseases, that are characteristics of this age range.

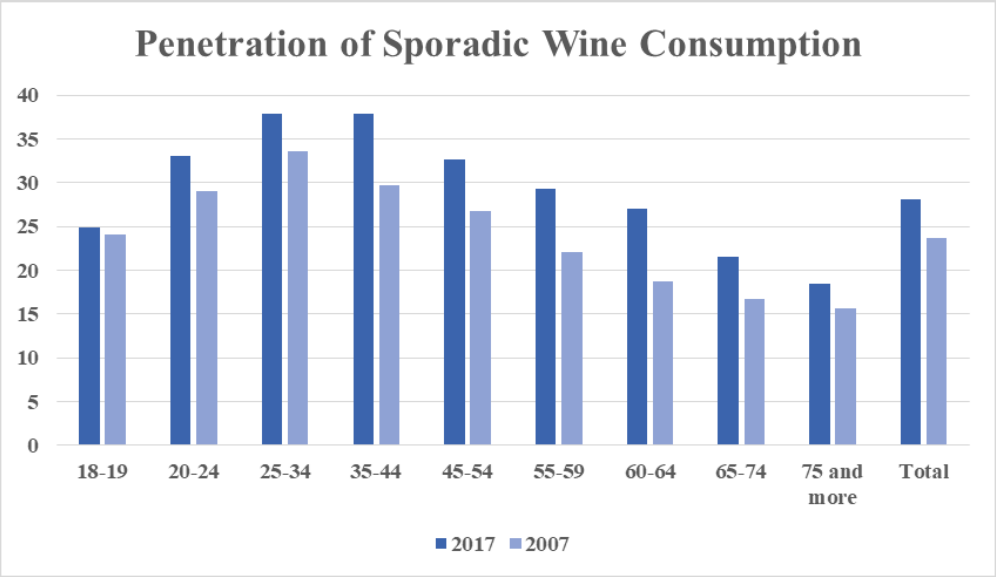
Table 2: *Italy Sporadic Wine Consumption by Age - % of the total population*

Sporadic Consumption (% total population)											
%	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
11-15	3,9	2,9	3,6	2,2	2,4	2,1	2,9	1,9	2	1,7	1,4
16-17	15	12,4	15,5	11,9	10,6	9,4	9,7	10,6	8,5	10,9	7,8
18-19	24,1	19,9	23,3	22,9	22,6	18,6	22	18,7	23,5	22,9	24,9
20-24	29	29,8	27,9	28,6	28,4	31,1	28	27	29,8	31,6	33
25-34	33,6	32,8	34,5	33,5	36,4	34,3	34,9	34,9	38,7	35,5	37,9
35-44	29,7	31,1	30,5	31,9	33,2	33,8	33,6	33,3	35,1	34,7	37,8
45-54	26,7	27,6	28,7	28,7	28,4	28,7	29,9	30,1	31,9	32,2	32,7
55-59	22,1	23,6	24,9	26,4	26,7	25,6	26,5	26	29,5	28,6	29,3
60-64	18,7	20,5	22,5	19,8	22,4	23,1	23,7	23,5	25,4	26,4	27
65-74	16,7	18,1	18,8	19,8	19,4	19	20,6	21,3	21,2	21,3	21,6
75 and more	15,7	16,2	17,6	15,5	16,2	17,2	18,2	17,6	18,4	18	18,5
Total	**23,7**	**24,2**	**25,1**	**24,8**	**25,6**	**25,4**	**26,0**	**25,7**	**27,4**	**27,0**	**28,1**

Source: I numeri del vino

It is also possible to notice a reduction in sporadic consumption of wine among the elderly: less than half of 55 and 74 year-olds are sporadic consumers. The growth, however, remains high in the younger classes, with 86% of those in the age range of 18-34 years not drinking every day.

Figure 7: *Penetration of sporadic wine consumption by age – 2017 vs. 2007 (% of total population)*



Source: I numeri del vino

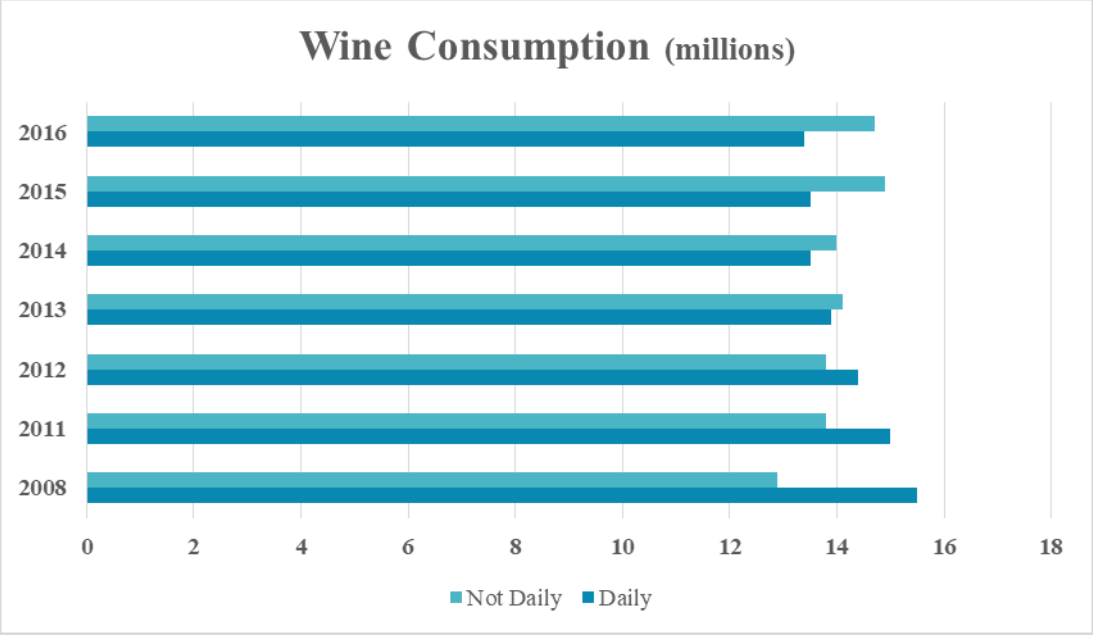
In the previous graph, of figure 7, it is possible to analyze the prenetration of sporadic wine consumption, by age range, in the years 2007 and 2017. As previously mentioned, the number of people who drink sporadically is considerably higher between 25 and 44 years; while the older age groups are those which represent a lower percentage of the population who drink sporadically.

Table 3: *Italy Wine Consumption by Age – % of the total population*

Consumption of Wine by Age (% total population)											
%	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
11-15	6,9	4,7	5,3	4,4	4,8	3,2	4,4	3,3	2,8	2,9	2,6
16-17	23	19,3	22,9	17,9	18,2	14,1	16	16,1	15,5	18	16,6
18-19	35,7	29,1	33	34,5	33,3	29,4	32	28,9	34,5	33,9	36,1
20-24	41,8	43,4	41,8	42,5	41,5	43,3	41,9	40,4	42,5	45,7	45,8
25-34	55,5	53,1	54,7	52	54,9	52,2	53,1	52,1	54,5	52,4	54,9
35-44	58,7	57,9	58,2	57,9	58,3	57	55,9	54,6	57,1	56,5	57,5
45-54	64,9	62,9	62	61,8	61,2	58,9	57,7	56,5	58,8	58,4	59
55-59	64,8	62,4	64,1	64,8	64,1	61,5	62,2	59	61,2	59,4	58,4
60-64	65,2	64,8	63,8	63,6	63,2	62,4	60,6	59,7	60,2	61,7	60,1
65-74	60	61,1	62,1	61,4	60,2	60,5	59,7	58,3	59,2	59,3	58,6
75 and more	52,5	53	53,7	52,8	51	50,5	49,7	51,2	52,4	49,9	54
Total	**54,4**	**53,4**	**54,0**	**53,3**	**53,3**	**51,9**	**51,6**	**50,5**	**52,2**	**51,7**	**52,6**

Source: I numeri del vino

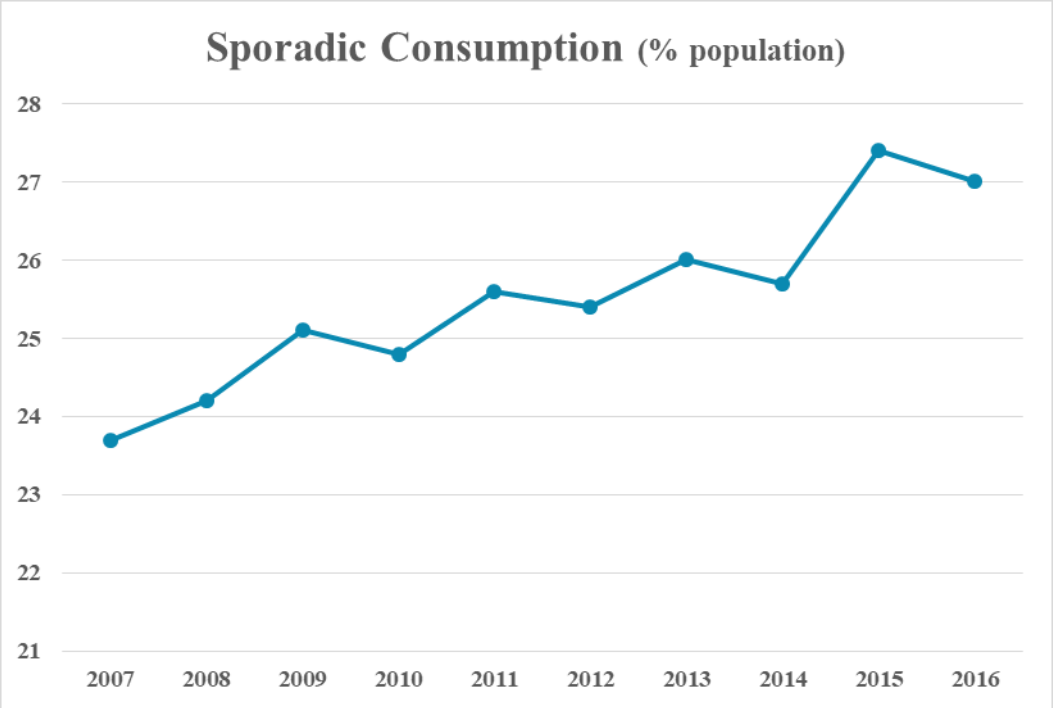
Figure 8: *Daily and Not Daily Italian Wine Consumption in millions*



Source: Vino in Cifre

With an increase in the degree of schooling, the Italians began to rush the wine and consume it sporadically. Still referring to the Newsweek publication, with the creation of strict traffic laws against alcohol, Italians also started to consume less wine in restaurants and bars. The daily consumption of half a liter of wine droped from 7.6% in 1983 to 2.3 in 2016. It is possible to analyze in the graph of the figure 6 the behavior change regarding the ingestion of daily and not daily wine; in 2013 the numbers have reversed and in 2016 the difference has already become considerable.

Figure 9: *Italian Wine Sporadic Consumption by the population percentage*



Source: I numeri del vino

1.4 WINE SALES IN ITALY

The following tables present the wine sale numbers in the last years by category. In the table 4 it is possible to analyze a contrast between the value in sales and the volume sold. Over the years the sector has been getting more, the volume has been decreasing. One reason for this is the consumption, and one can also include exports of higher quality wines, such as the DOP category, which has been showing a high sales, but keeping the

volume relatively constant. This data reveals that more expensive wines are being consumed in smaller quantities, while the periodic consumption of ordinary wines is falling in volume and value.

Table 4: *Firm and Sparkling Wine Sales in Italy*

Firm and sparkling wine sales							
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Sales in value (mln euro)	1.427,10	1.440,40	1.470,30	1.515,90	1.505,40	1.540,30	1.556,70
Sales in volume (mln liters)	575,4	572	553,7	517,7	505,1	511,3	506
Average price (euro/liter)	2,48	2,52	2,66	2,93	2,98	3,01	3,08

Source: Vino in Cifre

Table 5: *Italy Wine Sales by Quality Brand in million liters*

Wine Sales							
(mln liters)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Wine	575,4	572,0	551,4	513,1	502,5	503,4	498,3
Dop Wine	168,7	169,0	165,1	164	164,4	163,9	165,5
Igp Wine	152,7	147,8	140,9	127,6	120,1	121,5	122,6
Common Wine	254,0	255,1	245,4	221,5	218	218,2	211

Source: Vino in Cifre

The data in tables 5 and 6 refer to wine sales numbers in Italy. For a better analysis, the graph of Figure 10 compares the data from the two tables.

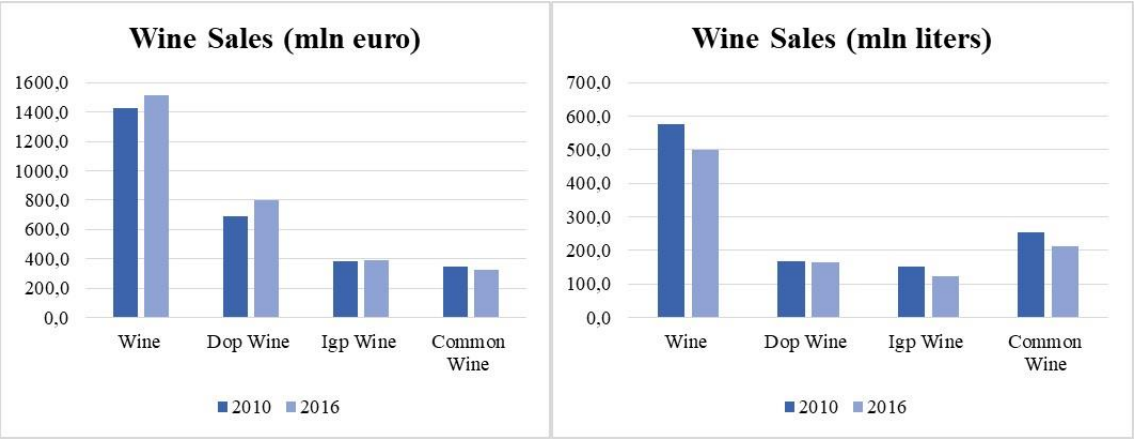
Table 6: *Italy Wine Sales by Quality Brand in million euro*

Wine Sales							
(mln euro)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Wine	1427,1	1440,4	1.464,90	1.497,50	1.489,30	1.495,00	1.511,50
Dop Wine	691,2	698,5	707	732,1	748,6	768,7	797,1
Igp Wine	386,3	386,4	394,5	396,1	381,5	381,1	389,6
Common Wine	349,7	355,5	363,4	369,3	359,2	345,2	324,8

Source: Vino in Cifre

Analyzing the DOP category, which is the one that most interests in this document, the quantity of sales in liters remained basically the same in the two years, 2010 and 2016; while the numbers in euros were higher, which leads us to conclude that the value of wine in this category has increased.

Figure 10: *Italy Wine Sales by Quality Brand in million euro and million liters in the years 2010 e 2016.*

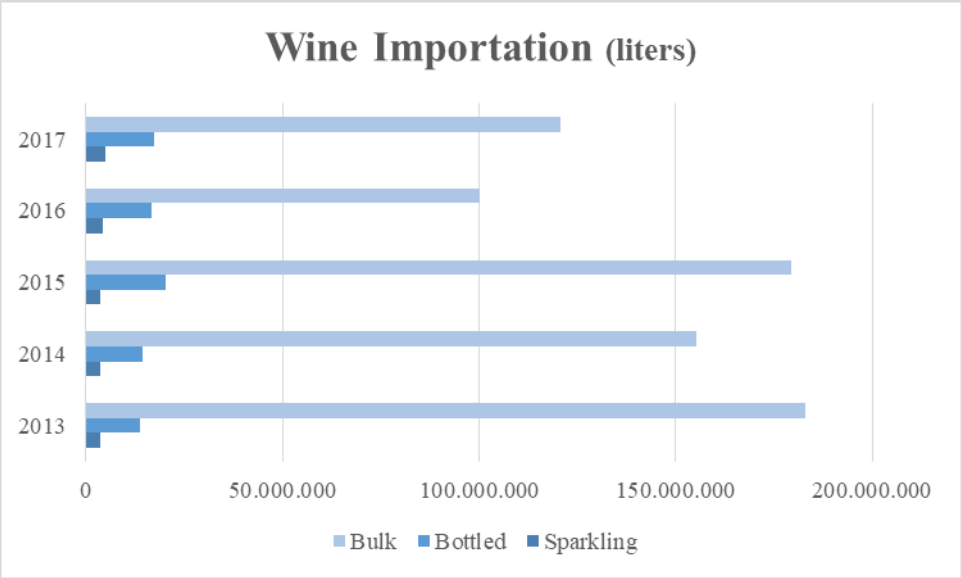


Source: Vino in Cifre

1.5 ITALIAN WINE IMPORT

Despite the external influences and the globalization of new products, over the years, the Italy's wine import has dropped in the last years, specially in 2016. The consumer's preference have been changing in recent years, as already mentioned above the high quality wines are increasingly gaining space and attention of Italians, but the search and preference of the local consumer is maintained in Italian wines.

