Red obsession: the ascent of fine wine in China

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Abstract

This article uses hammer prices from five global auction houses to analyse the price premium Bordeaux fine wine yielded at Hong Kong wine auctions over the period 2007 to 2014. We find that fine wine was on average sold at a 19% premium on the Hong Kong market. The strong latent demand by Chinese customers coupled to wine market characteristics are put forward as an explanation for this premium. We further observe that the Hong Kong premium is not uniform and most pronounced for wines with perfect Parker scores or for the most powerful brands. The premium has declined throughout the sample period from 60% in 2008 to establish itself at a level of 15% since 2012. This can be attributed to the increase in knowledge on fine wine by Chinese customers.

JEL Classification: C60, F14, Q11, Q14

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1 Introduction

Fine wine from Bordeaux, a product that two decades ago was virtually unknown to all but some of the Chinese[1] population, has become fashionable and much discussed from Hong Kong to Beijing. The discovery of signature molecules in pottery jars in Jiahu dating back 5'000 years suggests that alcohol fermentation has a longstanding practice in China (McGovern, 2009). While traditionally most wines consisted of grains such as rice or millet, grape wine has seen a rapid ascent in recent years. The increase in wine consumption has catapulted China into one of the most coveted markets for wine exporting countries. Since 2000, China has seen an increase from 4.9 million USD in bottled wine imports to 1.3 billion USD by 2011 (OIV, 2014). Today, China and Hong Kong are also the most important customers for Bordeaux wines. China is the largest importer of Bordeaux wines representing 20% in volume and 17% in value of all Bordeaux exports. Hong Kong, on the other hand, has positioned itself as the number one place for fine wine from Bordeaux representing 5% in volume and 18% in value of all Bordeaux exports in 2011 (Le Monde, 2012). It has further positioned itself as the fine wine gateway to China with a 82% re-exportation rate of French wines to mainland China (Beaujard, 2014).

Several factors are responsible for the intensified interest in fine wine and the increase in fine wine consumption in China. An increased economic and political openness has led the population to adopt traits from Western lifestyles. At the same time, Chinese government policies have altered consumer behaviour by favouring healthier red wine consumption as opposed to traditional rice wine. Finally, a better education and stronger income has led to the emergence of a newly educated and wealthy class which is fond of fine wine (Sun, 2009). Furthermore, fine wine has not only grown into a popular consumption good but has also turned into a gift of predilection and an alternative investment among wealthy Chinese. According to Forbes magazine, wealth held by the 100 richest Chinese totalled 376 billion USD in 2014 which constitutes an increase of 121% since 2009. Over the same period, the number of millionaires rose by 189% to 2.4 million inhabitants. This strongly growing affluent class has discovered luxury goods and collectibles as a mean to differentiate itself and to convey its new status to the outside world. It thus favours prestigious objects such as iconic Bordeaux wines and has led Chinese and Hong Kongese (Ultra) High Net Worth Individuals to put 17% respectively 14% of their total wealth into collectibles in form of jewellery, art, precious metals and fine wine (Barclays, 2012).

[1] Throughout the paper the term China and Chinese refers not only to the People's Republic of China but also to the Special Administrative Regions of Hong Kong and Macau.

The wine market caters to different customers and their needs and thus ranges from relatively cheap bulk wine for everyday consumption and which can be found in most supermarkets to fine wine that is more expensive and rare to source. In this paper and in line with literature on wine, we concentrate on fine wine which displays specific features. It foremost has to display a secondary market, typically auctions, on which the bottles can be exchanged after their initial release (Masset and Weisskopf, 2013). For a wine to effectively appear repeatedly on the secondary market it should ideally present three criteria: it should have the ability to improve in bottle and thus show an important aging potential; it should emanate from a well-known wine-growing region and have a long standing history and reputation; it should have been awarded high scores by experts (especially Robert Parker) or be high-standing in an official classification. Overall, this favours the most iconic Bordeaux wines.[2] Especially the most iconic wines from the Medoc, Pomerol and St. Emilion have established a strong reputation over the last century, are at the top of their respective official classifications and are continuously well-rated by different experts. The fine wine universe thus becomes relatively narrow. According to Milner (2011) investable fine wines are restricted to the 25 best Bordeaux wines and a minority of wines from other regions. He further indicates that 95% of Liv-ex[3] turnover is from Bordeaux wines and more than half of it is concentrated on the five first growths of the Medoc. Masset and Weisskopf (forthcoming) confirm that wine funds predominantly invest in the most iconic Bordeaux wines. We, therefore, believe that analysing these prestigious wines from Bordeaux correctly represents the world market for investable fine wine.

In this paper, we first describe the interest of Chinese for fine wine from Bordeaux across the last decade and the concurrent evolution of Hong Kong into the major place for wine auctions. We show that the demand for Bordeaux fine wines has strongly increased over the last decade and that the abolition of excise duties in Hong Kong has favoured the creation of a fine wine hub catering for the growing Chinese demand. We then construct fine wine indices over the period 2007-2014 using a hedonic pricing approach and hammer prices from five global auction houses over the fourteen most iconic Bordeaux wines. The resulting indices are used to examine the existence and evolution of a fine wine price premium at Hong Kong auctions. We find a 19% premium for fine wine sold at Hong Kong auctions as compared to other auction locations. We argue that the emergence of the premium is the outcome of a strong demand and the specificities of the fine wine market. The strong latent demand for fine wine in China and Hong Kong has

[2] Appendix 1 gives a graphical overview of the Bordeaux region and appendix 2 an introduction on some of the important characteristics of the Bordeaux fine wine market.

[3] The London International Vintage Exchange (Liv-ex) is an internet-based trading platform for fine wine that was founded in 1999. It has established itself as the premier source for wine trading and indices.

been coupled with certain difficulties in sourcing these wines at the beginning of the millennium. The opening of the market in Hong Kong and the reduction in excise duties in 2008 has created the opportunity for Chinese consumers and investors to more easily source these fine wines. This has led to a sudden surge in demand for these wines in Hong Kong. At the same time, fine wine buyers trade an emotional asset on a segmented market with different auction places and facing information asymmetries and high transaction costs. Wine prices thus can vary relatively strongly from one auction place to another over longer time periods without reaching an identical price. We further show evidence that the price premium is not uniform across wines. The premium is strongest for wines with the largest brand power or the best expert scores at levels between 20 and 25%. We attribute this phenomenon to the relative inexperience of market participants. Buyers have entered the market by purchasing those wines that have been most advertised or that deliver outstanding quality as evidenced by perfect expert scores. This is reinforced by a wish to convey a signal of status and refinement that is most easily reached by buying the most visible wines. Finally, we observe that the premium has been declining over time from 60% in 2008 to a stable level of around 15% since 2012. We argue that this is mainly due to the closing of the educational gap that leads buyers to consider a wider range of possible wine purchases. This is coupled to a clamp down on ostentatious behaviour and anti-fraud measures by the government and the appearance of fake wine bottles that has reduced demand for specific iconic fine wines.

