Wine Analytics: Fine Wine Pricing and Selection under Weather and Market Uncertainty

I want to submit an abstract for:

Conference Presentation

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Keywords

wine futures, pricing, weather uncertainty, market uncertainty, risk aversion

Research Question

(1) What is the impact of weather and market fluctuations in young wine prices?
(2) How can a wine distributor choose between wine futures and bottled wine?

Methods

(1) Empirical analysis for predicting/explaining wine prices,
(2) Mathematical model and its ensuing analysis for the wine distributor's fine wine selection problem.

Results

(1) Weather and market fluctuations explain futures prices and their evolution to bottle prices,
(2) A distributor should always invest in futures,
(3) Financial benefit from our model is significant.

Abstract

This paper examines a wine distributor’s annual decision regarding the selection of bottled wine and wine futures under weather and market uncertainty. At the end of each summer, a winemaker harvests grapes, crushes them in order to produce wine. A fine wine goes through a long aging process ranging between 18 to 24 months. The wine can be sold in advance in the form of wine futures, often referred to as “en primeur” due to the popular futures campaign for Bordeaux wines. Wine futures begin to trade before the first summer following the harvest (approximately eight months after harvest). The wine gets bottled in the second summer and is sold for retail and distribution; those who purchased this wine in the form of futures also receive their wine shipment.
To understand the difference between bottled wine and wine futures, let us consider the 2013 vintage of a fine wine as an example. The 2013 vintage of this wine is made from the grapes harvested in September 2013; its futures are sold in May 2014, and the wine is bottled and sold in May 2015. Similarly, the 2014 vintage is produced from the grapes harvested in September 2014, and its futures come out in May 2015. As a result, the distributor has two products in May 2015 from the same fine wine producer: (1) The 2013 vintage in the form of bottled wine, and (2) the 2014 vintage in the form of wine futures (a contract to take the possession of the 2014 vintage wine in May 2016). Thus, in May 2015, a fine wine distributor has to select the amounts of bottled wine from the 2013 vintage and wine futures of the 2014 vintage. Our paper assists wine distributors in the following way: (1) It builds an empirical analysis in order to estimate the influence of weather and market fluctuations on the prices of wine futures and bottled wine; and (2) based on the empirical findings, it develops an analytical model that determines the allocation decisions between bottled wine and wine futures under weather and market uncertainty.

Quality of a fine wine is greatly influenced by weather conditions during the grape growing season; often higher temperatures lead to better quality of grapes and wine. Due to differences in weather conditions from one year to the other, two consecutive vintages of the same wine may have very different quality, and hence, price. A striking example regarding the impact of weather on wine futures prices can be seen from the Bordeaux region where the summer of 2005 was very hot and dry, resulting in one of the finest vintages in recent years. Prior to the growing season in 2005, the wine futures for the 2004 vintage of Troplong Mondot was released to the market at the price of $62/bottle. The impact of superior weather in the summer of 2005 was so big that the wine futures price for the 2005 Troplong Mondot jumped to $233/bottle, corresponding to a 276% increase when compared with the futures price of the previous vintage. This is an example of the improved weather conditions from 2004 to 2005, and its impact on wine futures prices. Moreover, the positive weather during the summer of 2005 negatively impacted the 2004 vintage wine, and caused the bottle price of the 2004 vintage to go down to $54 per bottle, resulting in a 13% reduction from its futures price from the prior year. This is an example where the growing weather condition not only influences the wine futures price of its vintage but also the evolution of a futures price to the bottle price in the previous vintage.

In addition to weather fluctuations, changes in the market conditions also drive fine wine prices. All fine wine futures and bottles are traded in London International Vintner’s Exchange (Liv-ex). We use Liv-ex 100 index composed of 100 most sought-after wines to describe the fine wine market conditions. Liv-ex 100 index exhibits a significant downturn in the market in 2008, a 17.17% decrease when compared to 2007. The top Bordeaux winemakers priced their 2008 vintage wines 16.66% less than the 2007 vintage wines on average, even though, the growing seasons of these two vintages observed highly similar weather conditions. Our analysis combines the impact of weather and market fluctuations in explaining wine futures prices as well as their evolution to bottled wine prices.

Under the presence of such drastic changes in vintage prices depending on weather and market conditions, a wine distributor is often puzzled with whether to invest in wine futures of the previous year’s vintage or buy recently bottled wine from two vintages ago. While wine futures exhibit a greater uncertainty as future weather conditions can negatively influence the bottle price as in the example of the 2004 Troplong Mondot, it also allows the distributor to lock up limited supply at lower prices. Moreover, futures can be easily traded in Liv-ex, the financial exchange for fine wine without having to make physical shipments and comply with legal restrictions; thus, wine futures are highly liquid in comparison to bottled wine. Purchasing bottles can be perceived as a safer bet upfront as the bottle prices are revealed; however, market conditions continue to influence these prices. The distributor can observe the summer weather conditions getting comparative indications as to how the futures price is going to evolve to the bottle price; moreover, the distributor can later change its allocation through buying additional or selling existing futures with limited ability to move its bottled wine inventory.

When should a wine distributor engage in futures? Our work finds motivation from the conversations with the executives at the largest wine distributor in the US and in the world. Earlier research (Ashenfelter et al. 1995 and Ashenfelter 2008) has shown that mature Bordeaux wine prices can be predicted accurately using growing
season weather conditions, but these studies conclude that young wine prices (i.e., futures prices and prices for the recently released bottled wines) cannot be predicted using weather conditions. Our empirical analysis complements these studies as we show that weather and market fluctuations can explain the young wine prices at the highest statistical significance.

In the absence of an empirical model that can explain the futures price and its evolution to the bottle price, a distributor would not be encouraged to make investments in futures as futures can be perceived as risky alternatives compared to bottles. Rather, the distributor would spend its money in physical bottles where the price is already evolved and has smaller uncertainty. Indeed, this has been the practice at some of the distributors as they invest solely on bottled wine, bypassing the futures alternative. Considering that a wide majority of wine trade occurs at young wine stages, our empirical findings have significant implications as they are expected to cause an increase in the number of trades in the financial exchange. Our analytical model is built on the findings from the empirical analysis, and it helps wine distributors make informed and better decisions regarding the selection of vintages and winemakers.

In addition to the above practical implications, our paper makes three main contributions. First, our empirical study provides significant explaining power to aid distributors in understanding the pricing infrastructure using weather and market fluctuations. Specifically, we show (1) how futures price of a wine that is not even bottled yet can be predicted, and (2) how this futures price evolves to the bottle price through changes in weather and market conditions. We find that (1) a vintage with a warmer growing season fetches a greater futures price than the previous vintage; and, (2) futures price of a vintage is negatively influenced by a warmer growing season for the upcoming vintage, leading to a lower bottle price. Second, we develop an analytical model for a fine wine distributor in order to determine the optimal selection of bottled wine and wine futures using a value-at-risk measure under weather and market uncertainty. We develop the structural properties of the optimal decisions and we show that a distributor should always invest in wine futures because it increases expected profit despite being a riskier asset than bottled wine. Third, our study demonstrates the financial benefits from using our analytical model based on the empirical findings. The average profit improvement is 22.78%, and the benefit is higher under risk aversion. Our analysis provides insights into how to improve the distributor’s selection and make financially healthier allocations between futures and bottled wine, leading to reduced risk and increased profit.