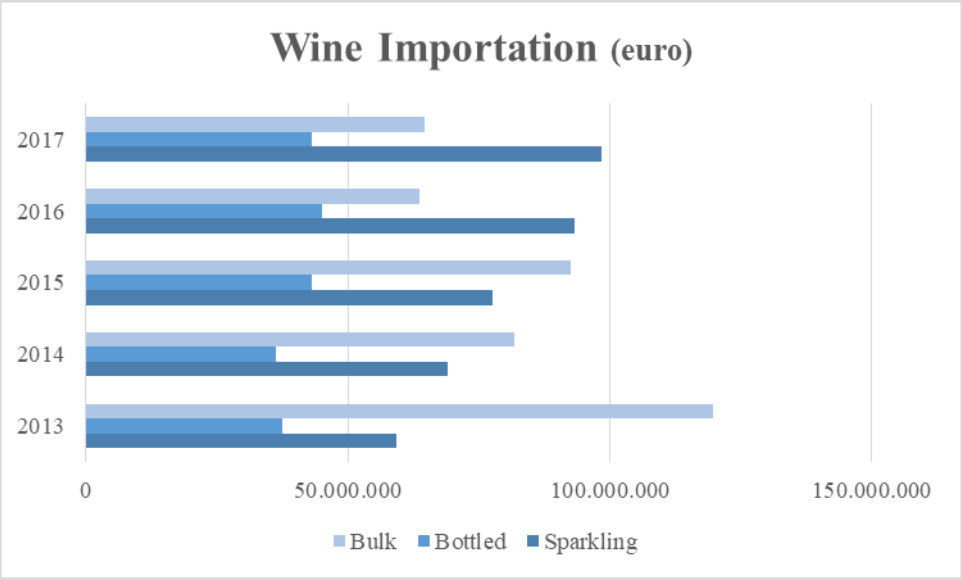
Figure 11: *Italian Wine Import in liters*



Source: Vino in Cifre

The chart of the figure 12 draws the corresponding value, in euro, of the last imports. The difference through the years is not too big, revealing that possibly the characteristics of imported wines follow the same standards that have been registered in the Italian wine market. The countries that most export to Italy are France and Spain, and this trend may be linked to the high quality of these wines and the similarities in their cultures.

Figure 12: *Italy Wine Import in euro*



Source: Vino in Cifre

1.6 ITALY EXPORT

Italian wine exports are the largest in the world, ahead of another two leading leaders, France and Spain. This activity brings many benefits to the Italian market, being a large part of its production destined to the foreign market. As it is possible to identify in the tables 7 and 8, the export of high quality wines has presented an annual increase in its numbers, along with the IGP wines, which presented a very considerable increase from the year 2015.

Even with all its tradition and quality, the Italian market is facing increasing competition from the so-called New World Wine Producers, which are the USA,

Australia, Chile and South Africa. The trend of world consumption follows the same internal Italian standards, that is, the preference for high quality wines is increasing every year.

Table 7: *Italian Wine Export by Quality Brand in million liters*

Wine Export by Quality Brand (mln liter)					
	2013	**2014**	**2015**	**2016**	**2017**
Dop Wine	312,65	310,48	305,26	306,72	311,74
Igp Wine	337,62	340,81	359,98	343,11	348,38
Common Wine	69,15	70,79	62,95	61,00	61,60
Sparkling	127,93	119,42	117,98	117,30	119,39
Varietal Wines	9,69	8,71	10,32	14,82	18,33
Totale	**857,05**	**850,21**	**856,49**	**842,96**	**859,44**

Source: Vino in Cifre

The tables 7 and 8 show the export numbers of Italian wine in the last years, in liters and euro. Despite the drop of the production in more than 20% in 2017, the exports were up in value and volume.

Table 8: *Italian Wine Export by Quality Brand in million euro*

Wine Export by Quality Brand (mln euro)					
	2013	**2014**	**2015**	**2016**	**2017**
Dop Wine	1.305,74	1.324,06	1.376,09	1.430,74	1.479,47
Igp Wine	905,96	946,13	1.049,34	994,67	1.040,69
Common Wine	117,13	114,21	105,57	99,74	103,77
Sparkling	270,33	254,39	254,06	266,81	281,02
Varietal Wines	22,69	20,96	25,41	28,56	34,16
Totale	**2.621,84**	**2.659,75**	**2.810,47**	**2.820,51**	**2.939,12**

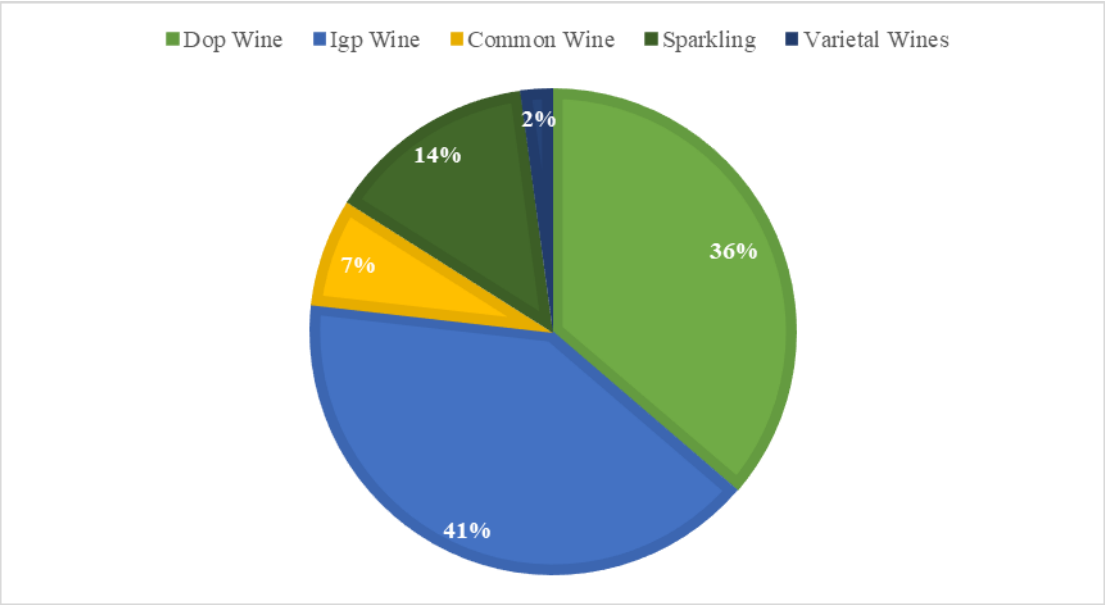
Source: Vino in Cifre

Figure 13: *Comparison of Wine Export by Quality Brand in million euro in the years 2013 and 2017*

Source: Vino in Cifre

The figure 14 is a representation of the export numbers, by quality brand, in the year 2017. Igp was the one that presented the highest number in exports, followed by the Dop wines.

Figure 14: *Italian Wine Export by Quality Brand in the year 2017*



Source: Vino in Cifre

The US is the largest importer country of Italian wines in value, presenting a 6% increase in sales last year, as we can see in table 9. Russia showed a growth in imports of 47%, the largest in 2017, being the wine one of those products that were not affected by the embargo imposed by Russia 4 years ago. Growth is followed by China with 25% and UK with 8%.

***Table 9**: Italian Wine Exports by Destination – Top 20 Destinations for Italian Wine Exports in 2017.*

Rank	Country	Volume (1,000 hl)	Country	Value (mln €)
1	Germany	5,532.1	United States	1,376.9
2	United States	3,230.4	Germany	972.6
3	United Kingdom	3,089.1	United Kingdom	799.7
4	France	1,052.0	Switzerland	356.9
5	Canada	793.0	Canada	332.1
6	Switzerland	737.7	France	168.5
7	Austria	478.7	Japan	160.2
8	Russia	477.6	Sweden	152.6
9	Sweden	475.1	Denmark	144.7
10	Netherlands	439.8	Netherlands	141.6
11	Japan	430.4	China	124.3
12	Denmark	379.0	Belgium	121.7
13	Belgium	365.8	Russia	111.2
14	China	358.2	Austria	101.3
15	Czech Republic	329.6	Norway	83.7
16	Spain	217.9	Australia	51.9
17	Poland	204.0	Poland	49.3
18	Norway	187.8	Czech Republic	42.6
19	Lithuania	157.8	Spain	39.9
20	Hungary	150.2	Brazil	37.6

Source: Italian Wine Central

2 THE BAROLO WINE

"The wine of the kings, the king of the wines" – The Barolo's History

The history analysis of the barolo wine begins in the Neolithic phase with the first inhabitants of the Langa: i Liguri Stazielli o Statielli.[7] They were responsible for the cultivation of the first vineyards on the lands of Langa Ligurum[8]. But the first appraisers of this wine were the galli, who then had their lands conquered by the Romans. Those, in turn, great lovers of wine, introduced different forms of cultivation, conservation[9] and trade, having in the year 89 BC Alba Pompeia as Municipality under the pompeo Strabone consoul[10]. In terms of trade, it is relevant to mention that the Romans were responsible for warming the wine market in the region, and this fact is evidenced thanks to two stars funerary to Bra and Manzano, found in the area of Alba.

Although it is very difficult to precisely establish the presence of the Nebbiolo grape[11] - the main ingredient of the Barolo wine – in the region of Piemonte, some facts seem to connect directly to this grape at the time of the Romans in Langa[12]. A sentence by Giulio Cesare read "... et de Murra optima ad nostra Romae metropolium perduximus vina" possibly referring to the wine from this grape and that historically was related to the event where after the Gallica War, Giulio Cesare took with him a great amount of the wine to Rome.

After the decline of the Roman Empire and the subsequent invasion of the Barbariche, the wine goes into oblivion due to the commercial and productive fall

[7] STAZIELLI. - Pre-Roman Ligurian population of the high valleys of Bormida. di Pietro Baroccelli - Enciclopedia Italiana (1936)

[8] Name originated from the Latin, referred to the *"land of liguri",* that were the first inhabitants of the Langa lands. Possible also to refer to "Lingua", Latin word that makes mention of "lingua di terra" due to the shape of its hills.ROMANELLI Leonardo Barolo – IL RE DEI VINI ROSSI SFIDA IL TEMPO ED ESALTA I GRANDI PIATTI – Page 12

[9] Instead of storing the vine in terracotta amphorae, the Romans introduced wooden barrels, which so far were only used for beer.

[10] Consorzio di Tutela Barolo Barbaresco Alba Langhe e Roero. Barolo: Mito di Langa. 2009. Page 17

[11] The first record of the Nebbiolo grape dates back to 1268 in Vini made by Rivoli's Castle in the Documenti della Storia del Piemonte, preserved in Rivoli, while the first description of the grape in 1305 by Pier de Crescenzi, said: *"... a spice of black grapes, which is called Nubiola, which is delightful to handle, and is marvelously vinous, and has the grain a little long, and wants fatty earth, and very letaminated, and fears the ume, and soon it swarms, and it makes excellent wine, and to be preserved, and very powerful, and it does not have to stand in the graphies as well as a day or two. And this is very praised in the city of Asti and in those parts ... ".*

[12] A citation in the Naturalis History, *Plinio il Vecchio* referred to a late-maturing, cold-resistant black grape of Piedmont's origin.

suffered. In this time of few records, it is concluded that the wine continued to be produced, but only for local consumption. New records are only found in the year 1000, when there is a great increase of wine also in other regions.[13]

After the year 1787 the Barolo started to have a greater attention. The then future president of the United States, Thomas Jefferson, made an itinerary through France and to some regions in the north of Italy[14]. When he arrived in Torino, precisely at the Hotel d'Angleterre, he tasted *"vino rosso di Nebbiolo"* and made the following observation:: *"as lovable as the soft Madeira, dry on the palate like the Bordeauz and as lively as Champagne".*[15]

With the rise of the Savoias to the power of Piedmont in 1713, we noticed a greater political stability, which brought a considerable improvement to the Nebbiolo and other great wines.

In 1751, the first reference to Barolo was made: some Piemont's person, with the intention of creating a wine company to transport the wine to England, sent the first "Barol".[16] This sending served as an incentive to the king Carlo Emanuele III, who financed the Piedmont's society to send another batch of wine to England. This shipment and another one of two English merchants - Wodmans and Clies -, did not have the expected result due to the distance to be covered and the current form of transport. It was from these events that the quality and durability of the wine came to receive a greater attention.[17]

However, the modern Barolo has its history begun in the thirties of the nineteenth century, with the arrival of the Count of Cavour, Camillo Benso. Camillo was the son of Michele and lived at that time in Torino. The father, worried about his son's very innovative ideas for that time and place, sent him to Grinzane, to be the syndicate of that commune and to take care of the vast land that belonged to them. Thanks to his innovative

[13] From the *Rigestum Comunis Alba*, it is possible to note that in 1026 the present-day regions of Barolo's production were considered to be a very good wine vocation. Romanelli, L. Barolo – IL RE DEI VINI ROSSI SFIDA IL TEMPO ED ESALTA I GRANDI PIATTI. Page 27

[14] The purpose of this trip was to know the methods of cultivation the Piemont's rice, of great quality at that time, and implement it in the United States, more precisely in South Carolina. Rosso, M. – Barolo: Mito di Langa. 2009. Page 18

[15] This observation was of great importance because it was possible to know that the Barolo that time already was consumed in Torino and had great notoriety.

[16] At that time the Barolo was considered of equal quality to Bordeaux.

[17] The wines, until that moment, were kept in wooden barrels. Its transport was made in small casks, among them was the typical Piemont's "*carrà*" , botte of elongated form.

knowledge and the trips made to France, Camillo began to make great changes in the agriculture in the lands of his family, beginning with the planting of new vineyards and specializing the cultivation of rice.

In 1836, the Count of Cavour asked for the help of a friend, the oenologist Pier Francesco Staglieno, who was a great expert in agricultural techniques for the viniculture, became the person in charge of the plantations and the manufacture of wine. He was responsible for the implementation of significant changes in the fermentation and conservation of wine by using sulfur in their process.

In the year 1847, a contract of sale is signed between Louis Oudart, French wine merchant, and the Count of Cavour. After staying at Count's house, Oudart knew his plantation, and Camillo sold his entire crop to the house "Oudart and Bruchè", and this one, in turn, was responsible for the costs of the revenge.

At this time we have in one side Staglieno, who produced a wine of young and sweet characteristics, and in the other side Oudart, with an aged wine and drier. At the same period, was recorded the beginning of the use of glass bottles in the smearing of the wines, and when the "Barolo 1844" came bottled. Then began the modern history of Barolo.

The Barolo that is closest to the present times was developed, with all the care, by the Marquises Falletti. After the sixteenth century, along with the Savoia notoriety, the political presence of the Falletti family grew. In 1806, Carlo Trancredi Falletti, last descendant of the family and Mayor of Torino, married Giulia Vittorina Colbert di Maulévrier, French noblewoman. After the death of Trancredi, Juliette inherited all the lands of the family Falletti, among them the great lands of Barolo, that comprised La Morra, Serralunga and Barolo. Giulia then asks Camillo Cavour's permission to consult with Oudart, and so apply her techniques in the production of wines from the Marquise's lands.

In a meeting between the King Carlo Aberto and Giulia, he asked her when he would experience the so famous wine from her lands. Immediately after this encounter, the marquise sent the king, in Torino, 325 *carrà* of wine, one for each day of the year, except for the 40 days of Lent. In love with the wine, King Carlo Aberto starts to produce it on his lands with the help of Staglieno. At the same time, the three great families,

Savioa, Cavour and Falletti, with the help of Oudart and Staglieno, were responsible for the transition from the traditional Nebbiolo to the modern Barolo.

A bit before 1850, when the "menù" was implemented as written practice of the dishes in the royal banquets in the Savoia family, the name Barolo was evidenced for the first time, without reference to the Nebbiolo.[18]

It is possible to say that the notoriety of the Barolo wine did indeed begin after the unification of Italy in 1861. Soon after the proclamation, the capital of Italy passes from Torino to Firenze, which brought an expressive decrease in the Torino economy, and consequently in the prestige of Barolo, which at that time was produced for local consumption, and served mainly at large court banquets. After a few years, the Turin's market begins to rekindle, and two big companies are born: Martini & Rossi, Gancia and Contratto. And in 1878, *"Casa Vinicola E. di Mirafiore per la producione di Barolo*" was created in Fontanafredda, being in fact the first company dedicated exclusively to the production of Barolo. Until this moment Barolo's path was exclusively local, without having the commerce as fundamental objective. With the popularity and international commerce growing, the Barolo became a wine of great admiration which earned him several adjectives, among them the most famous: "the wine of the kings, the king of the wines".

In 1908, after the First World War, the Agrarian Consortium set the boundaries of land for the production of Barolo, and Giacomo Conterno, after returning from Carso, began to produce high quality crops, starting a big business. And in September of 1927[19], in the Official Gazette, the "Decree of typical wines" was published, which officially limited the Barolo area, which comprised the whole municipals: Barolo, Castiglione Falletto, Serralunga, Castelletto and Perno; and part of the Commons of La Morra, Monforte, Verduno and Grinzane. In 1966 this demarcation was placed in the DOC and had the addition of the municipals of Roddi, Diano d'Alba, Novello and Cherasco.

The post Second War was very dramatic for the production and trade of wines. Italy lived the poverty generated by the War, where the wines were considered luxury goods. This generated insecurity for the producers, who did not have insurance against hailstorm or guarantee of profit after harvest. If something happened to the plantation,

[18] Rosso, M. Barolo: Mito di Langa. 2009. Page 26
[19] Rosso, M. Barolo: Mito di Langa. 2009. Page 39

that would be a synonymous of a future with misery. As a consequence, the grape plantations suffered an expressive fall, which led to the creation of the Cooperative among the producers of Castiglione Falletto, who came to help the grape growers.

Thanks to Renato Ratti, the Contemporary Barolo wine is born: 13/14 days of fermentation, two years in the wood and one year in the bottle. In the following years, a different Barolo was born, ready to drink and appropriate for the international market, whose creation was given thanks to young producers of Elio Altare.

In 1966, the Barolo wine became a wine of controlled designation of origin (DOC), and in 1980, a wine of controlled and guaranteed designation of origin (DOCG), which ensured a more effective and efficient control. After this great change, the Barolo has a high economic leap and became a wine of great importance whether in large or small companies, young oenologists or technical consultants.

2.1 THE MAIN CHARACTERISTICS

2.1.1 Terroir

As mentioned above, Barolo wine is considered "the wine of the kings, the king of the wines", but this characteristic is not only due to the historical facts that surround it. An important point to be mentioned that makes Barolo a unique and excellent wine is the question "terroir"[20]. Its meaning goes far beyond the literary translation of territory.