Our article contributes to literature across several dimensions. First, this article sheds new light on price dynamics of real assets. Evidence on real assets such as collectibles (including fine wine) is so far limited but has gained in attention in recent years. Second, our study extends our understanding of the influence emerging markets, and here especially China, has on alternative investments. This paper is, to the best of our knowledge, the first to consider investments in fine wine from an emerging markets perspective. This constitutes an important aspect as many fine wine producers are entering or evaluating Asian markets as they believe these to have the most potential. Third, it examines the creation and evolution of a price premium of an alternative and emotional asset in an emerging market. This enables us to evaluate how the new and strongly growing demand for an asset can create price distortions on imperfect markets. After several years of continuing strong demand we believe to have enough data to correctly evaluate price distortion effects resulting from an information acquisition process in an emerging market. Fourth, unlike, previous papers we use a much deeper and more comprehensive dataset. So far the very vast majority of studies have concentrated on a single auction house and location. In this study we expand the geographical reach by analysing different market places in Asia, Europe and

North America. We also make use of data emanating from five global auction houses that dominate the market for fine wine auctions.

The remainder of this paper is structured as follows. The next section reviews the literature on wine investments. Section 3 describes the specificities of the Chinese market for fine wine and of auctions in Hong Kong. Section 4 specifies our hypotheses and section 5 the data. Section 6 describes the methodology while section 7 reports results. The final section concludes.

2 Wine as an investment

The first in-depth study on red Bordeaux wines by Krasker (1979) finds that wine does not perform significantly better than a riskless asset over the period 1973-1977. In a follow-up study Jaeger (1981) extends Krasker's sample period and reduces storage costs and observes that wine performs 16.6% better than US Treasury-bills. Di Vittorio and Ginsburgh (1996) analyse the price evolution of Medoc wines and the characteristics that drive wine auction prices. They find that between 1981 and 1985 wine prices increased by 75% but went down by 15% between 1985 and 1992. The most important characteristics driving wine prices are related to climatic conditions during the wine growing season and wine expert ratings. These results are confirmed by Jones and Storchmann (2001) who find that climate, Parker ratings, ageing of wine and scarcity all influence the quality and consequently the prices of Bordeaux wines. [4]

For the period 1986 to 1996, Burton and Jacobsen (2001) analyse red Bordeaux wines which yield returns of 7.9% p.a. over the period as opposed to 13.5% for stocks and 5.8% for T-bonds. This poor result is further reduced by the presence of insurance and storage costs, liquidity issues and the difficulty to obtain some wines. Fogarty (2007) argues that wine returns have been understated in previous papers due to three aspects. First, investors can identify and will invest in quality wines and vintages and not in poor vintages (these are however included in most studies). This corroborates evidence on the influence of climate and expert ratings as described above. Second, investors are interested in after-tax profits. Wine investments are tax-exempt in several countries which constitutes a reduction in costs. For financial assets such as bonds and stocks, on the other hand, taxation is non-negligible. Third, risk-return profiles should not be compared pair-wise but in a financial portfolio framework. As most investors hold different assets, the

[4] Several studies have looked in more detail at the influence of different characteristics on wine prices. See for example, Ashenfelter et al. (1995) for the impact of climate, Cardebat et al. (2014) and Masset et al. (2015) for the influence of experts and ranking or Hadj Ali et al. (2008) for Robert Parker's influence. Storchmann (2012) gives a good overview of the wine economics field and its advances thus far.

benefits of adding wine to a portfolio and its impact on portfolio risk and return should be analysed.

First evidence of wine in an investor's portfolio was published by Sanning et al. (2008). They study the risk-return relation for equities and Bordeaux wines. In line with other studies, they observe that wine outperforms stocks and only has a low exposure to market risk factors which is beneficial in terms of portfolio diversification. Masset and Henderson (2010) find that average returns and volatility are attractive for Bordeaux wines. However, the results strongly depend on vintage, rating and ranking of the wine. In a portfolio framework evidence suggests that Bordeaux wines are relatively uncorrelated with stock markets and should therefore be included in a portfolio. Kourtis et al. (2012) study wines from different world regions and confirm results with correlations offering significant diversification benefits to investors. Masset and Weisskopf (2010) show that wine from different French, Italian and US wine regions outperformed the US stock market while displaying a lower volatility. At the same time, wine generates positive alphas and lower betas in a CAPM framework. Focusing on the economic crisis of 2001-03 and the financial crisis of 2007-09 results are even more favourable for wine. Looking at a conditional CAPM framework alphas and betas are shown to be time-varying. Though wine is not correlated to equity markets it is affected by the economy. In a final step, Masset and Weisskopf analyse the impact of wine on portfolio performance. The inclusion of wine is beneficial for a financial portfolio. Once again this is most pronounced during crises. Recently, Fogarty and Sadler (2014) caution investors on the true benefits of wine for portfolio diversification purposes. They argue that benefits may be spurious depending on the index construction and diversification measurement methodology employed. In a recent article Dimson et al. (forthcoming) study fine wine returns over a very long time period, from 1899 to 2012. They show that fine wine has offered a real rate of return of 5.3% per year versus 5.2% for equities. Considering transaction and insurance costs wine returns decrease to 4.1% and thus it underperforms equity. Therefore, fine wine delivers returns close to those from equities and higher than those from other collectibles. Their findings further indicate that wine correlates positively with stocks using a total beta approach. This stands in contradiction with Sanning et al. (2008), and is explained by the use of a long time period and yearly instead of monthly returns.

3 The place of Hong-Kong and China on the wine market

3.1 China and fine wine – a turbulent affair

The discovery of tartaric acid in amphorae dating back 5'000 years, gives evidence that the history of alcohol fermentation is ancient in China (McGovern, 2009). Its importance has, however, had ups and downs through successive dynasties. First grape viticulture dates back to the Han dynasty (206BC – 220AD) and was brought back from Central Asia to the attention of the Emperor who started large scale cultivations (Black, 2006). Wine quickly became a favoured consumption good, was offered at shrines and used for celebratory occasions (Nishijama, 1986). After the Han dynasty, grape wine fell into oblivion and only resurfaced 400 years later during the Tan dynasty (618-907AD). It was once again the emperor (Tang Tai Zong) that took up wine making practices from Western provinces leading to a renewed enjoyment of wine (Zhengping, 2011). Over the next millennium the popularity of wine continued to vanish and resurface to finally re-establish itself as a European import in the late 19th century. 1892 marks the beginning of the modern Chinese wine industry with the establishment of China's first modern vineyard under the name of Zhang Yu Wine Company which continues to exist until today. After the foundation of the People's Republic of China the wine industry witnessed a decrease in interest once again. Large scale production and wine consumption only slowly picked up again in the 1970s with the launch of the Economic Reforms and the opening towards outside countries.

Over the last two decades, the traditional consumption of rice and millet wine has slowly been substituted by red wine as favoured beverage. This shift can be attributed to the positive health connotation of grape wine in China (Deadman (2005); Lee (2009)) and the decision of the Chinese government to favour wine to safe keep grain for food production (Thorpe, 2009). Wine colour and taste is an important purchase criterion (Balestrini and Gamble, 2006). Chinese consumers dislike strong, bitter or acid tastes which explain the predominance of red wines (85% of the market) over white wines (Dewald, 2003). Furthermore, the colour red is considered as a sign of celebration and happiness in the Chinese culture (Liu and Murphy, 2007). This has led to a strong position for red grape wines. Following an increase in consumption of 175% to 1.87 billion bottles between 2005 and 2013 China has become the world leader in red wine consumption, ahead of France and Italy (OIV, 2014) and is also far ahead of any other Asian market (Anderson and Wittwer, 2013).