In the course of the discussion, terroir can be understood as a portion of land, be it large or small, generally considering a single vineyard. Natural influences are understood from climatic to morphological conditions. These characteristics can be understood as: conditions that are created according to the climate, soil morphology, altitude and exposure, geological characteristics of soil and mineral and organic elements, water quality, population of typical "indigenous" yeasts of the place. For a better

[20] *Terroir:* in the enogastronomic language, term indicating the relationship that binds a product (wine, coffee, etc.) to the characteristics of the microclimate and the soil in which it is grown. Trecani

understanding, it is possible to say that two wines produced from the same grape, coming from the same producer, but from different vineyards, are, without a doubt, different.

However, all the conditions mentioned above, which are of Nature exclusiveness, do not alone yield the unique characteristics of a wine. It is therefore right, to the point of terroir, to cite intervention and human oenological culture as crucial for the final wine. It is useless for a given grape to be planted in perfect natural conditions if human decisions are not the most appropriate. For the time being, it is possible to exemplify these attitudes as the moment in which the grape is harvested, the process of maceration, the temperature control in the winemaking phase, and so on.

This issue will be addressed further when economic analysis is introduced.

2.1.2 Cru

Cru[21] is another term used in the wine world to characterize the wines according to a certain delimited geographical area. In a literal sense, the cru is a vineyard in which climate, soil and other factors, natural or not, differentiate one wine from another produced even in nearby places. In wine terms, cru indicates the geographical area of origin of a wine, the property, the vine, the production methods, the marketing and the qualitative history of a company.

In order to classify the wines according to their quality among the various areas within a single denomination, the cru scale was created, which consists of a percentage evaluation that recognizes the maximum value of 100% for the best wine, and thus classifying the others according to this reference product. This scale aims to price the grapes of the areas of unique denomination.

[21] *Cru*: it is a word of French origin, and derives from the verb "coitre", that means grow. In France, the term cru is combined with all that comes from the earth, fruit, vegetables, milk, honey, etc.

2.2 GEOGRAPHICAL AREA AND ITS CHARACTERISTICS

The barolo is located in the Langhe region. This, in turn, is located to the right of the river Tanaro and inside the Western Alpine Arc; its rock formation dates from the Oligocene and Miocene times. However, the most important feature of the region was the formation of the Tertiary Basin of Piedmont. Its importance is given thanks to the numerous sediments accumulated there during millions of years, and that were deposited to the bottom in the zones higher and lower due to the tectonic activities that occurred.

In 1929, Professor Ferdinando Vignolo Lutati wrote in "Sulla delimitazione delle zone a vini tipici" respect the characteristics of the wine lands[22], where his conclusions about the lands of Barolo are still appreciated by many criticals of the sector, and for this reason follows transcribed:

" The man has found in these low hills a gentle slope and domes-shaped a particularly suited soil to the vine, so the overlaid of numerous series of concentric rows that strike the gaze of those who walk the Talloria valley for the first time. , the road from Alba to Barolo.

Much more complex is the nature of the land on which outstretch the towns of La Morra and Verduno, formed in part (for the portion included in the Barolo area as it was delimited in the Alba congress in 1927) still from the Tortoniano and partly from the following Messinian horizon, made up of deposits of marls, sands and conglomerates (sometimes with very large elements) among which it often encounters calcareous and gypsy formations and sometimes very thin sulfur lenses incorporated in the gypsum; just like in the hills of La Morra. Of this horizon, takes particular interest in viticulture the gessifera formation due the influence in the carratteri of the wine and to which it is desired (perhaps for greater sulfate content) that sense of circle at the head that easily produces wine from vineyards on chalk.

Exactly performed analyzes have shown in wines coming from vineyards on chalky soils a higher sulfate content (up to double), a ratio between glycerine and lower alcohol (up to p. 4.5 per 100 p alcohol) at the minimum generally accepted by us (about

[22] Ferdinando concluded that for the fair delimitation of wine lands one could not take into account the meteorological issues of the areas and not even the tasting factor of the wines, but the nature of the terrain. Rosso, M. Barolo: Mito di Langa. 2009. Page 40

7 p.) and a lower acidity both fixed and volatile, in comparison to the same quality of wine coming from neighboring vineyards but in non-chalky soils. "

According to Marco Giardino, associate professor of applied geomorphology at the University of Turin, "about five million years ago, a strong seismic activity under the Langhe basin, as the western part of the Tertiary Basin of Piedmont is known, pushes the submerged land upwards, causing the trapped water to escape and form the hills of the Langhe. " He further explains that the Langhe hills are technically defined as slopes, ridges formed by inclined sedimentary rock.[23]

Besides the maritime sediments that characterize the Langhe, it is important to say that the area is divided into three different geographical formations: Lequio, being the oldest formation, is located predominantly in Serralunga d'Alba and in some parts of Monforte d'Alba, where one finds the most structured and long-lasting barolos; the second formation, Sant'Agata Fossili Marls, lies in the regions of Barolo and La Morra, and the respective Barolo the formation is more perfumed and elegant; and finally Arenarie di Diano d'Alba, located in parts of Castiglione Falletto, responsible for the production of elegant and structured Barolos.

According to Ferdinando Vignolo Lutati, the Barolo land can be divided in three different types of soil[24]:

Marne, of a variant colour from greyish white to bluish, containing about 25-30% of calcium carbonate;

Yellow-reddish-brownish lands, clayey and very poor in limestone;

Sandy soils with about 15% calcium carbonate and 15-20% quartz sand.

"The first (the marly, the most extensive) corresponds to what may be called the exquisite normal barolo; to the second (the least frequent) a barolo a little less valuable for the complex of characters; to the third (also not very extensive and less productive) a barolo a little less alcoholic, perhaps, but with a strong scent that makes it highly prized even a year old."

[23] O'Keefe, K. Barolo and Barbaresco: The King and Queen of Italian Wine. 2014
[24] Rosso, M. Barolo: Mito di Langa. 2009. Page 41

Data collected by the Dati Regionale dei Terreni Agrari Bank- Laboratoire Agrochemical Piedmont Region - show that parts of Monforte d'Alba have more sand followed by Barolo, Castiglione Falletto, Serralunga d'Alba, La Morra, and Verduno, the latter for their less sand, but a greater amount of clay. According to studies by Igor Boni, a soil researcher in Soster Barolo's study: "In normal climatic years, vines in sandy soils generally perform better because they produce less, accumulating more sugar in the grapes".[25] In general, the soils and subsoils with a high percentage of sand and sandstone drain rapidly, which means that the vineyards located in these areas - Monforte d'Alba, Barolo and Castiglione Falletto - show better results in the rainy years, while in drought years they are more affected than the vineyards with higher percentage of clay, for example those that are in La Morra, which maintains the humidity, consequently, they present a worse result in rainy seasons.

According to data from the Dati Regionale dei Terreni Agrari Bank, and following the conclusions of Soster Barolo, one of the fundamental components of the Langhe soils is calcium carbonate, being responsible for the structured characteristic of Barolos wines. Thus, we conclude that the vineyards in La Morra produce more elegant wines, because they present smaller amounts of calcium carbonate, and vice versa to the other areas, where Barolo is more structured.

Referring to the cru term, each community of the Barolo area presents its own crus[26], being:

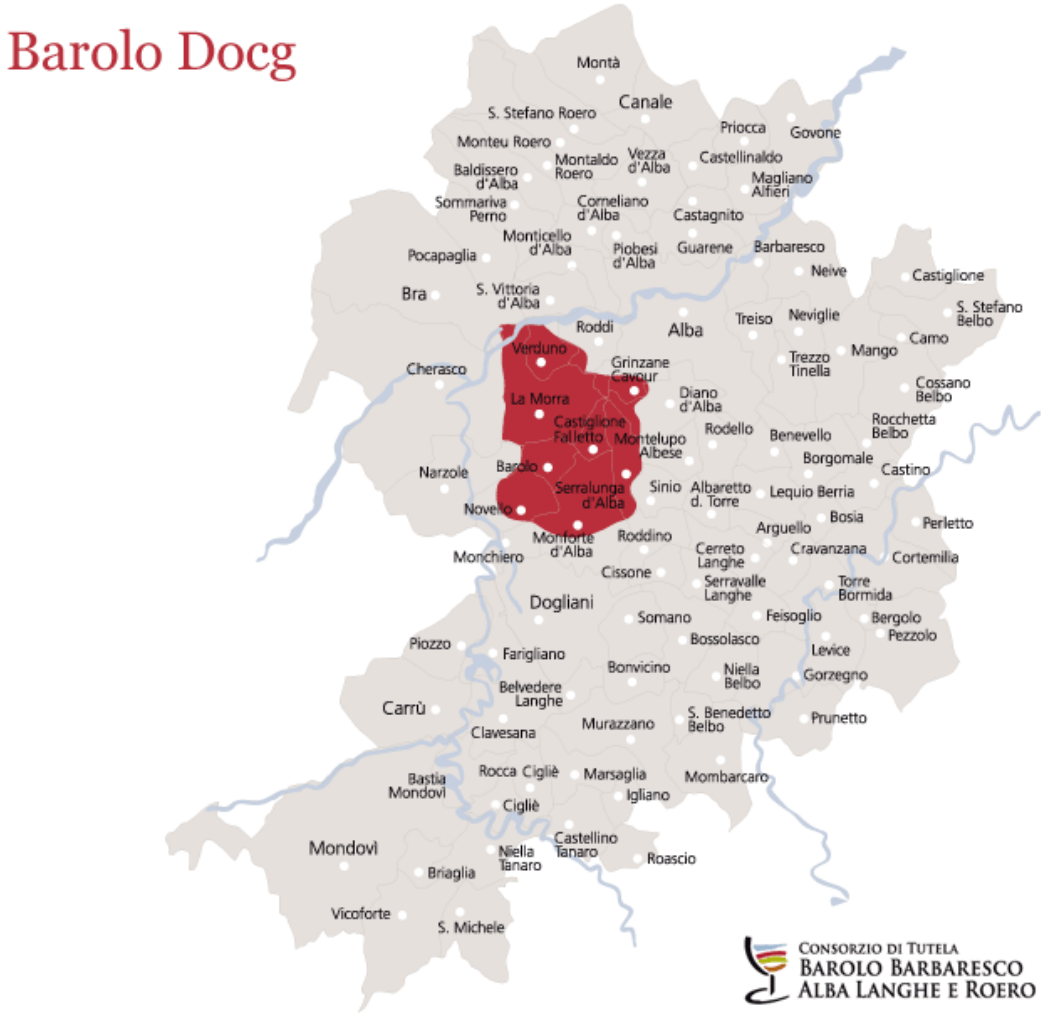
- Barolo: the most important and historical cru of this region is the Cannubi, having a multifaceted composition land, it mixes different parts of the Tortonian and Elvezian period, resulting in a wine where the perfume and structure have high levels. Sarmassa, Costa rose and part of Brunate, are the other crus from Barolo.

[25] O'Keefe, K. Barolo and Barbaresco: The King and Queen of Italian Wine. 2014

[26] The first to draw a map of the Barolo crus was Renato Ratti, in 1979, for personal control. He divided it into two categories: the "historical zones of traditional vocation" and those of "particolar qualitative characteristics". In 1993, Massimo Martinelli published a successive edition of that of Ratti, where he followed the French models of Bordeaux and Borgogna in indicating a "premier cru", proposing a selection of "first category" where indicated "the best areas of high qualitative characteristics ". The cast of Martinelli proposed 10 first category crus: Rocche dell'Annunziata, Brunate, Cerequio, Cannubi, Marengo-Rivette, Lazzarito, Gabutti-Parafada, Rocche di Castiglione, Villero and Monprivato. However, this selection brought discontent among grape producers in the regions, leading in 1999 to the decision that each Barolo produced community Barolo should, on its own account, present a selection map of its respective crus, where it would later be submitted to the approval of the Ministry.

- Catiglione Falletto: the crus are Rocche e Villero, where the Barolo wines are complete in taste and perfume.
- La Morra: Cerequio, Brunate, Rocche e Monfalletto are the crus of this region, and their Barolos are wines of elegance and subtlety.
- Monforte: the most famous cru is Bussia, which presents wines with an intense color; and the others are Ginestre, Vigna del Colonnello and Santo Stefano di Perno.
- Serralunga: Gabutti, Marenga, Rivette, Vigna Rionda, Lazzarito, Ornato,Prapò, Parafada, produce Barolo rich in alcohol content, with extractive substances, color and robust, suitable for long storage, first in cask and then in bottles.
- Verduno: Monvigliero is considered the unparalleled cru, with incomparable perfumes, is a particular soil rich in silicon and gypsum.

Figure 15: *Barolo's Region Map*



Source: Consorzio di Tutela Barolo Barbaresco Alba Langhe e Roero

2.3 THE WEATHER

Due to its geographical position - between the Maritime Alps and the Apennines of the Italian Riviera - the lower part of the Langhe, where Barolo's production is located, is characterized by firm climatic seasons, namely hot summers and cold winters. In the summers, the temperature oscillation between the day and the night influences in the season of growth and aroma of the wines. The Apennines serve as a geographic barrier, protecting the area from storms and currents of cold air arriving from the sea; while warm air from the Mediterranean temperates the cooler air that comes from the Alps. Another important influencer of the climate in this region are the hills, which also act as

geographical barriers, causing in the areas of Barolo several microclimates, which end up being essential in the development of the grapes.

2.4 NEBBIOLO: THE PRINCE OF THE GRAPES

For the wine that is denominated as "the wine of the kings, the king of the wines", its main component could not have any denomination. The word Nebbiolo has two possible and more accepted origins: association with the word "nebbia", that in Italian means fog, which characterizes the hills of the Langhe, and the white layer that resembles the fog, which surrounds the skin of the grape.

Being considered the most important factor of the Barolo, the grape Nebbiolo was considered by Lorenzo Fantini as " the Prince of the grapes"[27] and "King of the Vines" by numerous other researchers. Because of its striking features, its growth is specific in the Langhe hills due to the soil conditions mentioned in the section 2.2. For this reason its cultivation is rare both in Italy and in other parts of the world.[28]

Nebbiolo is the only grape that is part of the Barolo, providing complexity and luminosity, determining characteristics for it. It has an intense aroma, which changes as the wine ages. Its cultivation time is the longest of the Piedmont, being the first to sprout and the last one to mature. For this reason, growers tend to prefer southern, southwestern and south-eastern exposures because they guarantee more sunlight to help with ripening. However, with rising temperatures and frequent torrid growth seasons since 2003,

[27] Fantini, L."Monografia sulla Viticoltura ed Enologia della Provincia di Cuneo". 1879.

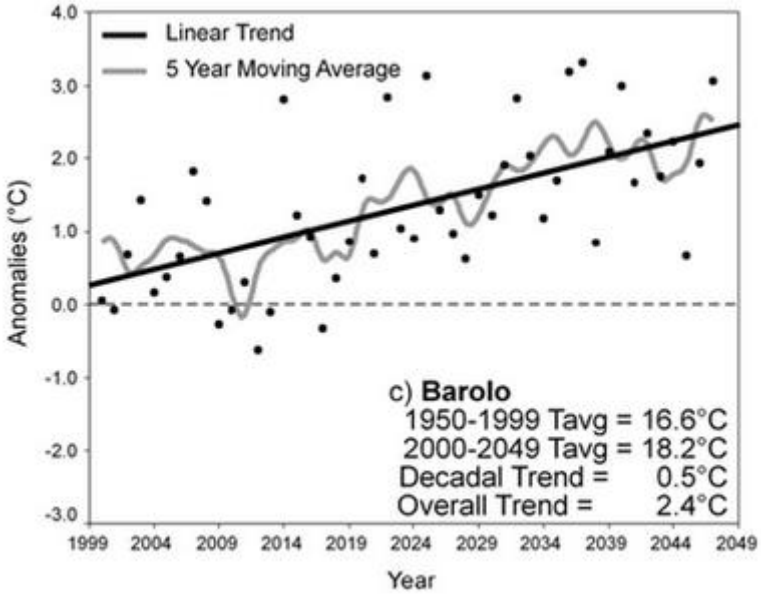
[28] O'Keefe, K. Barolo and Barbaresco: The King and Queen of Italian Wine. 2014 - "According to Unione Italiana Vini, based on the most recent official statistics available from an international agricultural census in 2010, of the 5,992 hectares (14,806 acres) of Nebbiolo planted in the world, 4,477 hectares (11,063 acres) are planted in Piedmont, 811 hectares (2,004 acres) are in Lombardy's Valtellina, and 44 hectares (109 acres) are cultivated in Valle d'Aosta, demonstrating the grape's predilection for the Alpine foothills and a continental climate. It is also planted—albeit in minute and ever- decreasing amounts—in Lombardy's Franciacorta, where a few producers still add it as part of the blend to make Curtefranca Rosso. Only about 456 hectares (1,127 acres) of Nebbiolo are planted in the rest of the world, including 75 hectares (185 acres) in the United States, 180 hectares (445 acres) in Mexico, 48 hectares (119 acres) in Argentina, 98 hectares (242 acres) in Australia, and 26 hectares (64 acres) in Uruguay." Only about 456 hectares (1,127 acres) of Nebbiolo are planted in the rest of the world, including 75 hectares (185 acres) in the United States, 180 hectares (445 acres) in Mexico, 48 hectares (119 acres) in Argentina, 98 hectares (242 acres) in Australia, and 26 hectares (64 acres) in Uruguay."

questioning has begun whether the theory of exposure sites is in fact real.[29] The figures XXX show the change in the temperature in the Barolo's area.

> *"In the Barolo region it is cultivated in rows, and at the same position the old vines with long shoots, not much fertilized and with pruning neither too long nor short troppre, give better wine. In the same vineyard the vines pruned to ten buds give grapes and therefore wines much higher than those pruned to twelve, fourteen and fifteen gems. Nebbiolo, however, is a delicate plant, especially at the time of flowering, and that ripens its bunches very late: the people say on its behalf that they called it nebbiolo because it is harvested when there are already autumn mists. In fact, the happy harvesting songs here sometimes go on until the end of October."*
>
> Don Domenico Massè

[29] According to the publication made by Greenpeace "Quale futuro per il vino italiano? L'effetto dei cambiamenti climatici sulla produzione vitivinícola" (2012), there was demonstrated, through a questionnaire carried out in 2005 with 255 wine producers in Italy, France and Germany, the following opinions: "In terms of wine quality, two thirds of respondents in Italy (a total of 72) confirmed that quality had an impact and, in 55% of cases, this was a positive impact. 56% also noted an impact on quantity; of these, the majority of responses (31 out of 40) recorded a decrease in production. At the same time, 56% reported an impact on the increase in pests; in general, a strong majority of 80% perceived an increase in the threats to wine production".

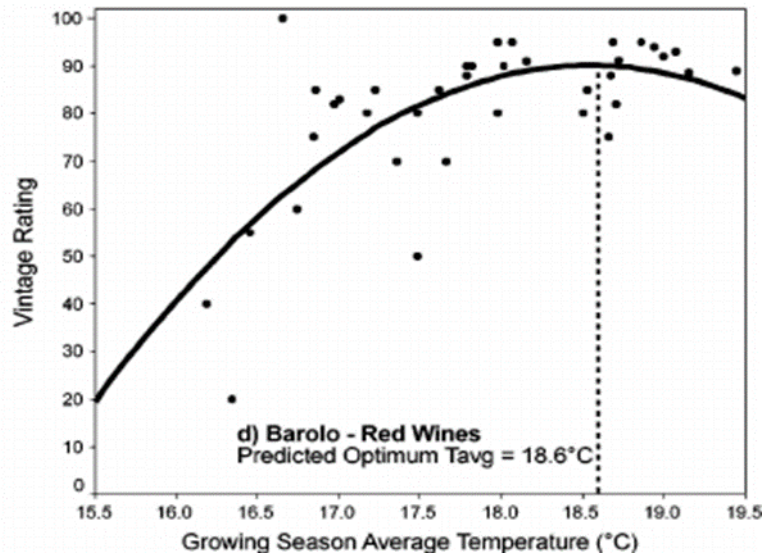
Figure 16: *Observed growing season average temperature anomalies for Barolo. The analisis were made for 1999-2049, where it is possible to see the increase in the temperature in the range 2000-2049, making the comparison with the temperature in 1950-1999.*



Source: Greenpeace

In the zone of Barolo are cultivated three types of Nebbiolo: Lampia, that at the moment is the most predominant for being more resistant to downy mildew and more productive, but not so resistant to powdery mildew and Botrytis; Michet, name given thanks to its "mica" form, this is loaf, is less productive than Lampia, but is considered more constant and more resistant to Botrytis; and finally, the Rosé, which almost disappeared because of its low production, inconstant and poor colours.

Figure 17: *Comparison between the Average Temperature and the Vintage Rating.Tavg: Average Temperature*



Source: Greenpeace

2.5 THE VINIFICATION PROCESS

The first vinification processes involving the Nebbiolo grape remained for decades, more precisely from the ancient Romans until approximately the 19th century, and were mainly based on the fermentation of grapes in large open wooden barrels, and the separation, in wood presses, of the must of the solid parts. Due to some evidence of the time, not very clear in understanding, it is believed that the Nebbiolo was vinified in several ways. What cannot be concluded is whether these processes were made due to a given preference for the final result of the wine, or if, due to climatic variations in the months of October and November in the canteens, fermentation of the wine ended up being interrupted.

With the arrival of the oenologist Pier Francesco Staglieno, the winemaking presented considerable changes, such as the fermentation in closed barrels. A point of great importance in the history and success of the Barolo wine came when Juliette decided to pass the wine fermentation, previously made out of doors, to underground barns, built at her request. This new structure created the protected microclimate and allowed the wine to be finalized under controlled temperatures, which brought it to remarkable structure.

One of the most used practices for the fermentation in the last century was the so-called "Cappello sommerso", created by Giuseppe Cappellano, also responsible for the creation of Barolo Chinato. Don Massè described this technique in 1928:

"As soon as they are harvested, the grapes are diligently passed by bunch, then the grapes chosen are crushed and destemmed, and the must with the marc is fermented in vats with false funds applied so that the fermentation takes place completely About the way to carry out the winemaking and to drain there are two systems.There is who, closing the vat hermetically, let that the fermentation exhausts by the complete decomposition of the sugar, not tapping the wine until it it comes out perfectly clarified: and this can last for months, until January and sometimes up to Pascqua. This is the old method, still followed tenaciously by the peasants, which gives a wine a little rough, but which, due to its already happened clarification, can also be immediately put into the bottle. Others

consider it more appropriate to run off when the mustwine still has traces of glucose, and in this case there will be wines that in the succession spring will ferment somewhat, and will require several decantings, but that on the other hand will remain softer and velvety than the former. Many wineries have also introduced the practice, recommended by eminent technicians and practiced for a long time in France, to hasten the clarification with very fine jellies. "

The process begins with the grape harvest[30], with the de-stemming and crushing operations, simultaneously, with the use of the destemmer, a specialized machine. At this point it is necessary to start the fermentation. it is possible to use yeasts to initiate the fermentation of nebbiolo, but many do not use it because if they maintain the correct temperatures, ranging from 13 ° to 17 °, the grape begins the process alone. The first fermentation can be done either in large wooden vats, from 30 to 80 hectoliters, or in vertical steel tanks. Until this time the process can last from 10 to 30 days, depending on the choices made by each producer. In fermentation the temperature is a factor of great importance, because once high, they activate the acetic bacteria that transform the sugar no longer in alcohol but in acetic aldehyde and then in acetic acid.

Soon after the alcoholic fermentation, malolactic fermentation occurs, which consists in the transformation of malic acid into lactic acid. There are two options: start it immediately after the alcoholic fermentation or wait for the next spring. In the first case, the wine is heated in thermally controlled tanks, or bringing the temperature of the cellar to 20 ° C. In the second case, the ambient temperature will gradually increase until the following summer.

Starting with the process of refining and conserving wine, there are two possible ways of doing them:

- Some producers use only large barrels with a capacity of 2,000 to 10,000 liters capacity, with a minimum presence of steel tanks used exclusively for alcoholic fermentation;
- Small barrels of wood or steel: the latter may have the presence of small barrels of various sizes, on average between 225 and 600 liters.

[30]As already mentioned, one of the probable reasons why the grape of the Barolo was known as nebbiolo was due to the fog that characterizes the month October, that was when its harvest happened. Currently, the harvest is made, as a rule, by the end of September.

At this moment is of extreme importance the type of wood and the period of use of the barrels. Today, French oak are used mainly for classic barrils and for larger vessels. Oak wood from different origins is also another choice; it comes from the forests of central France, Slavonia, Eastern European countries and also the United States.

It is possible to consider the aging in wood barrels as the most important process in the preparation of wine. Inside these containers is where the main processes of refining and gas exchange occur, through the wood and must.

Another very important phenomenon is the dissolution of the substances contained in the wood inside the wine: many barrils are made of oak wood, which is filled with two polyphenols: tannins and lignins. Lignins are water-insoluble polymers of polyphenolic nature and their degradation originates the precursors of many aromatic substances which are found in wine perfumes, especially if aged in small barrels of roasted wood. Tannins are, instead, ellagitannins, that is, hydrolysable tannins that release ellagic acid. For Barolo wine there are the important but rough tannins and delicate anthocyanins, which need a good refinement in wooden barrels, to be aged in the bottle for a long time. In fact, the slow oxygenation given by the deposition of the most in the barrel allows to stabilize the color and, as a consequence, the tannins can evolve into softer forms. Therefore, it is important to choose the type of wood keg, especially considering the size of the container and the way it was built.

2.6 CONTROLLED AND GUARANTEED DESIGNATION OF ORIGIN - BAROLO DOCG (DENOMINAZIONE D'ORIGINE CONTROLLATA E GARANTITA)

DOCG is the highest level of certification within the regulatory organization for Italian wines, commonly known as DOC, controlled designation of origin, and its main objective is to ensure that wines are precisely controlled so that consumers receive only those of better quality. In turn, DOCG means controlled and guaranteed designation of origin, and to enjoy this certification, the wine must have, for at least 10 years, of DOC.

In order to verify the wine, a single sample is chemically tested so that it complies with the requirements described in the discipline, while another sample is tested

anonymously by a committee of experts. This committee controls the wine before its cuddling, and it can obtain three possible results: the sample is "suitable" to be Barolo; "revisable", where a small defect has been found and can be corrected so that the wine is considered Barolo; and finally, can be considered “unsuitable”, and in this case, loses the right to be considered Barolo, and is considered to be a table wine. If the sample is approved, the producer receives from the Chamber of Commerce a stamp, pink in color, to be placed on each bottle of Barolo, and that guarantees that production was approved within the disciplinary requirements.

The following are some of the restrictions that Barolo must follow to be marketed according the “DISCIPLINARE DI PRODUZIONE DEI VINI A DENOMINAZIONE DI ORIGINE CONTROLLATA E GARANTITA “BAROLO””. They were selected in accordance with their importance related to this study.

Approved DOC with Presidential Decree of 23.04.1966 G.U.146 - 15.6.1966

Approved DOCG with Presidential Decree 01.07.1980 GU 21 - 22.01.1981

Article 1 - Denomination and wines

The "Barolo" denomination of controlled and guaranteed origin is reserved for red wines that meet the conditions and requirements established by this product specification for the following types:

- Barolo

- Barolo reserve

Article 2 - Ampelographic base

The wines with a controlled and guaranteed "Barolo" designation of origin must be obtained from grapes coming from vineyards composed exclusively of Nebbiolo grapes.

Article 3 - Production area of the grapes

The area of origin of the grapes capable of producing wines with controlled and guaranteed denomination of origin "Barolo", including the territories already delimited by ministerial decree of 31 August 1933, includes the entire territory of the municipalities of Barolo, Castiglione Falletto, Serralunga d'Alba and in part the territory of the municipalities of Monforte d'Alba, Novello, La Morra, Verduno, Grinzane Cavour, Diano d'Alba, Cherasco and Roddi falling within the province of Cuneo.

Article 4 - Rules for viticulture

The cultivation conditions of the vineyards must meet the requirements set out in the following points:

- land: clayey, calcareous and their possible combinations;

- position: exclusively hilly; categorically the land on the valley floor, wet, flat and not sufficiently sunny;

- altitude: not less than 170 meters s.l.m. and not more than 540 m s.l.m;

- exposure: suitable to ensure an appropriate maturation and to give the grapes and the derived wine the specific characteristics of quality, but with the exclusion for new plants, of the north side from -45 ° to + 45 ° sexagesimal.

- plant density: those generally used according to the peculiar characteristics of grapes and wine. The vineyards subject to re-enrollment or replanting must be composed of a number of vines per hectare, calculated on the sixth of the plant, not less than 3,500;

- training methods and pruning systems: traditional ones (training method: espalier, pruning system: Guyot);

- all forcing practices are forbidden.

The maximum yields of grapes per hectare of vineyards in specialized cultivation for the production of wines with controlled and guaranteed denomination Barolo:

Barolo and Barolo reserve: -Yield of grapes t / ha: 8

-Alcoholic strength vol. min. natural: 12.5% vol

The interested conductors who expect to obtain a higher yield than that indicated by the Piedmont Region, but not higher than the one established by this article, must promptly, and at least 5 days before the start date of their harvest, report , by registered letter to the competent bodies for the territory in charge of the control, the start date of the operations and the estimate of the higher yield, to allow for the appropriate investigations.

Article 5 - Rules for winemaking

The mandatory vinification and aging operations must be carried out in the defined area mentioned in this article.

The maximum yield of the grapes in finished wine must not exceed:

Barolo and Barolo reserve: - Yield grape / wine: 70%

- Max wine production: 56 hl/ha

The maximum yield of grapes in wine finished at the end of the obligatory aging period must not exceed:

Barolo and Barolo reserve: - Yield grape / wine: 68%

- Max wine production: 54,4 hl/ha

In the vinification and aging must be followed the most rational technical criteria and carried out the oenological practices to give the wines the best quality characteristics, including the enrichment of the sugary gradation, according to the methods and limits recognized by the legislation in force.

The following wines must undergo a minimum aging period of:

Table 10: *Barolo Aging Period*

Vino	Duration	Wood	Effect
Barolo	38	18	1º November of the year of harvesting of the grapes
Barolo Reserve	62	18	1º November of the year of harvesting of the grapes

Source: Disciplinare de Produzione Dei Vini a Denominazione di Origine Controllata e Garantita

The entry for consumption, for each of them, is allowed only starting from the date indicated below:

- Barolo: 1º January of the fourth year following the harvest;
- Barolo reserve: 1º January of the sixth year following the harvest.

At the time of certification, after the aging time as established above, the manufacturer can explicitly request the type "reserve".

Article 7 – Barolo chinato

The name "Barolo chinato" is permitted for aromatised wines prepared using Barolo wine as a basis without addition of musts or wines not entitled to that denomination and with an aromatization such as to allow, according to the provisions of current law, the reference in the denomination to china. The quantity of "Barolo" DOCG to be used for the preparation of "Barolo chinato" shall be communicated to the inspection body before preparation.

Article 9 – Packaging

The bottles in which the wines with the controlled and guaranteed denomination of origin "Barolo" are packaged and marketed, as per art. 1, must be of an Albeisa shape or corresponding to ancient use and tradition, of dark glass with locking devices allowed by current legislation.

The bottles in which the wines with the controlled and guaranteed denomination of origin "Barolo" are packaged and marketed, as per art. 1, must be of capacity permitted by the laws in force, but not less than 37.5 cl, with the exception of those from 200 cl.

3 BAROLO WINE COMPETITORS

The identification of the market competitors of Barolo wine was made considering the main and best known Italian wines, nationally and worldwide. Even though they present characteristics and properties different from those of Barolo, the intention is to analyze the possible options that are part of the choice and preference of the consumer when purchasing a wine. The idea is to make a brief introduction of the main wines that can influence the choice of the consumer at the time of purchase.

Therefore, the wines that will be briefly analyzed will be: Amarone della Valpolicella, Barbaresco, Brunello di Montalcino and Chianti.

3.1 AMARONE DELLA VALPOLICELLA (CLASSIC)

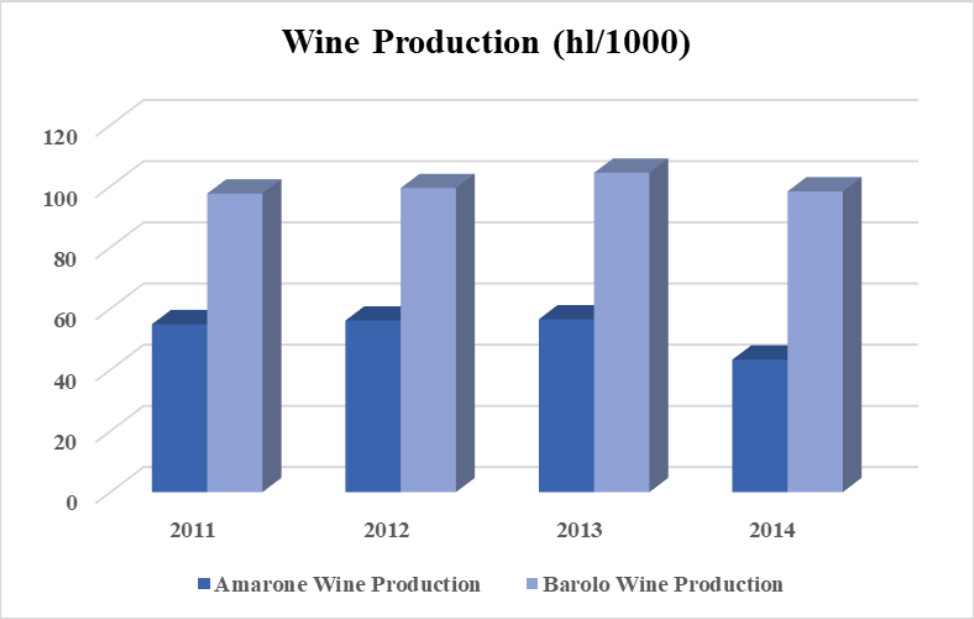
A red wine, produced in the province of Verona, comprising the territories of Fumane, Marano, Negrar, Sant'Ambrogio and S. Pietro in Cariano. The composition of Valpolicella presents between 45 - 95% of Corvina Veronese grapes, being allowed the use of up to 50% of Corvinone vineyard; 5 - 30% of the Rondinella grape; and a percentage less than or equal to 25% for (a) black grapes planted in Verona up to a maximum of 15%, being the maximum limit for each individual grape used of 10%, and (b) the remaining 10% for red grapes produced by Italian vineyards and grown in Verona.

It is wine with a dark red coloring, which has characteristic and accented aromas, and a warm and velvety flavor. The alcohol level varies between 14% Vol., for more. An aging of at least 24 months is required, and 48 months for those with the ‘Riserva’ mention. Like Barolo wine, it is permeated to make a reference, in the label, to the respective vineyard to which the wine belongs.