The accession of China to the WTO in 2005 has spurred imports of wine due to a decrease from 43% to 14% in custom duties. Economic factors, such as the rural exodus with its ensuing

access to more expensive goods, or the increase in wealth has spurred fine wine consumption. The interest and enjoyment of foreign wines has become especially prominent in the largest cities (Shanghai, Beijing, Shenzhen, Guangzhou or Hong Kong) in which a mix of expatriates, western-educated Chinese and an open-minded population can be found (Mitry et al. (2009); Lee (2009)). The relatively new curiosity in fine wine has led to a vacuum in wine knowledge which has made packaging, labelling and marketing efforts key to successfully selling wines. This has strongly favoured and consolidated the position of Bordeaux fine wines in China. Their producers (especially Lafite) were some of the first to enter the Chinese market at the beginning of the 1990s and with the help of French wine exporting associations have managed to cement their reputation and position as wine of predilection. As a consequence, imports of wine bottles have risen by more than 400% to 289 million litres over the period 2008 to 2013 with France accounting for a market share of around 53% (Geffroy, 2014).

Alcohol purchase and consumption at social or business events or as gifts is ancient, and culturally grounded (Liu and Murphy, 2007). The serving of prestigious wines at events is considered a mark of respect and generosity towards guests and conveys a signal of prosperity and status (Balestrini and Gamble (2006); Somogyi et al. (2011)) which both are at the core of Chinese culture. Thus, Chinese consumers are primarily seeking wine purchases that are able to convey these two messages. The country of origin of wines consequently becomes an important decision variable. Brand aware Chinese consumers are therefore looking for iconic fine wines that convey a sense of sophistication (Yu et al. (2009); Xu et al. (2014)). Overall, consumption choices of fine wine in China is geared towards wines based on colour, brand name and reputation rather than price (Camillo (2012); Liu and Murphy (2007)). This has strongly favoured sales of Bordeaux fine wines over the last decade. Recently, however, consumption patterns have started to evolve based on an increase in wine knowledge and a willingness to discover other wines regions. For example, fine wines from Burgundy and Italy have enjoyed increased popularity with their respective market shares growing from 1.2 to 6.8% and 0.9% to 3.3% between 2010 and 2013. However, both remain far behind fine Bordeaux wines with a market share of 83% in 2013 (Tsang, 2013).

3.2 Hong Kong – the gateway to China

The emergence of Hong Kong as the Asian marketplace for fine wine and wine auctions can be traced back to the abolition of excise duties on wine in February 2008. Soon after this regulatory change all major auction houses have started to open subsidiaries and to conduct wine auctions in Hong Kong. Acker Merrall & Condit, Christies, Bonham's and Zachys all initiated

wine auctions in 2008, followed by Sotheby's in 2009. Hong Kong has quickly established itself as a major venue for wine auctions representing a 11% market share in 2008 and becoming in 2010 already the largest place for wine auctions totalling a global market share of 48% and a turnover of 165 million USD.

The Hong Kong auction market has not only grown in size but has also gained in maturity and expertise. It has been able to attract some rare wine collections (such as the cellar of the El Bulli restaurant in 2012) and has consistently been able to sell 100% or close to 100% of proposed lots. It thus has also been able to fetch some of the highest sales prices. As an example, during an auction in 2010 more than 2'000 bottles of Lafite Rothschild emanating directly from the Chateau were sold by Sotheby's in Hong Kong. At the same auction three bottles of Lafite 1869 were bought by an unnamed Asian investor for HKD 1.8 million (or USD 233'000) each (Goldberg, 2010). This example and other evidence on Hong Kong wine auctions illustrate the passion Asian customers have shown for fine wine in recent years. This has led Asians and especially Chinese to be almost the sole buyers at Hong Kong wine auctions. For example, in 2013, 99% of all lots sold by Sotheby's in Hong Kong went to Asian customers (Lister, 2014). This circumstance is further evidenced by a 82% re-exportation rate of French wines from Hong Kong to China (Beaujard, 2014). The wine trade with China has been further facilitated by simplified customs rulings with Shenzen in 2010.

Hong Kong is, however, not only of importance for sourcing fine wine but also works as an opinion leader for large cities in mainland China. Hong Kong shares many similarities with China but has had a longer wine consumption history. It has the largest wine consumption per capita in Asia and due to its central location has established itself as the Asian hub for wine expositions (such as Vinexpo) and wine education. Growing Chinese visitor numbers have increased wine sales as travellers bring back wine bottles to China and make Chinese tourists face better wine education and choices. Hong Kong has further constructed a premium image for fine wines as purchasing in Hong Kong has a luxurious image for products that are not widely available in China. It was, for example, a Hong Kong company (Remy Fine Wine) that introduced Lafite Rothschild to mainland China over 20 years ago.

4 Hypotheses

Based on the evidence on the market for fine wine we derive three hypotheses that intend to analyse the influence the high Chinese demand and the specificities of the market have on Hong Kong auction prices.

Hong Kong wine auctions have strongly gained in size and attraction since 2008 as a response to the strong latent demand for fine wine in China. Hong Kong is the natural gateway for these consumers due to its local proximity and the lower language barriers. Second, some producers have catered for the Chinese market by issuing special labels (Lafite Rothschild added the lucky symbol for 8 on some of its bottles) or launching marketing campaigns that have attracted wine buyers to purchase their wines in Hong Kong. Third, the abolition of excise duties has rendered the sale and purchase of wines in Hong Kong very attractive. At the same time, the fragmentation and high transaction costs on this market allow some market locations to display higher prices over a considerable time period as arbitrageurs cannot take advantage of the price discrepancies and thus prices cannot converge. This strong demand from Chinese consumers and the difficulty of uniform pricing on the market for fine wine have driven prices on the Hong Kong auction market upwards and decoupled them from those on other markets. We therefore hypothesise that

Hypothesis 1: fine wine sold at Hong Kong wine auctions commands a premium as compared to other auction places.

Consumers on most Asian markets have only recently discovered fine wine and are thus relatively uneducated in this respect. This leads to a herding effect of customers to purchase wines that display the largest brand power and to ignore wines that are less renowned. Bordeaux producers have been very reactive and have been the first to offer specific labelling and marketing campaigns geared towards their Chinese customers. This is coupled with the importance of Chinese customers to convey a sign of refinement and status that makes the most iconic wines the choice of predilection. For example, Lafite Rothschild has been regarded as the most popular wine in China. The reasons for its success range from its rank as first growth in the 1855 Bordeaux classification, consistent good expert scores, good marketing efforts by the producer to the easiness to pronounce its name (Robinson, 2008). We therefore posit that

Hypothesis 2: the Hong Kong premium is stronger for higher rated and visible wines.

This hypothesis is further split into two sub-hypotheses:

- **Hypothesis 2a:** the Hong Kong premium is stronger the higher the expert score of a wine.
- **Hypothesis 2b:** the Hong Kong premium is stronger the higher the brand power of a wine.

Over the last few years consumers have started to educate themselves in terms of fine wine which has led to an increase in the number of wine tasting courses and publications geared towards Chinese customers. This has not only led consumers to open up to other wine growing regions such as Burgundy, Italy or the new world but also to be more critical about their Bordeaux purchases. The coupling of inflated prices and the massive counterfeit of iconic Bordeaux wines have gradually modified habits. Many consumers do not want to be perceived as overpaying for a bottle of wine that ends up being a fake (Jones, 2013). Moreover, the anti-fraud campaign initiated by President Xi Jinping has led to a decrease in demand for the most visible wines. Both situations have made customers shift their purchases from the most iconic wines to other producers and wines. At the same time, the economic environment in Europe and the United States has stabilised and improved since 2009. This has had a positive influence on wine demand and prices on US and European auctions. We therefore argue that

Hypothesis 3: the Hong Kong premium has declined over time.