A survey conducted by Tannico website showed that in 2017 Amarone della Valpolicella wine, jointly with Brunello di Montalcino, were the bestselling wines through e-commerce, in the premium and luxury segment, with a market share equal to 13.72%. Not only in Internet sales, Amarone's export numbers grew 10% in 2017, representing 68% of its total production. The growth followed in the Italian internal

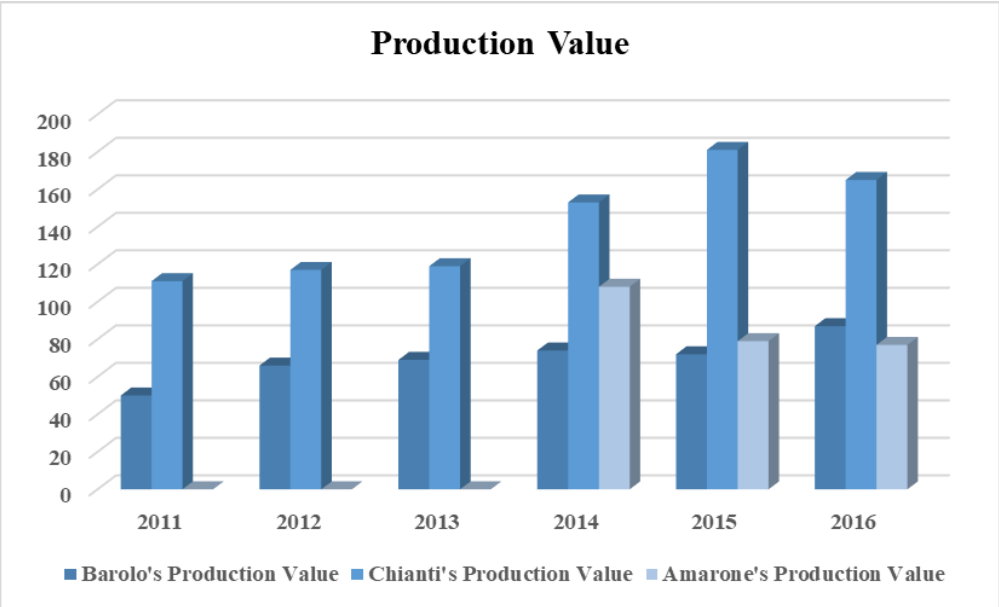
market, where the numbers showed a high growth of 20%. According to the Borsa Merci di Verona, Amarone's values revolve around 800 and 900 euro per quintal.

Figure 18: *Comparison between the Amarone della Valpolicella production with the Barolo production in hectoliters per 1000.*



Source: I numeri del vino

Figure 19: *Barolo, Chianti and Amarone Production Value Comparison in 2011-2016.*



Source: I numeri del vino

3.2 BARBARESCO

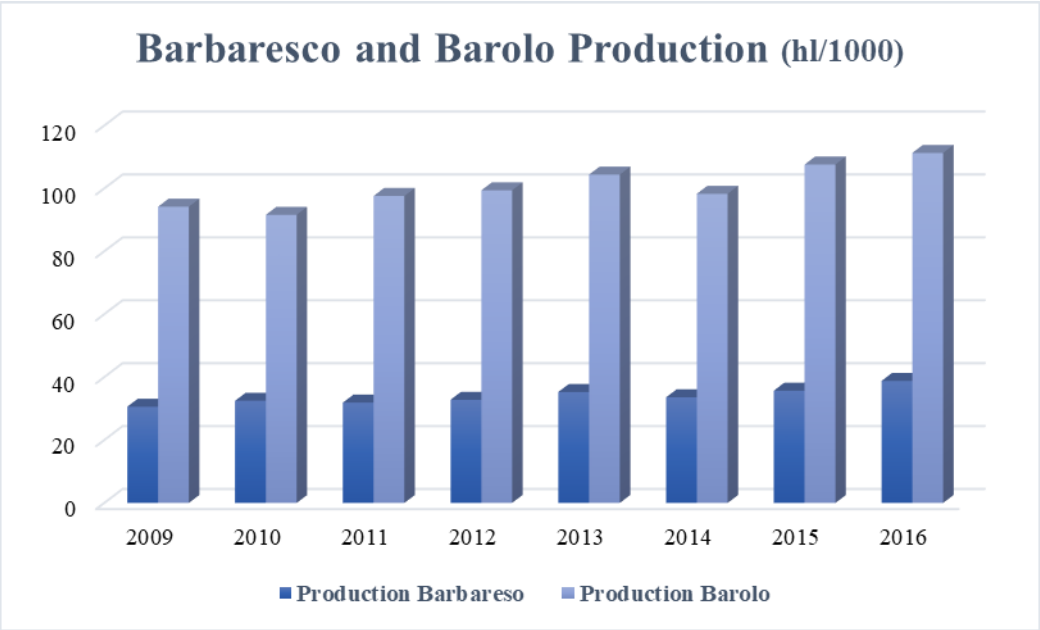
Like the Barolo, Barbaresco wine is produced using 100% of Nebbiolo grape. What makes it different in taste is due to the production areas established by the protection consortium. The region is located in the Province of Cuneo, and comprises the municipalities of Barbaresco, Neive, Treiso and a part of San Rocco Senodelvio, which is part of the municipality of Barbaresco and added to Alba.

In relation to the vinification process, the maximum yield should not exceed 70%, either for Barbaresco or for Barbaresco Reserve. If for any reason the yield is higher than the value indicated above, this number may not be more than 75%, if not the wine loses the right to D.O.C.G ..

As for aging, the minimum time established by the consortium is 26 months for the normal Barbaresco, and 50 months for the Barbaresco Reserve. After aging, the maximum residue of the grape in the wine cannot be higher than 68% for both types of Barbaresco.

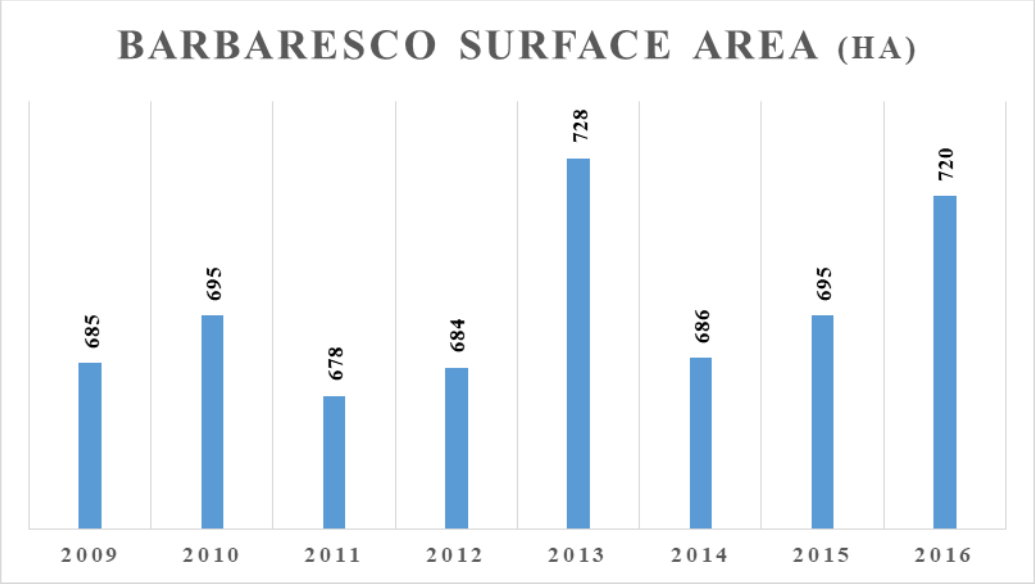
Being the Barbaresco a wine very appreciated and known in the wine sector, it was made a comparison between the numbers of production and planted area of this wine, and of the Barolo wine. It is possible to note the notoriety of this last wine; its production is approximately four times the one of Barbaresco, being the Barolo the Piemontese D.O.C.G. wine with a greater representatives. It is valid to remember that the basis for the comparison between these two wines was made exclusively by the fact that there is the same grape in its production, same denomination and topography, being the biggest differentiating point among them the structure of the soils where their grapes are planted (Barbaresco is produced in lands lower than the Barolo, presenting a greater amount of sand). They are not competitors for having similar tastes and structures, but because they are two great wines result of a great grape.

Figure 20: *Comparison between the Barbaresco and Barolo wine production in the years 2009-2016 in hectoliters/1000.*



Source: I numeri del vino

Figure 21: *The total surface area of Barbaresco wine in hectares*



Source: Regione Piemonte

3.3 BRUNELLO DI MONTALCINO (CLASSIC RED WINE)

Produced through the use of 100% Sangiovese grapes, it is a dry wine with an intense red ruby color, slightly tannic, harmonious and persistent at the end, and a very typical aroma. It is produced in the province of Siena, in the territory of the municipality of Montalcino.

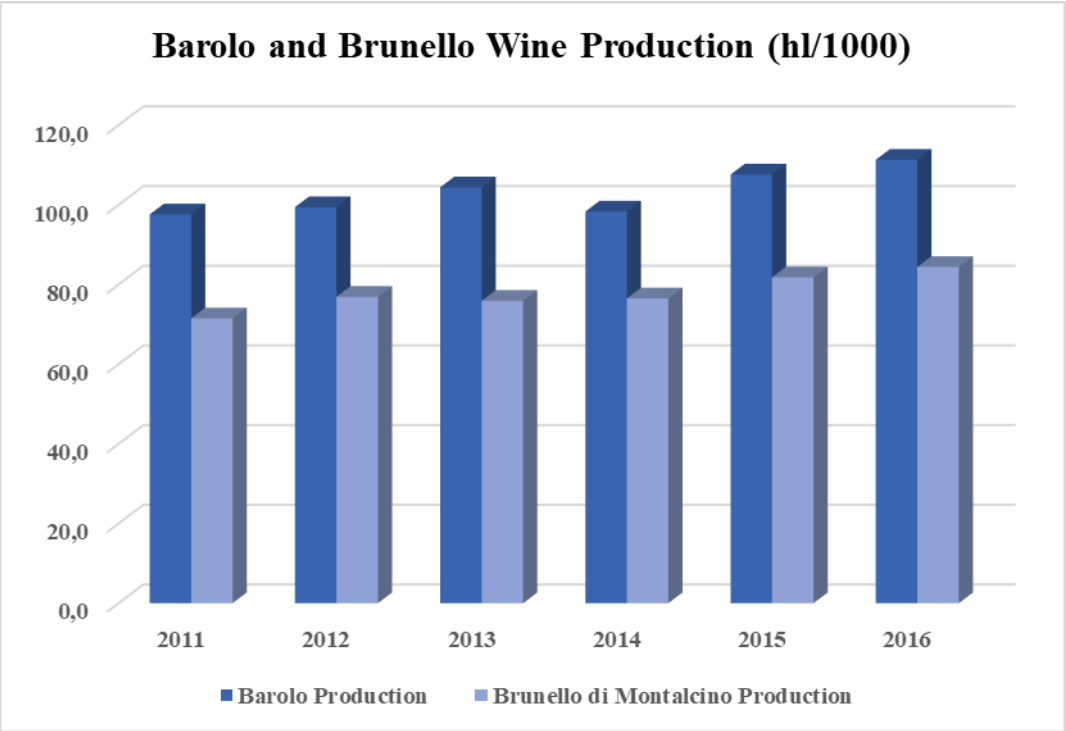
The foreseen aging time, before being placed on the market for consumption, is at least 5 years: a minimum of 2 years in oak barrel, and a rest of 4 months in bottle. For wines that receive the "Riserva" award, they must go through a period of aging of at least 6 years, 2 years in a barrel of oak, and at least 6 months of rest in a bottle. It is allowed to mention the vineyard on the label of the bottle to which the specimen belongs.

The Brunello di Montalcino wine is considered one of the biggest Italian classics, and leads the ranking of prices among the important wines: 1.065 euro per quintal, a growth of 5.4% compared to the year 2017, says Ismea. As mentioned above, together with Amarone wine, it obtained an online market share equal to 13.78%. The success in the Italian domestic market is a consequence of the growing external demand, which now represents 70% of all production. Following the same standards as Barolo, Brunello di Montalcino's most important market is the United States with more than 30%, followed by Europe with 20% and Asia with 15%; South and Central America represent 8% of the total exported, the remaining 15% being divided among other markets.

In the region of Tuscany, the harvest of 2017, the worst so far, was characterized by the production of 1 million and 600 liters, a drop of 1 million liters (145 million bottles, translated into 480 million euros lost) respect the previous year, and the main reason for such a significant drop was the various climatic changes present in this harvest.[31] The most produced vineyard is the Sangiovese, representing 62% of the area cultivated in the region, but just 6% of this amount corresponds to the area destined to the Brunello production.

[31] According Francesco Colpizzi, president of Federazione Vitivinicola di Confagricoltura Toscana, the harvest of 2017 is considered the worst of all times for the region of Tuscany due to the joint action of three climatic factors: the freezing of April, the drought from June to September and the ungulate effect.

Figure 22: *Comparison between the Barolo and Brunello wine production in the years 2011-2016 in hectoliters/1000.*



Source: I numeri del vino

The production of 2017 had a decrease of 34.86% with respect to 2016, as was mentioned before. In the graph of the figure 22 is possible to analyze the constant production respect the past years, as well as the Barolo's production. Along with external growth, Brunello's influence in tourism in the region has been increasing the number of visitors each year, for example in 2017, which has increased by 25% in the number of visitors, surpassing the mark of 1,500.000 people. This fact also brings greater importance to wine, which may be the protagonist of an advance in the local economy.

3.4 CHIANTI (CLASSIC RED WINE)

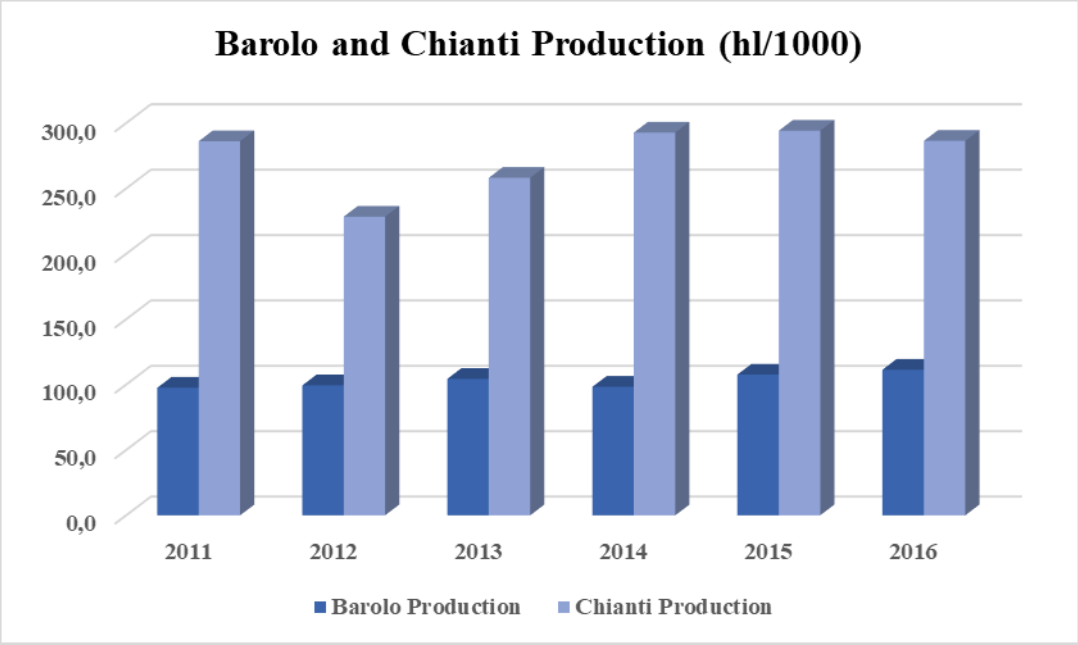
Like Brunello, the Chianti wine comes from Tuscany, specifically from the provinces of Arezzo, Firenze, Pisa, Pistoia, Prato and Siena. In its composition, it is possible to find 70% of the Sangiovese grape, and approximately 30% of white and black grapes which are suitable for cultivation in the Tuscan region, account for a) the vineyards of white grapes do not exceed, together or separately, the limit maximum of 10%, and b)

Cabernet Franc and Cabernet Sauvignon grapes, may not exceed the maximum limit of 15%, together or separately.

A red-ruby wine, it has sweet and pronounced aromas, a tannic and very harmonious flavor, that with time becomes soft and velvety. Its alcohol content is equal to or greater than 12% Vol. The wine must be aged for at least 11 months, and its trade is only allowed after October 1 of the year following the harvest. As for Chianti Riserva, the minimum aging time before consumption is of 2 years, with a minimum of 2 months of rest in the bottle. Its alcoholic value starts at 12.5% Vol.

In spite of the great importance of the Brunello di Montalcino wine for the region of Tuscany, the Chianti wine presents a 44% of production of all the area planted in this area. The great fall in the production suffered by Tuscany in the year 2017 also had consequences for the Chianti wine, which presented a reduction of 27.62%. Regarding the price (€/hectoliter) of production, it heard a fall of 11.3%, going from 264.20 in 2016 to 234.28 in 2017, according Ismea. Following is a graph of production figures in the last years, together with those of Barolo.

Figure 23: *Comparison between the Barolo and Chianti wine production in the years 2011-2016 in hectoliters/1000.*



Source: Il valore del vino

3.5 WINE GUIDES ANALYSIS

In Chapter 6, will be discuss the analysis of the data and how they were obtained. However, only for a base of comparison, in this section will be analyzed the wines competitor of barolo, in each of the guides used for the database. It will be a brief analysis, referring to the number of awards - wines considered excellent - received by each guide. The citation of these wines and their prizes in the guides in question will not influence or be taken into consideration in the study of the data obtained in chapter 6.

Even presenting typologies and production quantities considerably different, Barolo is the wine that, in all the guides analyzed in this section, presented a greater number of excellences. However, it is not possible to arrive at a precise conclusion about the reason for this difference because the main objective of this work is the Barolo wine analysis.

Table 11: *Analysis of the Excellences wines, representende by quantity, in each guide analysed in the Chapter 6.*

Wine Excellence Analysis					
Wine Guides \ Wines	**Barolo**	**A. della Valpolicella**	**Barbaresco**	**B. di Montalcino**	**Chianti**
Gambero Rosso 2007	16	7	8	14	9
Gambero Rosso 2018	30	15	14	10	15
Veronelli 2018	73	19	6	15	2
Vitae 2017	57	8	15	17	7
Vitae 2018	70	10	15	24	11
Slow Wine 2011	23	8	10	9	8
Slow Wine 2018	25	7	7	10	2
I Vini d'Italia 2018	22	7	14	11	8

Source: Guide Websites

4 BAROLO WINE MARKET

"Barolo, a wine with a garnet red color, an intense and characteristic aroma, a dry, full and harmonious flavor."