5 Data

The primary purpose of this study is to complement prior evidence on wine investments by studying the impact Chinese demand has had on the fine wine market. That is, we focus our attention on fourteen Bordeaux fine wines[5] and consider vintages from 1945 to 2009. These wines are among the finest and most sought-after in the world. Collectors, investors and wine funds allocate a substantial part of their portfolio into these wines. According to Liv-ex, they account for more than 80% of the fine wine market. Furthermore, the Liv-ex 50 index, a major wine index, tracks the evolution of these wines only. Similarly, more than 50% of the components of the Liv-ex 100 index (the "industry's leading benchmark") are made of these wines.

5.1 Presentation of the dataset

Our dataset covers auctions conducted between January 2007 and November 2014 and contains hammer prices for the 5 major global auction houses present in Hong Kong and on other auction places in the world.[6] More specifically, it consists of 94,494 lots representing a total

[5] These wines include Angelus, Ausone, Cheval Blanc, Haut Brion, Lafite Rothschild, Lafleur, Latour, Margaux, Mission Haut Brion, Mouton Rothschild, Pavie, Petrus, Le Pin, Yquem.

[6] Acker Merrall & Condit (New York, Hong Kong), Christie's (New York, London, Hong Kong, Los Angeles, Paris, Amsterdam, Bordeaux, Chicago, Geneva, South Kensington), Sotheby's (New York, London, Hong Kong), Zachy's (New York, Hong Kong, Los Angeles, Las Vegas), Bonham's (London, Hong Kong).

of 869,029 bottles (only 0.75l) for a value of 707 million USD. The hammer price includes the relevant buyers' premium for the auction house but is exclusive of sales taxes or VAT. We only consider homogeneous lots, i.e. lots that consist of exactly identical wines (same château and vintage).

Our sample contains 14 producers and 56 vintages that lead to 711 unique wines (i.e. 711 unique château-vintage couples). One of the peculiarities of fine wines and in particular Bordeaux wines is that their quality varies significantly from one vintage to another. In order to account for differences in quality among the various châteaux and vintages, we have gathered scores of Robert Parker who is considered the most influential wine expert. His scores are reported on a scale that goes from 50 to 100 points. For instance in the Pomerol appellation, vintage 1998 was considered extraordinary with an average score of 96 points while 1999 was more demanding and barely above average yielding a score of 88 points. The example of two wines from the dataset further illustrates the impact a vintage has on wine prices and scores. Petrus 1998 and Petrus 1999, while being produced by the same château, are qualitatively different wines selling for different prices. In 2013, 27 lots of Petrus 1998 (score of 98) were sold for a median price of 3'267 USD while for Petrus 1999 (score of 94) only 21 transactions occurred for a median price of 1'793 USD. We have score information for 92'160 transactions (representing 97.5% of all transactions). The average Parker score is 94.72 and the median score 95 points.

We further have information on the number of bottles in a lot (on average 9) and whether they are still in their original wooden case. The number of bottles is an important piece of information as it may influence the selling price due to an imbalance of supply and demand. Bottles in an original wooden case (OWC) should sell at a higher price as it lowers the uncertainty on storage conditions and reduces the risk of buying a counterfeit wine.

5.2 Descriptive statistics

In Table 1, we report the median price, the number of lots sold and the turnover per châteaux for Hong Kong auctions and worldwide auctions ex-Hong Kong. This table illustrates several interesting specificities. These fine wines trade at prices that are high but not necessarily uniform. We see a hierarchy with Le Pin and Petrus from Pomerol being the most expensive wines due to their relative scarcity on the market. These are followed by the first growths of the Medoc such as Lafite Rothschild or Latour. We also find that all wines trade at higher median prices in Hong Kong than in the rest of the world. On average the premium amounts to around 40% with Yquem displaying the lowest premium (8%) and Ausone the highest with 86%.

< Insert Table 1 here >

Hong Kong represents 30% of all trades but 45% of total turnover at wine auctions once again suggesting that wines in Hong Kong were on average sold for higher prices. Lafite Rothschild and Mouton Rothschild are the most traded at auctions in Hong Kong and in the world and represent together a third of the market. This is due to the larger number of bottles produced at Mouton Rothschild and the strong popularity of Lafite Rothschild over the period. Turnover figures show that Lafite Rothschild, Mouton Rothschild and Petrus have shown the highest sales accounting for more than 50% of total turnover. Furthermore, Lafite Rothschild has seen a large surge in demand in Hong Kong with its turnover there being as high as in the rest of the world.

Table 2 shows the median price, number of lots sold and the turnover per vintage for Hong Kong auctions and for worldwide auctions ex-Hong Kong. The turnover and number of sold lots demonstrate that some vintages, such as 1982 or 2000 attract more interest from collectors and investors than others, like 1981 or 1999. This is mostly due to differences in quality. Other exceptional vintages include 1945 (excellent and also highly symbolic as it corresponds to the end of WWII), 1959, 1961 and, more recently, 1990, 2005, 2009 and 2010. These vintages of outstanding quality also trigger higher median prices. For instance, the price for a bottle of 1945 or 1947 was above 2'000 USD, while wines from 1980 or 1984 traded on average for less than 250 USD.

< Insert Table 2 here >

Turning to Hong Kong we find that every single vintage yielded a premium as compared to the rest of the world. It was thus possible to sell these wines at a higher median price on the Hong Kong market. Evidence also suggests that turnover and number of lots per vintage is relatively similar in Hong Kong as compared to other auction locations. The best vintages were again sold the most but turnover for more recent vintages (2003-2009) were slightly higher in Hong Kong but similar or slightly lower for all other vintages. This indicates that Hong Kong customers were relatively more attracted by recent vintages.

Table 3 shows the median price, the number of observations and the turnover for each auction house and location. We observe that the importance of the different auction houses depends on the location. Christie's and Sothebys dominate the European market and account for nearly a quarter of worldwide turnover. In the United States, competition is more dispersed with Zachy's and Acker Merrall & Condit being largest followed by Christie's and Sothebys. On the Hong Kong market it is especially Acker Merrall & Condit and Sothebys that dominate with Christies and Zachy's being a bit smaller. In Europe and Hong Kong Bonham's has established itself as a boutique auction house that is smaller than the classic four wine auction houses. We further find that median prices were highest in Hong Kong followed by North America and Europe and that the Hong Kong market displayed a 45% market share by turnover.

< Insert Table 3 here >

Turning to the sample period we find that the Hong Kong market evolved from inexistence in 2007 to the largest market with a 60% market share by 2011. Prices also varied depending on the year in the sample period. On all three markets we evidence highest prices realised in 2010 and 2011 followed by a decline over the remaining 3 years. We further observe that in the United States Acker Merrall & Condit and in Asia Christie's and Acker Merrall & Condit yielded the highest median prices. In Europe, the three auction houses alternately led to highest prices. A premium at Hong Kong auctions is present for each auction house but varies depending on the auction house. Christie's has sold wines at a 79% higher price on average as opposed to Acker Merrall & Condit with a 10% premium.