As already mentioned, the Barolo carries with its name the definition of king of wines, a fame that precedes decades and decades. However, today it is not enough simply to have the name Barolo on the label of the bottle, as it was until the last decade. To ensure the continuation of all fame and success, different efforts are required, both internal and externally.

According Giuseppe Capuano, marketing manager of Vias Imports in New York City and representative of Damilano wines in the U.S., in an interview to Forbes, "you have to promote the winery by traveling all over the world— to the U.S., France, England, China, South America and Hong Kong to sell your wine. You have to keep the quality at a high standard and find a way to keep the price reasonable within the market. Prices cannot be astronomical because the competition is pretty tough all over the world. It's difficult. There's real competition."

The attention and knowledge of the foreign market, and especially the preferences of the different consumers, is an important differential between the big wines. Capuano referred to the American consumer market as a demanding market and that has a great knowledge about the wine world, and a special rush to the Barolo wine: "American consumers are looking to drink wines made from indigenous grapes, they love Barolo because it's distinct. It has character and is made 100% from Nebbiolo grapes. "

In the same report, Capuano mentions the Chinese consumer market, which presents preferences very different from those in the USA. The Chinese consume Barolo wine, but not in the same quantity as the Americans, and when they do, they choose the best specimens, which have higher prices. Due this difference, believes that it is important to better study this market, because each year, it grows more.

The purpose of this document, as already mentioned, is basically to understand how the market of the Barolo wine behaves in different situations, especially in relation to the price, which is a factor that influences the decisions of the producer as the consumer

. Wine companies need to study their market strategies, because when calculating the profits and costs of production and divulgation, the final price of the wines can no longer be how much the producer believes being the best for his company, since the competition finds at this point, the consumer final value. Giuseppe Capuano says, regarding this argument, that "when you increase the price, you have to spend a lot of time explaining why."

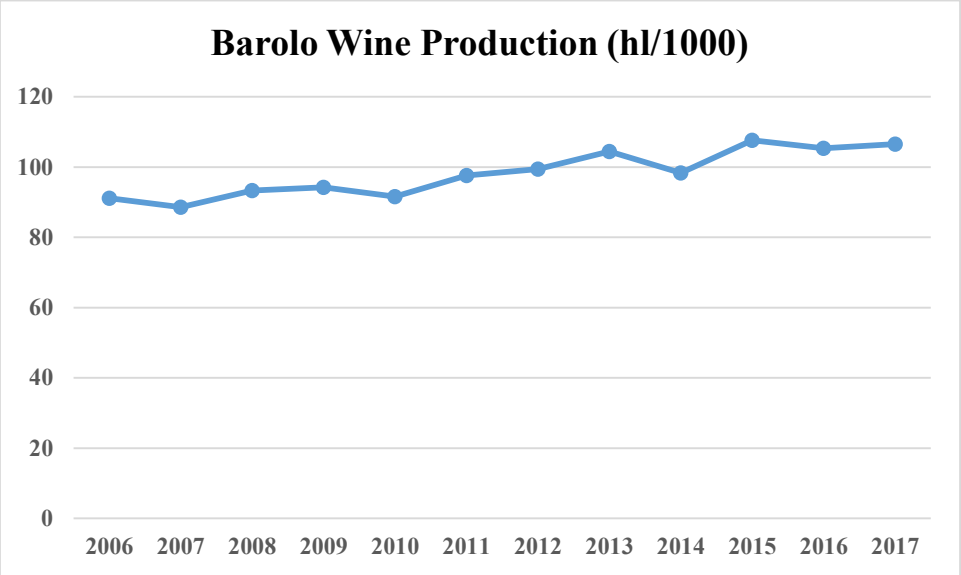
But price should not be analyzed as the only determinant factor for market competition. Quality is another point of extreme importance and should be analyzed and considered with great care. Producers come every year trying to improve quality through the implementation of new farming techniques and improvements to possible climatic consequences that may affect the harvest.

4.1 BAROLO WINE PRODUCTION AND SURFACE

The production of Barolo corresponds the 7th position among the 20 Italian regions producing wine, with Piedmont being the second largest producer, after the Veneto. The quality of the wines is analyzed through the denominations - DOCG and DOC - of the wines of each region. In this case, Piemonte owns 23% of all DOCG production - the maximum denomination obtained by a wine - in Italy, a quarter of all regions, coming second in the Veneto with 19%.

The graph of Figure 24 is a comparison of the Barolo production. The falls are always due to the climatic effects that, in many cases, the intervention to reduce the damages end up not being effective. Despite the falls in numbers, production has remained basically constant, showing a small growth in 2017.

Figure 24:*The Barolo wine production in hectoliters in the last years.*

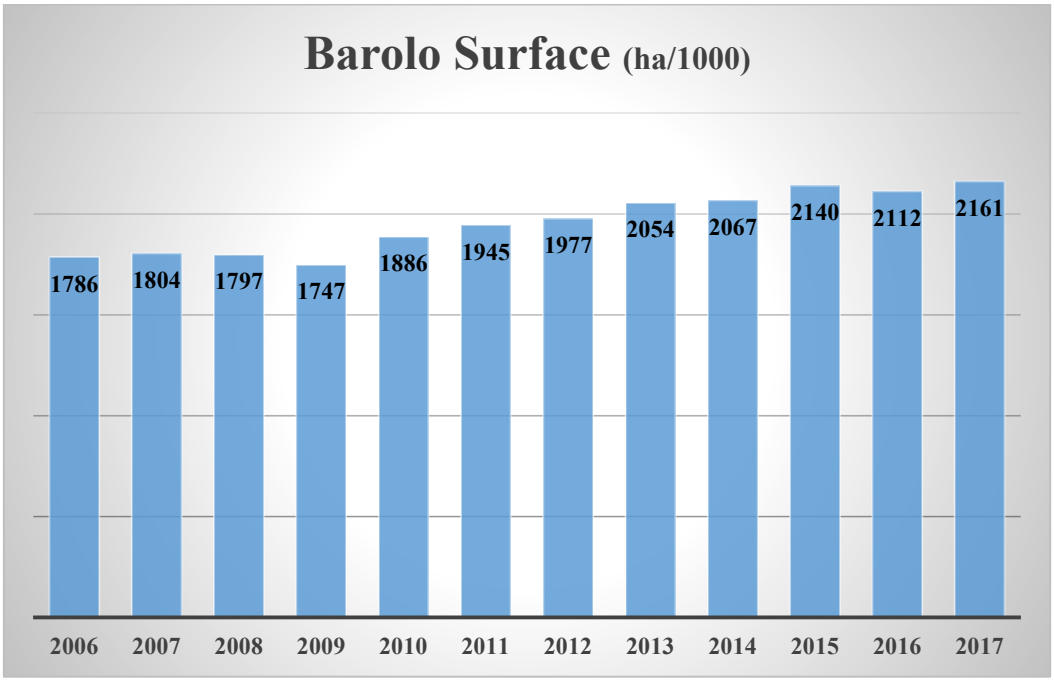


Source: Vignaioli

Another interesting and important fact to highlight together with the numbers discussed was the growth of the Nebbiolo vineyards area for the production of Barolo in 2017. Given the high demand for new hectares for planting, the consortium decided to grant 30 new hectares in the place of the 20 previously released. At present, with the 2,161 hectares destined to Barolo, the supply is meeting the demand, which is constantly growing, and always presenting a reduction in stock numbers. Bottling has maintained an average of 12,090,666 bottles in the last 5 years[32].

[32] Data collected from S@pori del Piemonte website.

Figure 25: *The Barolo surface area in ha in the last years.*



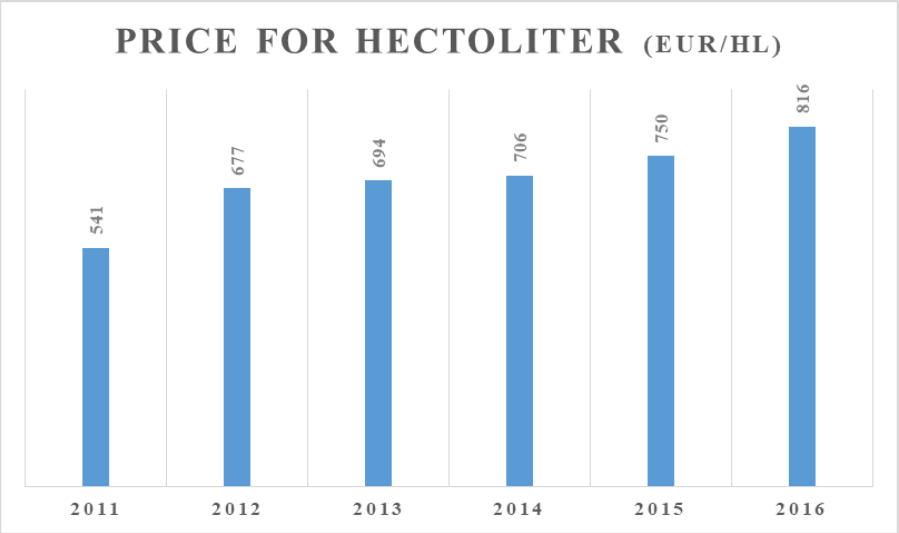
Source: Various Sources

4.2 HECTOLITER PRICES AND PRODUCTION VALUE

In Italy, the Barolo wine presents a 7% score among the wines most loved by the Italians, behind other classics like Montalcino and Chianti. This is a consequence of the new trend of Italian consumers, followed also by the Germans, who have preferred to consume less known wines, and even with lower prices.[33] But internationally, Barolo is still one of the most requested wines, mainly by the American, Canadian and Russian markets.

[33] Still according to Alessandro Sarzi, " out of 10 wines, 9 requests are from the autochthonous, for a search for authenticity and particularity. International vines are almost banned for stance ". Although the Nebbiolo belongs to one of the Italian autochthonous vineyards, the lesser known ones that are being discovered and enjoyed by consumers.

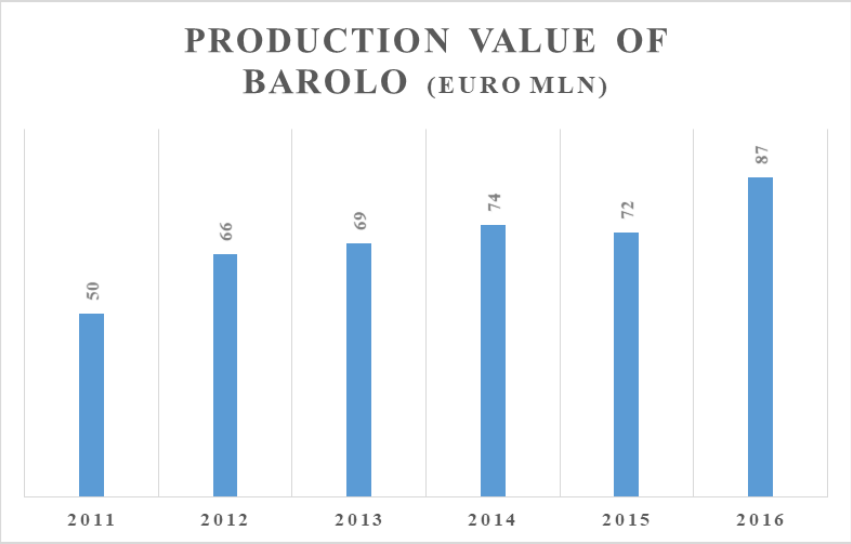
Figure 26: *The price of hectoliters in euro/hl in the last years.*



Source: Various sources

The Barolo demand has increased in recent years, resulting in a rise of the prices for this wine, both in the domestic and abroad markets. According to Alessandro Sarzi Amadè, for the Wine News' website, "the consumption, despite this, has increased, together with interest for less known areas and set aside. The price range that we deal with most successfully is that between 15 and 20 euros, which become 25-30 euros on the shelf. The movements of the most important wines, however, are calculated with the dropper".

Figure 27: *The production value of the Barolo wine in mln euro in the last years*



Source: Various sources

4.3 EXPORT

The export activity of Italian wines, as commented previously, is a sector of great importance for the Italian market. In the last years, Italy has been maintained the first position in wine export in the world, being its main recipient the United States of America.

When you think of Barolo wine, the reality is no different: approximately 80% of the production of this product is exported, and the first recipient is the USA. The Consortium of Langhe president, Andrea Ferrero, explained why this country is a great adept of Barolo wine: *"Barolo is made from a variety of grapes that must be understood and the United States is a mature market where culture. The long tradition of specialized magazines such as the Wine Spectator means that the American consumer is sensitive and has particularly appropriate requirements for enjoying such a prestigious wine."*[34]

***Figure 28**: The data of Barolo Export in hectoliter/1000 in the last years*

Source: Various sources

[34] TA Laura Taccani La Dolce Vita

5 THE BAROLO VINTAGE

The harvest of the grape is directly linked to the season's climate (temperature and rainfall), and when it presents significant changes, thus affecting grape maturation, the levels of sugars, acids and tannins may be affected. The phenology of Nebbiolo follows, in a generalized way[35], the following characteristics[36]:

- Germination: early; it occurs specially in the first ten days of April.
- Flowering: early; in the first ten days of June.
- Ripening: medium-early; it happens in the second decade of August.
- Grape maturation: late; it occurs in the second-third decade of October.

5.1 LAST VINTAGES: THEIR CHARACTERISTICS

The vintage year	The vintage characteristics
2000	A great vintage, in a year characterized by uniform heat, especially at the end of the season, when the grapes mature and consequently the accumulation of sugars occurs more quickly. The harvest occurred in a time without many rains but with a high temperature, having as final product a wine that does not present much complexity, being appropriate to consume it at the moment. (5 Stars)
2001	The harvest is considered excellent, and characterized by a Barolo of quality and possibility the aging up to 2024, approximately. Its acid and tannin concentrations are appropriate, thus presenting a well-structured wine. (5 Stars)

[35] In this case it was considered the class as a whole of the Nebbiolo grape. There are several types of Nebbiolo vineyards, but for the analysis of this study, it is not appropriate to specify each variation, since the data are, in general, exclusive to Barolo wine.
[36] Regione Piemonte. Vitigni del Piemonte – Varietà e Cloni

2002	It was a difficult year, with a high rainfall and the relevant presence of granite in the regions of Barolo, La Morra, Monforte d'Alba, which considerably affected the final product. The amount of wine produced was very low, but the quality of the wine was very much discussed among the wine producers. (2 Star)
2003	A year with an anomaly summer, with high temperatures, which at first made the producers apprehensive, especially at the time of maturation of the grape, very important for the concentration levels of acids and sugars. However, the Barolo 2003 presented an exciting wine to the taste of many connoisseurs, thanks to the innumerable features acquired with its aging, like color and physiognomy. (3 Stars)
2004	Of exceptional quality, the harvest of the year 2004 is considered one of the best for Barolo. The late harvest (end of October) and the quality of the climate in the time of maturation, generated grapes with perfect amounts of sugars, acids and tannins. The wines from these grapes are of a particular elegance and freshness, which are excellent characteristics to be able to store or consume them at the moment. (5 Stars)
2005	The harvest of the year 2005 resulted in elegant wines with the presence of well integrated tannins, but also presenting simpler wines. This opposite result was due to the rain that characterized the whole season, and did not bring greater damages to those producers who were able to harvest before the rains. This year's wines are not recommended for aging, but for the present consumption. (4 Stars)
2006	It was a good season for Barolo wine. The climate was characterized by periods of rain in the months of August and September, and by the low temperatures during the maturation

	phase of the grapes, which generated an optimum concentration of aromas. This year's wines are concentrated, with the tannins well integrated and with a good balance between its components; is suitable for aging. (5 Stars)
2007	The summer of 2006 did not show great variations, but it had a long period of temperatures above the average. This fact led to a halt in the phase of phenolic maturation, generating a high concentration of sugars. The result was wines with a higher alcohol content and with tannins not always ripe. (4 Stars)
2008	The 2008 grape harvest was later than usual. The summer was moderate with strong winds in August, and two weeks cooler in September, during the final stage of maturation, which resulted in well structured wines, but with tannins that will need a certain time to mature; for this reason they are adapted to aging. That is considered a excellent vintage for the Nebbiolo's grape. (5 Stars)
2009	The big point of the 2009 season was the maturation of the grapes. Thanks to the higher temperatures during this phase, it brought a non-uniform maturation. Some producers have harvested their grapes on several occasions due to lack of maturational uniformity; others still waited for the complete end of maturation, which caused problems with the quality of their grapes. For those who chose to harvest as the maturation was occurring (the first case), they obtained as a result Barolo wines of an excellent quality, leading specialists to classify this season as one to remember. (5 Stars)
2010	Considered a very good year, the season was characterized by a good climate until October, with few variations in May and relatively below average temperatures. The phenolic maturation was considered optimal, as well as the levels of acids, being these

	synonymous of longevity, where the recommended consumption is after some time of aging. The harvest was made in mid-October, generating elegant wines, well balanced between the acids and red fruits. The 2010 season was of great excellence for all Barolo crus, this year's wines being one of the most sought after and sold. A wine recommended for aging. (5 Stars)
2011	The weather in 2011 did not help the season in this year. The spring was characterized by above-average temperatures and lack of rain. The month of August was already filled with a high rainfall, which considerably affected the vineyards of Barolo, causing the sugars to accumulate faster than normal. The wines of this vintage are structured, fruity and aromatic. (4 Stars)
2012	The wines of the 2012 season can be considered of excellence, and are advised to be tasted after a short aging. In terms of quantity, it is considered one of the poorest after the war. This was a result of a harvest that had temperatures below the norm in the first half of the year, and hail in the maturation period, but despite these setbacks, achieving - for Nebbiolo - good results. (5 Stars)
2013	It was a year that, at the time of maturation, presented mild temperatures, but with an above-normal level of rain, which made it difficult to work the products. The resulting wines are fragrant and fresh, aromatic, and with great potential for aging. (4 Stars)
2014	It was a difficult season for Piedmontese vineyards: humid climate, very rainy and with little sun, which causes problems when maturing the grapes. But the result for Barolo this year was not as bad as expected at the beginning thanks to the producers' intervention in the right way and at the right time. This intervention was essential for the vineyards in the fungicide issue, which occurs due to the high amount of rainfall, and also

	to the maturation point, which would be considerably affected due to the low sunlight exposure. Great freshness and energy for the Barolos wines of this year 2014. (3 Stars)
2015	It was a special year for the Barolo wine. The climate throughout the season stimulated the growth and maturation of the grapes. In winter the snow came in normal amounts, and the spring rains were enough for the good growth of the grapes; the long and hot summer allowed the grapes to ripen well in advance. The wines are more alcoholic due to the high concentration of sugars. The only downside was the reduced production of grapes: the vines produced fewer bunches than the previous harvests. It will be a Barolo suitable for aging. (5 Stars)
2016	The climate was favorable to the harvest of the Nebbiolo, causing the producers to benefit from the abundant rain of the month of August and to postpone to the maximum the harvest time, until the last week of October, resulting in a much more mature grape. (5 Stars)
2017	This year was characterized by above average temperatures and a few rains, which anticipated the harvest time of the Nebbiolo grape, beginning in the second half of September, and ending at the beginning of October. The final result was better than expected at the beginning of the summer: the alcohol content remained in the mean, the ph level was considered good, and lower levels of acid, which proves a good maturation of the grapes. In quantitative terms, the yield of grapes was lower due to the low rainfall of the season. (3 Stars)

The harvests were classified following a ranking of stars, created according the characteristics described in each year. The ranks are followed described:

- 1 Star: Poor;

- 2 Stars: Discrete;
- 3 Stars: Good;
- 4 Stars: Great;
- 5 Stars: Excellent;

Another way of analyzing the vintages is through punctuations that basically express what was said before. Next, the website Wine Enthusiast classified the last years of the Barolo wine harvests through the punctuation in numbers. Between 80-82 is considered an acceptable vintage; 83-86 was characterized as good; if the score was in the range of 87-89, it is considered very good; 90-93 was considered excellent; 94-97 was a superb vintage; and lastly, if the year was attributed the score between 98-100, this harvest is classic.

In addition to using the ratings described above, the same website uses different colors to advise consumers if that wine can be consumed or if it would be better to wait for the delayed consumption.

Table 12: *Quality rating of the last vintages, in a crescent rating number, and the drinkability of the Barolo wine, in different colors.*

Type	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Barolo	94	93	86	94	93	93	98	95	91	95	95	89	97	86	82	97	95	92

	Hold
	Can drink, not yet at peak
	Can drink, may be past peak

Source: Wine Enthusiast

6 DATA COLLECTION

6.1 THE WINE GUIDES

The data collection began with the search for the Barolo's wine list through the Wine Spectator website. From this source, a total of 4990 Barolos wines were found, most of which contained the following information: the producer responsible for that sample, a sensorial analysis regarding its taste and structure, vintage year, specimens, recommended time for consumption and price in dollars.

From this database, an analysis was started with the main Italian wine guides. In this process the Barolos from the Wine Spectator website were confronted with those present in the guides. The objective of this analysis was to identify the wines considered excellent, and having also the possibility to make the same analysis of their producers (the excelence of the producer) in two of these guides: Vini d 'Italia (Gambero Rosso) and Slow Wine.

The guides used in the data analysis are:

- **Gambero Rosso:** the Gambero Rosso wine guide, Tre Bicchieri, is one of the most well-known and renowned guides in Italy. The analysis is made in several wines - in the edition of 2018 were more than 45 thousand wines analyzed - and also extended to its producers. The wines are judged and classified according to a ranking of "glasses": one black glass is destined to good wines in their respective categories; two black glasses are deigned for very good to best wines in the category to which they belong; two red glasses is the classification for very good wines to best that have reached the final tasting; and finally the three red glasses, which are intended for excellent wines in their respective categories. There are also the white cups that are the classifications of the wines that were analyzed in the previous editions. Producers are given a "star" when the three red glasses have been reached 10 times.

  In the analysis made, the excellent wines were shown, as well as the starry producers. For the other classifications described - one glass, two glasses -, wines were considered only as a quotation in that edition, without mentioning the position obtained.

The editions analyzed, referring to this guide were:

- Vini d'Italia 2018 - Gambero Rosso - Aa.Vv.

- **I Vini di Veronelli:** the Permanent Seminar Luigi Veronelli was created in 1986, non-profit, with the intention of following the world of agriculture and food. In the 2018 edition, 16,137 wines and 2,084 producers were selected, and for the wines, one of the following awards is directed: one star for discrete wines, which received a score between 80 and 85; two stars for good wines, to which is attributed a value of 86 to 89; for wines considered to be optimal, between 90 and 93, three stars are attributed; the super three stars represent the excellent wines, which received an evaluation equal to or greater than 94; the red flower represents the wines that are being listed for the first time or that have re-entered the guide after a long absence; the symbol of the blue flower, or a Great Scorpio, is attributed to the specimens that first entered or returned after a long time without being listed, and received the score greater than or equal to 94; the laurel represents the five Best Tastings, which in their respective categories, obtained the highest score; and finally the Sun, which is attributed to 10 wines that, according to the guide's description, deserve to be cited for their originality and value, regardless of their score.

  As well as the analysis made on the Gambero Rosso guide, only the wines that received the award of excellence were highlighted. The version used was:

- I Vini di Veronelli 2018 – Guida Oro – Seminario Permanente Luigi Veronelli

- **Vitae:** the guide used here, in the data collection, was from the year 2017, and for this edition were tested 35 thousand copies of wines, only a third of this entering amount was selectec to compose the guide. The maximum classification, attributed to excellent wines that have achieved a potution equal to or greater than 91, is symbolized by the four "vineyards". For those wines that came close to excellence, they obtained the three "vineyards" and a half. Another symbol, the cupid's arrow, symbolizes the wines that have touched the tasters since the first sip. And the symbol that makes reference to the relation of quality with territory of provenience, is the "moneybox".

- Vitae – La Guida Vini 2017 – Associazione Italiana Sommelier

- **Slow Wine:** One of the most known guides in the world of Italian wine, the first edition was launched in 1987, with Gambero Rosso. The guide presents several categories: the *snail* that symbolizes the wineries that presented ideals in tune with Slow Food; the *bottle*, which is desegnated to the company that presented an average quality in all its bottles; the *coin*, which is the relation cost-benefit that a company presented in all the bottles tasted; *vino slow*, bottle with an excellent organoletic quality and that they were able to present in the cup caraters connected to the territory, history and environment; *great vino*, better bottle with respect the organoletic profile; and finally *vino daily*, is deigned for bottles that cost up to € 10, and which present an excellent cost benefit.

- Slow Wine – Guida 2016 – Slow Food Editore - G. Gariglio
- Slow Wine – Guida 2018 – Slow Food Editore - G. Gariglio

- Annuario dei Migliori Vini Italiani 2018 – Pocket – L. Maroni

- **Le Guide de L'Espresso:** The 2018 edition was the sixteenth in the history of Espresso. There were 20 thousand wines analyzed, of which 1500 were selected. The wines are cataloged as follows: 100 wines to drink immediately, 100 wines to buy, 100 wines to be preserved and 100 wines to be re-stocked. It is also possible to search for each specific type of wine, for example, the Barolo wine, where a part with all selected wines is destined for the specimens. Unlike the other guides, I Vini d'Italia presents only the wines that have entered in one of the above mentioned lists. The difference in the classification in "excellent" or not in this case does not occur. Therefore, in the data collection made for this study, the wines inside the guide were considered excellent, and those who did not enter received the classification of "missing".

- I Vini d'Italia 2018 – Le Guide de L'Espresso - A. Grignaffini

The final result was 1168 Barolo's wine data that were present in the initial cast and also in one of the guides analyzed. The data that did not present a description of the wine were immediately excluded.

6.2 THE VARIABLES

The next step was the analysis of the variables, where the information was extracted from the data coming from the Wine Spectator website. The variables are analyzed as follow:

- Objective characteristics:

- *den*: a dummy variable which equals to 1 if the label on the bottle contains the name Barolo with another information; e.g. Riserva, respective *terroir* where the grape was produced and the vineyard; otherwise the value that is assumed is 0;
- *alc*: alcohol content, in %, present in the labels and descriptions in the wine bottles. These values, as well as the prices, were collected from the Italian guides used; for those who did not present this information, the search was made on the websites of the respective producers or on the following websites: Wine Enthusiast, The Sorting Table, wine.com, wine-searcher, vino.75, Tannico and cellar Tracker.
- *annata*: a dummy variable which assumes the value 1 if the vintage was considered excellent, otherwise 0. The data was collected through the analyse of several websites (e.g. lavinium, massolino) and some of these analysis are present in the previous chapter.

- Sensorial characteristics:

- *agi*: a dummy variable which equals to 1 if the wine needs a certain time to be appreciate. This information was obtained through the description of the wine, where it described the ideal time for consumption, or combined to this information there was also the recommendation for the aging of the wine; 0 otherwise;

- *arm*: a dummy variable which equals to 2 if the wine presents considerable aromas; it equals to 1 if the presence of the aromas is not so relevant and 0 if there is no reference to the any kind of aroma. This information was analyzed through the wine description introduced by the Wine Spectator;
- *blc*: a dummy variable which equals to 1 if the all components of the wine is balanced, 0 otherwise. This information was analyzed through the wine description introduced by the Wine Spectator;
- *tani*: a dummy variable which equals to 1 if the reference to the presence of tannins significantly affects the taste of wine; it assumes the value 0 if there is no reference of the presence of tannins in the gustatory analysis. This information was analyzed through the wine description introduced by the Wine Spectator;
- *pgm*: a dummy variable which equals to 1 if there is any reference to the pigmentation of the wine; 0 otherwise. This information was analyzed through the wine description introduced by the Wine Spectator;
- *std*: a dummy variable which equals to 1 if the wine presents a good structured of all its elements; 0 otherwise. This information was analyzed through the wine description introduced by the Wine Spectator;
- *lgt*: a dummy variable which equals to 1 if the final taste is considered long. In this case the descriptions of "lenght" and "finish" were considered a characteristic and measure of the longevity of the taste.[37] Otherwise, there is considered the value 0. This information was analyzed through the wine description introduced by the Wine Spectator.

The analysis of other variables was given through the information in the guides and through the search in sundry websites that make several analyzes of wines. The variables are following described as well as the manner how the data was found:

- *p*: price of bottles in dollar and euro. The values in euro were collected through several sources, being: the Italian guides used in the data collection process (only the guides that presented this data); the Wine Enthusiast, wine-searcher and Vivino websites.

[37] Some experts prefer to consider "length" as a distinct feature of finish. In these cases, the former refers exclusively to the description of how long the wine's taste persists in the mouth, being characterized mainly by the words "long", "moderate" and "short". The definition of "finish" refers more to the descriptive form of the final taste; this in turn is described as spicy, sweet, rich, savory, bitter, and so on.

➢ Other Characteristics:

- *bottles_tot*: number of bottles from which wine that were produced. The data was extracted from the Wine Expectator website and from the italian guides that was used in the analysis.[38]
- *pgm:* a dummy variable which equals to 1 if there is any reference to the pigmentation of the wine; 0 otherwise. This information was analyzed through the wine description introduced by the Wine Spectator;

The data extracted from the wine guides are based on the excellence attributed to each wine, and some of them also to the producers, as mentioned above. From these data, reputation variables were attributed:

➢ Reputational Characteristics:

- *gr_2018*: a dummy variable which is equal to 1 if the wine obtained the "Tre Bicchieri Rossi" from Gambero Rosso - the excellence - in the year 2018. The variable assumes the value 0 if the wine was mentioned in the guide but did not receive the maximum award. And finally, it is equal to "missing" if the wine did not appear in the guide.
- *ver_2018*: a dummy variable which is equal to 1 if the wine obtained the "Tre Blue Stars" – the excellence - from the I Vini di Veronelli guide in the year 2018. The variable assumes the value 0 if the wine was mentioned in the guide but did not receive the maximum award. And finally, it is equal to "missing" if the wine did not appear in the guide.
- *vitae_2017*: a dummy variable which is equal to 1 if the wine obtained the "4 T's" (the score above 91) – the excellence - from Vitae's guide in the year 2017. The variable assumes the value 0 if the wine was mentioned in the guide

[38] The Wine Spectator's website shows these data as "case". The website informs that each case of wine has 12 bottles of 750 ml. In the case of this study it was considered the number of bottles rather than the cases.

but did not receive the maximum award. And finally, it is equal to "missing" if the wine did not appear in the guide.

- *sw_2016* and *sw_2018*: a dummy variable which is equal to 1 if the wine obtained the excellence classification from Slow Wine guide in the years 2016 and 2018. The variable assumes the value 0 if the wine was mentioned in the guide but did not receive the maximum award. And finally, it is equal to "missing" if the wine did not appear in the guide.
- *lc_2018*: a dummy variable which is equal to 1 if the wine obtained the score equal or greater than 92 from the Luca Maroni's guide. The variable assumes the value 0 if the wine was mentioned in the guide but did not receive the maximum award. And finally, it is equal to "missing" if the wine did not appear in the guide.
- *vdi_2018*: a dummy variable which is equal to 1 if the wine has been considered within one of the following categories in the Le Guide de L'Espresso: 100 wines to drink immediately, 100 wines to buy, 100 wines to preserve and 100 wines to taste again. The variable is equal to "missing" if the wine did not appear in the guide.
- *gr_2018_prod*: a dummy variable which is equal to 1 if the producer obtained the "Red Star" from Gambero Rosso - the producer gained 10 times the "Tre Bicchieri Rossi" - in the year 2018. The variable assumes the value 0 if the producer was mentioned in the guide but did not receive the excellence. And finally, it is equal to "missing" if the producer did not appear in the guide.
- *sw_2016_prod* and *sw_2018_prod*: a dummy variable which is equal to 1 if the producer obtained the excellence classification from Slow Wine guide in the years 2011, 2016 and 2018. The variable assumes the value 0 if the producer was mentioned in the guide but did not receive the maximum award. And finally, it is equal to "missing" if the producer did not appear in the guide.

7 RESULTS

7.1 THE ECONOMETRICS ANALYSIS

The analysis of the data was done using the software STATA 14, and is based on the log-linear regression. The dependent variable is the price, and the other variables are the independent variables. Tests were performed using the variables already described in the previous section, and excluding those that did not show significant variations in price. This analysis was done through the p-value which tests the null-hypothesis of no-correlation of the independents on the dependent variable. If this correlation does not exist, the association between the variations in the independent variables is insufficient evidence that there is an effect on the population level.

The decision to exclude a variable was made through a significant level, set at 0.1. That is, all p-values that presented values above 10% were removed from the analyzes so that the accuracy of the model was maintained. For results below this level we can safely reject the null hypothesis for the entire population.

The purpose of these calculations was to analyze the association of the changes in the independent variables on the value, that is, what influences the final market price of the Barolo wine when analyzing the characteristics described in the previous chapters.

The most widely used population regression function is the log-linear and it is structured as following:

$$\log(p) = \alpha + \beta_1(sensorial\ variables) + \varphi_1(objective\ variables) + \gamma_1(other\ variables) + \delta_1(reputation\ variables) + \epsilon$$

Where:

- p: dependent variable; the final price of Barolo wine;
- α: it is the value of p when all independent variables assume the value of zero;
- β_1: coefficient vector that describes the size of the sensorial variables effect on the dependent variable;

- sensorial variables: vector of independent variables representing sensorial traits;
- $\boldsymbol{\varphi_1}$: coefficient vector that describes the size of the objective variables effect on the dependent variable;
- objective variables: vector of independent variables representing objective traits;
- $\boldsymbol{\gamma_1}$: coefficient that describes the size of the other variables effect under the dependent variable;
- other variables: vector of independent variables;
- $\boldsymbol{\delta_1}$: coefficient that describes the size of the reputation variables effect under the dependent variable;
- reputation variables: vector of independent variables representing reputational traits;
- ϵ: the regression error.

7.2 THE LINEAR REGRESSION ANALYSIS

The first model tested in linear regression is shown in table 13. The variables presented in the analysis are those sensorial, objective, pigmentation and number of bottles produced. The objective was to analyze the p-values obtained to understand the effect of these variables on price. The comparative value used for the evaluation of this influence was that mentioned above: the significant level at 10%.

The results considerably above the value 0.1 were highlighted in red on the next table. It is possible to conclude that the most critical data were those obtained with *tani* and *alc* variables, followed by *pgm*, *blc* and *arm*.

The result obtained was that already expected because the sensory variables *tani*, *pgm*, *blc* and *arm* are not characteristics that all wine consumers, especially those who are more ordinary, are able to identify, and consequently they do not influence in a general way the decision to acquire or not the product. Thus, the effect of these variables is not considered a guide to the market price of the wine.

Table 13: *First model using the sensorial, objective and the other variables*

Linear regression

Number of obs	= 509
F(11, 497)	= 3.75
Prob > F	= 0.0000
R-squared	= 0.0761
Root MSE	= .5845

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.241234	.0848875	2.84	0.005	.0744515	.4080166
agi	.0921527	.0534019	1.73	0.085	-.0127686	.197074
arm	.0506734	.0454736	1.11	0.266	-.0386708	.1400177
blc	.0422059	.0539289	0.78	0.434	-.0637508	.1481626
tani	-.00255	.0538307	-0.05	0.962	-.1083138	.1032138
pgm	.0197269	.054691	0.36	0.718	-.0877271	.127181
std	.0929236	.0613002	1.52	0.130	-.0275159	.2133631
lgt	.0848395	.052138	1.63	0.104	-.0175986	.1872775
bottles_tot	-2.75e-06	9.31e-07	-2.96	0.003	-4.58e-06	-9.23e-07
annata_2010_2012	.0818673	.0575183	1.42	0.155	-.0311417	.1948762
alc	-.0077832	.0841977	-0.09	0.926	-.1732106	.1576441
_cons	3.769889	1.226581	3.07	0.002	1.359965	6.179813

The second model used considered the dummies *den*, *agi*, *std*, *lgt*, *annata_2010_2012* and the variable *bottles_tot*. The dummy *annata* was created as a reference for the years 2010 and 2012, the best vintages between the four years that were considered in the database. The other variables were excluded for this second analysis due their high p-value, and consequently the uncertainty in rejecting the null hypothesis for the population evaluated. The results obtained are described below in the table 14.