6 Methodology

Fine wine is different from stocks, bonds or other asset classes. It does not have any cash-flows and trades on a complex, fragmented and illiquid market. Consequently, most wines are not exchanged regularly at auctions. These features need to be accounted for, or else they may induce biases in index construction.

A variety of methods can be used to estimate wine indices. In practice, wine index providers use a composite index technique, which is based on the weighted average price of the wines included in the index. The simplicity of this approach makes it convenient from a practical viewpoint. In academic research, most authors use hedonic regressions (see Jones and

Storchmann (2001) and (Fogarty, 2006)) or repeat-sales regressions (see Burton and Jacobsen (2001), Masset and Weisskopf (2010), Dimson et al. (forthcoming)). The two approaches deal with the heterogeneity of the traded wines and the lack of liquidity on the wine market.

In the present study, we use the hedonic regression approach as it uses all observations (not only repeat-sales transactions) and controls for a variety of wine and transaction-specific attributes influencing auction prices. Our sample, composed of relatively liquid and homogeneous wines, ensures that the number of observations per explanatory variable is high, leading to precise and robust inferences. This approach follows the assumption that the price of a bottle of wine depends on its attributes and the implicit value attached to each of them. The generic form of our hedonic regression for a specific lot *i* is:

$$p_i = \beta_0 + \sum_{j=1}^{J} x_{ij}\beta_j + \varepsilon_i \quad [1]$$

Where p_i is the natural logarithm of the price of lot $i = \{1,2,\dots,N\}$; X is a matrix, whose row i contains information about the attributes of lot i. These attributes include explanatory variables that are specific to the wine auctioned such as the name of the producer, the vintage and the expert score, but also distinctive variables such as the presence of an original wooden case or the number of bottles in a lot. In order to take the temporal evolution of prices and specificities of auction venues into consideration we extend equation [1] with two matrices of explanatory variables *D* and *Z*.

$$p_i = \beta_0 + \sum_{j=1}^{J} x_{ij}\beta_j + \sum_{t=1}^{T} D_{it}\theta_t + \sum_{k=1}^{K} Z_{ik}\gamma_k + \varepsilon_i \quad [2]$$

D is a matrix of dummies, whose row i column t takes the value 1 if wine i has been traded in period t and 0 otherwise. The coefficients associated to this matrix, pooled into vector θ, correspond to the natural logarithms of the index levels at the various dates $t = (1,\dots,T)$. Thus, a wine price index can be built on the basis of the exponential of these coefficients, $\exp(\hat{\theta})$, where $\hat{\theta}$ are the fitted regression coefficients from [2]. Z is a matrix of dummies, whose row i column k takes the value 1 if wine i has been traded at a specific auction house and location and 0 otherwise.

We consider five specifications, based on equation [2], which include a common set of explanatory variables and an interaction term for each specification to verify the three hypotheses. The first specification focuses on the premium for wines sold at Hong Kong auctions and is used to test hypothesis 1. The second to fourth specifications are more detailed as they assess the influence of expert scores and brand power on the Hong Kong premium. They will be used to test hypothesis 2. Finally, the last specification is used to test the possible decline of the Hong Kong premium as explained in hypothesis 3. Table 4 contains the list of variables used for each specification. We hereafter provide details and explanations on each variable.

< Insert Table 4 here >

A. Variables specific to the wine auctioned

We consider variables such as château, vintage, rating, number of bottles and the existence of an OWC. The purpose of these variables is to control for price differences among the various wines that have been auctioned. It is for instance known (Ashenfelter et al., 1995) that climatic conditions in the Bordeaux region vary from one vintage to another, thereby leading to important quality and price differences. In a similar vein, some châteaux may benefit from a better terroir (natural endowments), wine-making facilities or enjoy a stronger reputation, resulting in higher prices (Malter, 2014). In order to account for the quality of each château in a particular vintage, we resort to Robert Parker scores. Wines with low Parker scores often attract less attention from collectors and investors. Robert Parker is widely considered as the most knowledgeable Bordeaux expert (see Jones and Storchmann (2001), Masset et al. (2015)). He uses a range of scores from 50 to 100 points and based on this classifies wines into different categories. Consequently, a wine with scores between 50 and 59 is categorised as below average, 60-69 denotes average wines, 70-79 points designate above average to very good wines, 90-95 outstanding wines and finally 96-100 indicate extraordinary wines. We use standardised scores in our empirical specifications.[7] We also use Robert Parker squared scores in our specification as the relation between wine quality and price might be non-linear with highest-scoring wines selling at especially high prices.

The same wine proposed at the same auction venue may lead to different hammer prices. We therefore include two additional variables in the five specifications. We first add a dummy variable that takes value 1 if the auctioned wine comes in its original wooden case (OWC) and 0

[7] We standardise by subtracting the average score from original scores and dividing this by the standard deviation of scores.

otherwise. Wines in their OWC tend to trade at higher prices as the presence of the original case reduces the risk of buying a counterfeit. The second variable is defined as the number of bottles in a particular lot. This variable controls for the negative relation one would expect between the number of bottles auctioned and hammer prices.

B. Variables specific to the auction venue

Apart from the wine itself, auction characteristics may affect hammer prices. For instance, specific tax regimes, fee structures or shipping costs may lead to substantial price differences between auction houses and locations. Moreover, some auction houses enjoy a better reputation than others. In order to control for such effects, we include dummies for each of the five auction houses and three locations in the model. We further add dummies for each month over the period January 2007 to November 2014 to construct our indices.

Finally, we add an additional specific variable for specifications 2 to 5 to test our different hypotheses. To test hypothesis 2 we control for the impact wine visibility and quality has on the Hong Kong premium by following three separate specifications. In the first, we add an interaction term between Parker scores on the Hong Kong premium. In the second, we use interaction terms to evaluate the château-specific impact on the premium. In the third, we interact the Hong Kong premium with brand power of a château as indicated by Liv-ex to gauge whether brand visibility influences prices. To test hypothesis 3 we use dummy variables to estimate a time-varying Hong Kong premium in specification 5.

7 Results

7.1 Fine wine prices and the Hong Kong premium

Table 5 reports results on the coefficient estimates of specification 1. Findings are described for all auctions in the world, for the world ex-Hong Kong and solely for Hong Kong. The two sub-samples not only indicate that the coefficients and the model are robust but also allow us to obtain more information on the specificities of Hong Kong wine auctions. Over the 14 châteaux we only find Ausone and Lafite Rothschild to have a higher coefficient in Hong Kong than in the rest of the world. Cheval Blanc, Mission Haut Brion and Yquem are relatively cheapest in Hong Kong. The very low coefficient for Yquem can be explained by the aversion of the Chinese palate to sweet wines which makes them difficult to sell. Turning to the coefficients for the different auction houses it appears that globally auction houses are able to sell wines at relatively similar

levels with the exception of Bonhams that sells wines at lower prices than its competitors. In Hong Kong, however, Christie's is able to sell wines at higher prices than all other auction houses. This can be due to the higher visibility and reputation of Christie's that is also auctioning other collectibles and has a longstanding history.

< Insert Table 5 here >

The other coefficients are in line with previous evidence. The higher the number of bottles per lot the lower the price due to the imbalance of supply and demand. Many more people want to sell a wine but the demand is not absorbing it at a single auction. Wines in their original wooden case sell at higher prices due to a reduced probability of counterfeiting and better storage. Results on Parker scores are also in line with higher Parker showing better quality and thus leading to higher prices on average.

Figure 1 illustrates the vintage effect of fine wine. We take 1945 as reference as it yields the highest prices in the dataset. We observe that 1947 and 1949 have similar prices but that prices for all other vintages show, sometimes significantly, lower levels. We further notice that price levels strongly depend on vintage quality. In line with prior evidence and common perception vintages such as 1959, 1961, 1982, 1989 or more recently 2000, 2005 and 2009 yield high prices. This is due to two phenomena. First, these exceptional vintages are normally sold on the primary market ex-châteaux at higher prices than poorer vintages. Second, the aging and reselling potential of these wines are much more pronounced and thus constitute a more interesting purchase for collectors or investors. Finally, we see that price levels are robust irrespective of auction location.

< Insert Figure 1 here >

Figure 2 tracks the evolution of three wine indices over the sample period. The continuous line takes all observations into account, while the densely dashed line looks at Europe and North America and the more interspersed dashed line at Hong Kong. In general, we observe that the wine market displays an upturn between 2007 and the end of 2010 with price levels doubling. Since 2011 prices appear to have turned and show a more negative trend. We also see that Hong Kong auctions appear to be more volatile with four clear peaks during the period. Especially the

September 2010 peak is high showing the strong exuberance on the Hong Kong market around that time. It has also heralded the start of the decline on the fine wine market.

< Insert Figure 2 here >

The total sample used in Table 5 allows us to further test the occurrence and amplitude of a Hong Kong premium on fine wines. We find that over the period 2008-2014 fine wines sold at Hong Kong auctions yielded a significantly positive premium of 19.72% (exp(0.18)-1). This confirms hypothesis 1 in which we claim that the latent demand by Chinese customers coupled with the abolition of excise duties in Hong Kong has led this market to become the gateway to China. The lasting existence of this premium over six years further indicates that arbitrageurs were not able to profit from the situation and to make prices converge in the medium-term. The higher intercept in specification 1c for the Hong Kong market further indicates that wines were on average priced more highly on this auction place which further validates hypothesis 1.

7.2 Wine visibility and the Hong Kong premium

Table 6 reports results for specifications 2 to 4. We argue that the Hong Kong premium is not uniform and will depend on the château, wine quality and its brand power. On a relatively new market with consumers who have only a limited background on fine wine it seems natural that buyers try to find indicators to guide their purchases. In a first step, we therefore analyse in more detail the impact Robert Parker has on wine prices. As he is considered the premier authority on Bordeaux wines with a strong track-record since the 1970s he should be the premier source for potential buyers wanting a better understanding of which wines to purchase.

In specification 2 we add interaction terms between Parker score categories and the Hong Kong premium to our initial model. The score categories are based on the official categories used by Robert Parker and range from 50-79 points being average to below average to 100 representing perfection. We find a U-shaped relation with the highest premium on wines that either have very low scores (50-89) or a perfect 100 points. The premium for the 100-point wines indicates that buyers put a high price on the symbol of perfection and that owning a 100-point bottle is conveying a strong signal of status. This is reinforced by the lower coefficient for the nearly perfect wines with a score of 99 points. For the low scores the lack of wine knowledge may induce buyers to believe that the brand is more important than the quality of a vintage. Knowledgeable buyers will know that, for example, Lafite Rothschild is an excellent wine but also

that a poor vintage has an effect on aging potential or on resale value that makes it less worthwhile a purchase. On an emerging market, in which status and signals are more important, buyers will purchase the most prestigious brands and might be satisfied with poorer vintages as they are cheaper but still convey a status signal. This lends support to hypothesis 2a.

< Insert Table 6 here >

In a second step, we analyse the impact each Chateau individually has on the Hong Kong premium. Specification 3 therefore adds an interaction term between the Hong Kong premium and each château to the baseline model. We find that Yquem displays a negative coefficient reinforcing the notion that sweet wines have a difficult time selling in Asia. The most positive premium is found for Lafite and Mouton Rothschild on the left bank and for Ausone and Le Pin on the right bank. For the two Rothschild wines visibility may explain the result. Especially Lafite Rothschild was the first producer to actively advertise its wines in China and has until today a privileged position on this market. For Ausone and Le Pin its scarcity and low transaction volume as evidenced in Table 1 may explain the premium. Overall, it appears that wines that can convey a strong signal of status and refinement are favoured. This is both achieved through the scarcity of a wine or through its visibility on the market and supports hypothesis 2b.

In a final step, we analyse the influence of brand power on the premium using specification 4. For this, we interact the Liv-ex Power 100 that annually ranks wines according to their brand power with the Hong Kong premium. We argue that those châteaux with the strongest brand will be most visible and should therefore convey more easily a message of refinement, wealth and status. The negative interaction term indicates that the higher a wine is ranked the higher the premium becomes. This shows that the development of a brand, especially on markets with low product knowledge, is important for producers to increase demand. This strongly favours the sales of Lafite and Mouton Rothschild that display the highest rank but penalises wines such as Cheval Blanc or Lafleur with a relatively low ranking. This validates hypothesis 2b that higher visibility leads to a higher premium.

7.3 The decline of the Hong Kong premium

Figure 3 illustrates results of specification 5 in which we add interaction terms between the Hong Kong premium and the time of sale. We further fit a polynomial model of degree 3 to

estimate a temporal trend.[8] We argue that the Hong Kong premium is not uniform across time. First, the economic and financial recovery in Europe and North America has led to higher demand for fine wine on these two continents. Second and more importantly, the Hong Kong market has evolved over the sample period. It progressed from a market in which fine Bordeaux wines were finding buyers very easily to a market in which buyers become more wine-educated and want to discover new producers and wine regions. The launch of the anti-corruption campaign by President Xi Jinping has further put a damp on the most conspicuous wine brands. Finally, the strong increase in fake bottles of Bordeaux fine wine, especially for Lafite Rothschild, has also had a negative effect on auction results for these wines.

< Insert Figure 3 here >

Figure 3 demonstrates that the premium varies through time and displays a very large increase for one Hong Kong auction in October 2010 in which the buyer's frenzy pushed the premium to 90%. This peak coincides with the very strong and high priced sales of Lafite wines mentioned in section 3.2. The estimated trend gives a clearer idea and shows that the average premium is indeed declining through time in an inverse logarithmic manner. It has strongly declined between 2008 and 2010, the years wine auctions were first conducted in Hong Kong and a true frenzy broke out on fine wine in this part of the world and which led to a 60% premium. It has since 2012 stabilised at a premium of around 15%. This order of magnitude once again hints at a somewhat higher demand in Hong Kong and China but also at high transaction costs that do not make prices converge and the premium disappear. This confirms hypothesis 3.

7.4 Robustness tests

To verify the robustness of the results obtained in the previous sections, a series of tests are performed.[9]

1. **Impact of outliers:** the presence of the peaks in the indices suggests that outliers could be driving some of the index coefficients. In order to control for the impact of outliers on the coefficient estimates, we identify the 1% highest residuals in absolute terms and redo the

[8] The polynomial model of degree 3 is used as an example. Results using a model of degree 2 or 4 yield very similar results.

[9] Detailed results are not reported here but are available from authors upon request.

regressions without the corresponding observations. The indices and results are not significantly altered.