The result obtained with the dummy *annata* remained basically constant between one model and the other. Many people associate the climate of a particular vintage as an important determinant of the final price because it directly affects the sensory characteristics of wine. The model shows that this dummy does not significantly influence the dependent variable, as do the other sensory variables *agi*, *std* and *lgt*, which are little present in effect. The principal reason for this result is the low influence they have on the preference of an ordinary consumer[39], even though they are supposed to be important characteristics, which vary constantly due the vintage climate and other production effects.

[39] The ordinary consumer is the reference to all people who are not considered within the group of sommeliers experts.

But an important point to note is the influence of the dummy *den* on price: over 24%. That is, this is the size of the effect under the dependent variable. The denomination that is written in the label considerably influences the decision when choosing a particular wine, which directly affects its final value.

Table 14: *Second model without the variables which presented, in the first model, a p-value greater than 10%.*

Linear regression

Number of obs	= 509
F(6, 502)	= 6.62
Prob > F	= 0.0000
R-squared	= 0.0719
Root MSE	= .58291

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.2455584	.0849882	2.89	0.004	.0785821	.4125348
agi	.0900441	.0531267	1.69	0.091	-.014334	.1944221
std	.0962373	.0595913	1.61	0.107	-.0208417	.2133163
lgt	.0900874	.0513129	1.76	0.080	-.010727	.1909019
bottles_tot	-2.71e-06	8.85e-07	-3.06	0.002	-4.45e-06	-9.67e-07
annata_2010_2012	.0789397	.0559781	1.41	0.159	-.0310405	.1889198
_cons	3.694786	.0925944	39.90	0.000	3.512866	3.876706

Following the previous procedure, the variable *annata* was withdrawn for a comparison of values, since even presenting a p-value above that one established, the accuracy could still be maintained with the variable present in the model. The following result was found:

Table 15: *Third model without the variable annata.*

Linear regression

Number of obs	= 509
F(5, 503)	= 7.88
Prob > F	= 0.0000
R-squared	= 0.0679
Root MSE	= .58356

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.252266	.0853498	2.96	0.003	.08458	.419952
agi	.0749487	.0519408	1.44	0.150	-.0270988	.1769963
std	.0951168	.0597934	1.59	0.112	-.0223587	.2125924
lgt	.0917816	.0514325	1.78	0.075	-.0092673	.1928305
bottles_tot	-2.77e-06	8.84e-07	-3.13	0.002	-4.50e-06	-1.03e-06
_cons	3.728291	.089662	41.58	0.000	3.552133	3.904449

The ideal model, where only the sensorial and characteristic variables are considered, is shown and shown in table 16.

Table 16: *First final model with the most influence variables.*

Linear regression

Number of obs	= 509
F(4, 504)	= 9.73
Prob > F	= 0.0000
R-squared	= 0.0642
Root MSE	= .58416

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.268824	.0843313	3.19	0.002	.1031397	.4345082
std	.0989894	.0604678	1.64	0.102	-.0198106	.2177894
lgt	.090202	.0515082	1.75	0.081	-.0109953	.1913993
bottles_tot	-2.78e-06	8.64e-07	-3.22	0.001	-4.48e-06	-1.08e-06
_cons	3.754311	.0870754	43.12	0.000	3.583235	3.925386

In the final model it is possible to conclude the importance of the dummy *den* on the value of the price, while the other sensorial variables presented little power of influence. For the consumer, the name of Barolo with another information, or only Barolo, is a characteristic that influences in a decisive way in the decision of the purchase.

In the second part of the linear regression analysis, we considered the variables related to the reputation of the wines and producers, together with the dummies of the last ideal model, arising from the Italian wine guides that were used in the collection of the data. The choice to compare the sensorial characteristics with those of reputation has the purpose of analyzing whether even in the presence of a reference guide, people still consider, with the same importance, the sensorial attributes, and consequently, if they have the same under the prices.

The reputation variables, in turn, refer to excellent wines, and also equals those not excellent to those that are not present in the guides. This equality was considered with the premise that a wine that is not present in the guide has the same effect on the readers of those not present. The only exception is the variable that refers to the guide Vini di Italia, which presents only excellent wines or those not mentioned, the missing one.

The result of this second part reveals a very interesting fact: the variables referring to the guides Slow Wine 2016 and 2018 did not present a significant influence, as did Luca Maroni and Vini di Italia. In the case of Slow Wine the result obtained was due to the fact that a guide does not analyze the same wines in the previous guides. However, the variables that mention the reputation of the producers in Slow Wine had a significant influence on the price. The table 17 shows the data obtained in this first analysis.

Table 17: *First model using the reputational variables.*

Linear regression

Number of obs	= 509
F(14, 494)	= 15.61
Prob > F	= 0.0000
R-squared	= 0.3175
Root MSE	= .5039

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.2644222	.0728331	3.63	0.000	.1213214	.4075229
std	.0946204	.0527421	1.79	0.073	-.0090061	.198247
lgt	.0643229	.0447807	1.44	0.152	-.0236612	.152307
bottles_tot	-2.13e-06	8.04e-07	-2.66	0.008	-3.71e-06	-5.56e-07
gr_2018_o	.7863418	.203184	3.87	0.000	.3871304	1.185553
gr_prod_2018_o	.09655	.0472553	2.04	0.042	.0037038	.1893963
ver_2018_o	.1778643	.0852488	2.09	0.037	.0103693	.3453593
vitae_2017_o	.4173194	.0915886	4.56	0.000	.2373682	.5972707
sw_2016_o	.2013412	.2092125	0.96	0.336	-.2097148	.6123972
sw_2018_o	.0980464	.1233979	0.79	0.427	-.1444031	.3404958
sw_prod_2016_o	.3119538	.0589762	5.29	0.000	.1960788	.4278289
sw_prod_2018_o	.2339171	.0754791	3.10	0.002	.0856175	.3822167
lc_2018_o	-.0644243	.0886977	-0.73	0.468	-.2386955	.1098469
vdi_2018_m	.0359812	.1019173	0.35	0.724	-.1642637	.236226
_cons	3.416549	.3197536	10.68	0.000	2.788304	4.044794

Following the procedure of excluding the variables that presented p-values above the significant level and including that referring to the excellent wines of Vini di Ialia, we obtained the values in the table below.

The results remained constant, excluding the variables vdi_2018_e and lgt, which responded to the linear regression with the p-values above 10%.

Table 18: *Second model, excluding the variables which presented the p-value above 10%.*

Linear regression

Number of obs	= 509
F(11, 497)	= 19.60
Prob > F	= 0.0000
R-squared	= 0.3141
Root MSE	= .50361

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.2702249	.0735118	3.68	0.000	.1257928	.414657
std	.0939766	.0526887	1.78	0.075	-.0095435	.1974967
lgt	.0621374	.0448255	1.39	0.166	-.0259334	.1502083
bottles_tot	-2.16e-06	8.14e-07	-2.66	0.008	-3.76e-06	-5.64e-07
gr_2018_o	.8074074	.2215301	3.64	0.000	.3721566	1.242658
gr_prod_2018_o	.0972724	.0473079	2.06	0.040	.0043242	.1902207
ver_2018_o	.1730604	.0840265	2.06	0.040	.0079695	.3381514
vitae_2017_o	.4038741	.0905327	4.46	0.000	.2260001	.5817481
sw_prod_2016_o	.3327892	.0594004	5.60	0.000	.2160823	.449496
sw_prod_2018_o	.2415643	.0743095	3.25	0.001	.0955647	.3875638
vdi_2018_e	-.1027433	.2950752	-0.35	0.728	-.6824918	.4770053
_cons	3.520488	.073441	47.94	0.000	3.376195	3.664782

The final model, excluding only the dummies selected above, is shown in table 19 below.

Table 19: *Second final model with the most influence varibales.*

Linear regression

Number of obs	= 509
F(9, 499)	= 22.79
Prob > F	= 0.0000
R-squared	= 0.3113
Root MSE	= .50364

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.2769669	.0726449	3.81	0.000	.1342394	.4196945
std	.0952897	.0525193	1.81	0.070	-.0078965	.198476
bottles_tot	-2.13e-06	7.93e-07	-2.68	0.008	-3.69e-06	-5.70e-07
gr_2018_o	.800779	.2193027	3.65	0.000	.3699086	1.23165
gr_prod_2018_o	.0944276	.0463685	2.04	0.042	.0033261	.1855291
ver_2018_o	.1700323	.0848378	2.00	0.046	.0033489	.3367156
vitae_2017_o	.4034117	.0904732	4.46	0.000	.2256563	.5811671
sw_prod_2016_o	.3366863	.0590826	5.70	0.000	.2206049	.4527676
sw_prod_2018_o	.2433661	.0737368	3.30	0.001	.0984932	.388239
_cons	3.547873	.0750789	47.26	0.000	3.400363	3.695382

Analyzing the table above, the variable gr_2018_o is the one with the greatest influence on price, among all other variables, with an incredible size of effect of 80%. One possible reason is the popularity that such a guide presents in the wine world.

The sensory variables have maintained the same degree of influence as in the other models, showing that even with the presence of guides as an aid, consumers react in the same way regarding their choices. The influence shown by the guides is more relevant than the characteristics of the wines themselves.

Following to the last analysis, was added, to the model above, the independent variable score_ws, which refers to the qualification of the Barolo wines according to the Wine Spectator website.

The result obtained can be analyzed as follows:

Table 20: *First model adding the score Wine Spectator variable in the second final model.*

Linear regression

Number of obs	= 509
F(10, 498)	= 23.00
Prob > F	= 0.0000
R-squared	= 0.3495
Root MSE	= .48996

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.1866957	.0742941	2.51	0.012	.0407272	.3326643
std	.0492218	.0506691	0.97	0.332	-.0503298	.1487733
bottles_tot	-1.93e-06	8.20e-07	-2.35	0.019	-3.54e-06	-3.16e-07
gr_2018_o	.6941101	.1992233	3.48	0.001	.3026884	1.085532
gr_prod_2018_o	.0893084	.0444459	2.01	0.045	.0019839	.176633
ver_2018_o	.1060724	.0850381	1.25	0.213	-.0610053	.27315
vitae_2017_o	.3962957	.0919892	4.31	0.000	.2155609	.5770304
sw_prod_2016_o	.2878264	.0558287	5.16	0.000	.1781375	.3975153
sw_prod_2018_o	.1873429	.0717758	2.61	0.009	.0463222	.3283636
score_ws	.0672104	.0135557	4.96	0.000	.040577	.0938437
_cons	-2.533818	1.219197	-2.08	0.038	-4.929223	-.1384139

Excluding the variables selected above, we obtained the results summarized in table 21. The only sensorial variable that remains, with a small reduction of influence, is the den, which proved once again to be the dummy, of this category, that most influences the price.

Table 21: *Resulting model after exclusion of the variables which presented the p-vale above 10%.*

Linear regression

Number of obs	= 509
F(8, 500)	= 28.14
Prob > F	= 0.0000
R-squared	= 0.3463
Root MSE	= .49017

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.1841466	.0722606	2.55	0.011	.0421748	.3261184
bottles_tot	-2.03e-06	8.23e-07	-2.46	0.014	-3.64e-06	-4.09e-07
gr_2018_o	.7295297	.1888738	3.86	0.000	.3584455	1.100614
gr_prod_2018_o	.0934643	.0441319	2.12	0.035	.0067575	.180171
vitae_2017_o	.3869532	.0919339	4.21	0.000	.2063289	.5675776
sw_prod_2016_o	.2839051	.055543	5.11	0.000	.1747785	.3930316
sw_prod_2018_o	.1848269	.0716638	2.58	0.010	.0440276	.3256263
score_ws	.0713181	.0132054	5.40	0.000	.0453732	.0972631
_cons	-2.886695	1.191255	-2.42	0.016	-5.227177	-.546213

Finally, for the purpose of a more detailed analysis, the variable score_ws2 was created with the intention of analyzing at what moment, or better in what score, the Wine Spectator score influences the price more. The following calculation makes this thought clearer.

$$\log(p) = \beta_0 + \beta_1(score\_sw) + \beta_2(score\_sw)^2$$

$$\frac{\partial \log(p)}{\partial score} = \beta_1 + 2\,\beta_2(\text{score\_sw})$$

Substituting the coefficients by the results obtained in table 22, we obtain the following result:

$$\frac{\partial \log(p)}{\partial score} = -2.7 + 2 * (0.015)\ (\text{score\_sw})$$

Equating the left side to zero will enable to find the marginal price, that is, the smallest point of the curve in which the increment in the score unit considerably increases the value of the price.

$$0 = -2.7 + 0.03 * (\text{score\_sw})$$

$$\boxed{(\textbf{score\_sw}) = \textbf{90}}$$

For wines that have been designated, through the Wine Spectator website, a score greater than or equal to 90, have an influence on the final value of the wine greater than those with a lower rating.

Table 22: *Ideal final model including the new score_ws variable.*

```
Linear regression                               Number of obs     =        509
                                                F(9, 499)         =      28.20
                                                Prob > F          =     0.0000
                                                R-squared         =     0.3698
                                                Root MSE          =     .48177
```

logp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
den	.2096941	.0656908	3.19	0.002	.0806294	.3387588
bottles_tot	-1.91e-06	7.14e-07	-2.68	0.008	-3.32e-06	-5.10e-07
gr_2018_o	.613386	.1700979	3.61	0.000	.2791897	.9475823
gr_prod_2018_o	.0952877	.0430215	2.21	0.027	.0107621	.1798133
vitae_2017_o	.3619394	.0941905	3.84	0.000	.1768806	.5469983
sw_prod_2016_o	.2776056	.0543119	5.11	0.000	.1708974	.3843137
sw_prod_2018_o	.1661179	.0700074	2.37	0.018	.0285722	.3036635
score_ws	-2.695271	.7420504	-3.63	0.000	-4.153199	-1.237342
score_ws2	.0150821	.0040828	3.69	0.000	.0070605	.0231037
_cons	123.9062	33.70331	3.68	0.000	57.6883	190.1241

Therefore, it is important to emphasize that above the score of 90, the variable *score_ws2* influences in a relevant way the dependent variable, when compared to *score_ws*. The readers of this website give more attention and relevance to wines ≥ 90. The dummy *den* still presents itself as a determining factor in price, even in the presence of the guides. Now, in relation to the reputational characteristics, they in turn have proved the cause of greater relevance on the final price. Among them, Gambero Rosso is the most important guide: 61% influence under the dependent variable. One point to note is the fact that the reputation of the producers in the Gambero Rosso shows only 9% of effect on the price, concluding that consumers pay attention to the reputation of the wine, not the excellence of its producers.

8 CONCLUSION

At this point it is already possible to answer the question made at the beginning of this study: what factors does drive the market price of wine? The results obtained in the regression models showed a path contrary to the one initially suggested: the factors that most affect the final price are not related to the sensorial characteristics, but rather than the qualitative reputations attributed by the wine guides.

This study analyzed the numbers of the Italian wine market, with the main focus being the Barolo wine. The numerical data that were presented was concerning the production, export and value of this product, as well as a brief analysis of its competitors and the last vintages characteristics. The Barolo wines database extracted from the Wine Spectator site was used in the analysis of the guides present in the Italian market. This part had as main focus the study of the sensorial and reputational characteristics of each wine, so that the necessary variables for the calculation of the linear regression models were obtained.

The first model considered in the linear regression revealed a contrary tendency suggested by many: the climate and the production process are the main influential factors in the market price of a wine. The sensorial characteristics, direct consequences of the points mentioned above, are not determinant variables in the choice of a wine, due to the fact that an ordinary consumer does not consider them so relevant, or even because the lack of knowledge in recognizing them at the time of consumption. Thus, the variable that most stood out in the final model, the one that most influences the consumer, was the *den*, which refers to the denomination of the wine present in the label of each bottle (e.g. Barolo or Barolo Cannubi). The effect size caused by this feature in the price was approximately 20%.

When testing a new model including the variables related to the wine guides, it was possible to conclude that those of Slow Wine, Luca Maroni and Vini di Italia do not influence the prices like the others present in the calculations. In relation to the Slow Wine guide, the reputation of the producers proved to be an important characteristic, while the one designated to the wines had to be excluded. The possible reason for this result is the fact that different wines are analyzed in different editions of the guides.

Besides this, it was possible to affirm the importance of the great wine guides as a tool for the consumption choice. The Gambero Rosso 2018 guide had a 60% price effect on wine, the highest among all guides, concluding that readers are actually influenced and believe in the rating and judgment provided by these guides.

The last analysis, where the variable $(score\_sw)^2$ was considered, presented a very interesting result, where from the value 90, in the score attributed by the Wine Spectator website to a wine, the final price was submitted to an influence greater than that suffered by the variable *score_sw*. That is, the scores below this value do not considerably guide a consumer in choosing a wine like those above 90. However, it is not possible to assign a direction to that qualification, that is, if the score is based in the sensorial characteristics of wine, or in other possible aspects to which this study is not able to present a conclusion. However, in view of the action to which the price was submitted with this score, it is possible to concluded that this variable is an important reference base for consumers in deciding which wine to choose.

As was concluded in the study "Taste or reputation: what drives market prices in the wine industry? Estimation of a hedonic model for Italian premium wines" developed by the professor who assists this document, Luigi Benfratello, together with Massimiliano Piacenza and Stefano Sacchetto, the reputation of the wines, as well as their producers when presented in the guides, was presented as the determinant factor to direct the final market price of the wine, and in the specific case of this document, the price of the Barolo wine.

And to conclude, a future suggestion for the continuation and improvement of this study would be the in-depth analysis of the factors on which are based the reputational characteristics attributed to wines and their producers on each guide used in the presented calculations.

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