2. **Definition of the reference price:** auction dynamics present specificities (demand-supply imbalance; declining price anomalies) that can bias the use of auction hammer prices. We thus want to ensure that the definition of the price does not impact results. We rerun the regressions employing median prices (by wine, auction date, place and house) instead of taking hammer prices individually. Overall results remain qualitatively similar.
3. **Impact of auction houses:** results in Table 5 indicate that the price differential of wines sold at Christie's as compared to other auction houses is more important in Hong Kong than on other auction markets. It is therefore possible that Christie's auctions are driving the premium on the Hong Kong market. To alleviate this possible bias we re-estimate all regressions without Christie's auctions. We find that Christie's is able to profit from its reputation and consequently displays the highest average premium in Hong Kong with 34%. All other auction houses, however, also display strong and significant positive premia of between 12 and 23%. The premium is a phenomenon that remains valid across the whole Hong Kong market and is not driven by a single auction house.
4. **Impact of wine age:** the age of wine is not directly associated to its visibility but it is indirectly influencing the notion of rarity as older wines tend to appear less often at wine auctions. In order to control for this effect we use specification 3 and add an interaction term between the Hong Kong premium and wine age. The premium remains positive and significant across all age categories, but it appears to increase the older a wine gets. This suggests older wines yield an additional rarity premium.

8 Conclusion

Hemingway wrote that wine "has been brought to the greatest perfection, and it offers a greater range for enjoyment and appreciation than, possibly, any other purely sensory thing". Wine is regarded as an experience good that has to be tasted to be fully appreciated but it is also considered a passion investment whose price has considerably appreciated over the last decade. Both attributes related to the absence of cash-flows leads wine prices to be tributary to the purest form of offer and demand. The latent demand and recent surge in interest for fine wine in China has led to the emergence of new consumers that want to experience wine and invest in their passion. This has had a non-negligible influence on the structure of the wine market and wine prices.

In this paper we have analysed the existence and evolution of a price premium on the Hong Kong auction market as compared to the North American and European markets. Our study is based on an extensive set of auction hammer prices covering Bordeaux fine wines sold over the period 2007-2014 at five different auction houses around the world. Using a hedonic regression approach which relates auction prices to wine attributes we find evidence that wines sold on the Hong Kong market triggered a 19% premium. We argue that the emergence of the premium is the outcome of a strong latent demand from Chinese customers and the incapacity to conduct arbitrage strategies on the wine market due to its specificities and complexity. We further show evidence that the price premium is not uniform across wines. The premium is strongest for the most visible wines. We attribute this phenomenon to the relative inexperience of market participants. Buyers have entered the market by purchasing those wines that have been most advertised or that deliver perfect quality due to their high expert ratings. This is reinforced by the wish to convey a signal of status and refinement that is most easily reached by buying the most visible brands or the best graded wines. Finally, we observe that the premium is declining over time. We argue that this is mainly due to the closing of the educational gap that leads buyers to consider a wider range of possible wine purchases. This is coupled to a clamp down on ostentatious behaviour and anti-fraud measures by the government and the appearance of fake wine bottles that has reduced demand for specific iconic fine wines.

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Table 1
Median price, number of lots sold and turnover per château

Château	Region	Rank	Worldwide (without HK)			Hong-Kong (only)		
			Median Price	Nobs [in %]	Turnover [in %]	Median Price	Nobs [in %]	Turnover [in %]
Angélus	St-Emilion	1A	203	1.5%	0.44%	290	0.4%	0.21%
Ausone	St-Emilion	1A	447	1.3%	0.87%	833	0.7%	1.02%
Cheval Blanc	St-Emilion	1A	436	4.9%	3.27%	620	2.2%	2.47%
Haut Brion	Pessac-Léognan	1gcc	397	7.3%	4.64%	542	3.2%	3.36%
Lafite Rothschild	Pauillac	1gcc	825	11.5%	13.16%	1'119	5.7%	12.11%
Lafleur	Pomerol	NC	605	1.3%	0.95%	655	0.8%	0.90%
Latour	Pauillac	1gcc	528	8.4%	6.42%	839	3.7%	5.57%
Margaux	Margaux	1gcc	491	8.0%	5.23%	650	3.4%	3.85%
Mission Haut Brion	Pessac-Léognan	NC	408	3.2%	1.74%	552	1.6%	1.43%
Mouton Rothschild	Pauillac	1gcc	386	11.2%	7.31%	576	4.4%	5.27%
Pavie	St-Emilion	1A	182	1.6%	0.49%	288	0.6%	0.29%
Pétrus	Pomerol	NC	1'553	5.5%	8.00%	2'225	2.4%	6.99%
Le Pin	Pomerol	NC	1'546	0.7%	0.90%	2'002	0.5%	1.03%
Yquem	Sauternes	1sup	400	3.4%	1.53%	435	0.9%	0.57%

1gcc denotes First Growth (1855 classification); 1A denotes First Growth A (St-Emilion, 2012 classification) and NC represents "non-classified" wines.

Table 2
Median price, number of observations and turnover per vintage

Vintage	Worldwide (without HK)			Hong-Kong (only)		
	Median Price	Nobs [in %]	Turnover [in %]	Median Price	Nobs [in %]	Turnover [in %]
2009	790	0.2%	0.2%	856	0.2%	0.4%
2008	490	0.5%	0.4%	577	0.5%	0.6%
2007	368	0.5%	0.3%	459	0.3%	0.3%
2006	434	0.7%	0.4%	527	0.7%	0.7%
2005	705	1.7%	1.7%	784	1.6%	2.3%
2004	345	1.3%	0.7%	423	0.9%	0.8%
2003	484	2.7%	2.1%	650	2.4%	3.0%
2002	351	1.5%	0.8%	472	0.7%	0.6%
2001	398	1.7%	1.0%	553	0.9%	0.8%
2000	937	4.8%	6.1%	1'162	3.4%	6.8%
1999	357	1.9%	1.1%	451	0.7%	0.6%
1998	405	3.0%	2.2%	555	1.6%	2.0%
1997	292	1.2%	0.6%	395	0.3%	0.2%
1996	589	4.0%	3.4%	780	2.1%	3.0%
1995	410	3.8%	2.4%	529	2.1%	2.3%
1994	287	1.4%	0.7%	415	0.3%	0.3%
1993	284	1.0%	0.5%	366	0.2%	0.2%
1992	317	0.4%	0.2%	571	0.1%	0.1%
1991	275	0.3%	0.1%	421	0.0%	0.0%
1990	706	4.2%	4.0%	916	1.9%	3.2%
1989	629	3.6%	3.4%	1'046	1.5%	2.7%
1988	357	2.0%	1.0%	453	0.4%	0.4%
1987	270	0.4%	0.2%	421	0.0%	0.0%
1986	647	3.6%	3.1%	850	1.4%	2.0%
1985	401	1.9%	1.0%	476	0.5%	0.4%
1984	242	0.2%	0.1%	369	0.0%	0.0%
1983	434	1.9%	1.1%	523	0.4%	0.4%
1982	1'127	5.9%	8.7%	1'495	2.5%	7.0%
1981	273	0.7%	0.3%	421	0.1%	0.1%
1980	251	0.2%	0.1%	264	0.0%	0.0%
1979	276	0.7%	0.3%	781	0.1%	0.1%
1978	258	0.9%	0.4%	444	0.2%	0.1%
1977	273	0.1%	0.0%	457	0.0%	0.0%
1976	377	0.6%	0.3%	632	0.1%	0.1%
1975	460	1.3%	0.7%	833	0.3%	0.4%
1974	268	0.1%	0.0%	813	0.0%	0.0%
1973	266	0.2%	0.1%	464	0.0%	0.0%
1972	271	0.1%	0.0%	552	0.0%	0.0%
1971	351	0.4%	0.2%	1'015	0.1%	0.1%
1970	309	1.3%	0.6%	559	0.3%	0.3%
1969	283	0.1%	0.0%	740	0.0%	0.0%
1967	1'020	0.4%	0.2%	1'161	0.1%	0.1%
1966	412	0.8%	0.4%	625	0.2%	0.1%
1964	424	0.4%	0.2%	865	0.1%	0.1%
1962	592	0.3%	0.1%	774	0.0%	0.0%
1961	1'653	1.1%	1.1%	2'511	0.3%	0.8%
1959	1'708	1.0%	0.8%	2'316	0.3%	0.6%
1957	467	0.1%	0.0%	840	0.0%	0.0%
1955	939	0.5%	0.2%	1'562	0.1%	0.1%
1953	945	0.3%	0.1%	1'501	0.1%	0.1%
1952	666	0.2%	0.1%	1'260	0.1%	0.1%
1950	848	0.1%	0.1%	1'749	0.0%	0.0%
1949	1'670	0.4%	0.2%	2'845	0.1%	0.2%
1948	1'202	0.1%	0.1%	1'821	0.0%	0.0%
1947	2'057	0.5%	0.4%	4'433	0.1%	0.3%
1945	2'468	0.7%	0.8%	3'848	0.2%	0.6%

Table 3
Median price, number of observations and turnover per year, auction house and location

Panel A: North America	Christie's			Zachy's			Acker Merrall & Condit			Sotheby's			Bonhams		
	Median Price	Nobs [in %]	Turnover [in %]	MP	N%	T%	MP	N%	T%	MP	N%	T%	MP	N%	T%
2007	500	0.8%	1.0%	658	2.1%	1.7%	687	1.8%	1.3%	498	1.5%	1.6%	466	0.6%	0.2%
2008	420	1.5%	1.5%	510	2.5%	1.5%	726	1.6%	1.0%	403	1.2%	1.0%	555	0.5%	0.2%
2009	360	1.3%	0.8%	500	1.7%	1.0%	581	0.8%	0.4%	378	0.6%	0.4%	436	0.2%	0.1%
2010	669	0.8%	0.8%	733	1.6%	1.3%	732	1.3%	1.0%	655	0.8%	0.9%	550	0.3%	0.2%
2011	686	0.8%	0.8%	726	1.8%	1.2%	915	1.3%	1.2%	807	0.8%	0.9%	545	0.5%	0.3%
2012	699	0.6%	0.6%	610	1.8%	1.2%	738	1.2%	1.0%	613	1.0%	0.9%	595	0.3%	0.2%
2013	535	0.7%	0.5%	613	1.1%	0.8%	677	0.7%	0.5%	551	0.6%	0.5%	535	0.2%	0.1%
2014	510	0.6%	0.5%	561	1.0%	0.7%	823	0.5%	0.4%	473	0.5%	0.4%	595	0.2%	0.1%
All	500	7.1%	6.4%	605	13.5%	9.5%	718	9.1%	6.8%	527	6.9%	6.7%	506	2.8%	1.3%

Panel B: Europe	Christie's			Zachy's			Acker Merrall & Condit			Sotheby's			Bonhams		
	Median Price	Nobs [in %]	Turnover [in %]	MP	N%	T%	MP	N%	T%	MP	N%	T%	MP	N%	T%
2007	456	2.6%	2.2%							395	1.7%	1.3%	258	0.2%	0.1%
2008	395	1.9%	1.6%							405	2.0%	1.6%	442	0.3%	0.2%
2009	380	1.4%	1.0%							475	1.3%	1.0%	307	0.3%	0.1%
2010	499	1.6%	1.3%							487	1.6%	1.5%	533	0.4%	0.2%
2011	534	2.1%	1.9%							594	2.2%	2.2%	609	0.5%	0.4%
2012	488	1.9%	1.5%							498	1.5%	1.3%	535	0.4%	0.2%
2013	476	1.7%	1.3%							603	1.3%	1.2%	492	0.5%	0.3%
2014	489	0.7%	0.6%							461	1.8%	1.3%	487	0.4%	0.2%
All	465	13.9%	11.4%							484	13.3%	11.3%	492	2.9%	1.7%

Panel C: Hong-Kong	Christie's			Zachy's			Acker Merrall & Condit			Sotheby's			Bonhams		
	Median Price	Nobs [in %]	Turnover [in %]	MP	N%	T%	MP	N%	T%	MP	N%	T%	MP	N%	T%
2007															
2008	1'102	0.1%	0.2%	780	0.2%	0.3%	756	0.6%	0.7%				700	0.1%	0.2%
2009	972	0.3%	0.7%	625	1.0%	1.0%	781	0.7%	0.7%	846	0.4%	0.6%	537	0.1%	0.1%
2010	1'280	0.8%	2.0%	918	1.0%	1.4%	942	2.0%	3.1%	1'039	1.9%	3.9%	420	0.2%	0.2%
2011	1'024	1.7%	3.3%	989	2.3%	3.5%	915	2.5%	3.9%	1'033	1.6%	3.0%	676	0.2%	0.2%
2012	624	1.3%	1.5%	656	1.2%	1.3%	741	1.4%	1.9%	653	1.6%	2.0%	704	0.1%	0.1%
2013	781	0.6%	1.1%	724	0.8%	0.9%	682	1.3%	1.5%	889	0.9%	1.5%	724	0.1%	0.1%
2014	593	0.7%	0.9%	606	0.6%	0.6%	673	0.8%	0.9%	658	1.4%	1.7%	527	0.0%	0.0%
All	846	5.5%	9.9%	781	7.0%	9.0%	787	9.1%	12.6%	839	7.8%	12.7%	613	1.0%	0.9%

Table 4
List of variables used in the hedonic regression

Variables	Details	Used in specification				
		1	2	3	4	5
A. Variables specific to the wine auctioned :						
Château	Dummy variables for each Châteaux	×	×	×	×	×
Vintage	Dummy variables for vintages 1945 to 2009	×	×	×	×	×
Rating	Existence of a Parker's rating (dummy variable), Parker' score and score^2	×	×	×	×	×
OWC-12	Dummy variable to control if the wine is sold in the 12-bottle Original Wooden Case (OWC)	×	×	×	×	×
Quantity	Number of bottles sold in a particular lot	×	×	×	×	×
B. Variables specific to the auction venue :						
Auction house	Dummy variables for Acker Merrall & Condit, Bonhams, Christie's, Sotheby's, and Zachy's	×	×	×	×	×
Time of sale	Dummy variables for January 2007 to November 2014 (used to construct the index)	×	×	×	×	×
Auction location	Dummy variables for Europe, USA and Hong-Kong(*)	×	×	×	×	×
Hong-Kong premium × Parker score	Dummy variables to estimate the influence of Parker scores on the Hong-Kong price premium		×			
Hong-Kong premium × Châteaux	Dummy variables to estimate château-specific Hong-Kong price premia			×		
Hong-Kong premium × Châteaux' brand power	Interaction term to assess if the Hong-Kong price premium depends on the châteaux' brand power				×	
Hong-Kong premium × time of sale	Interaction terms (set of dummy variables) used to estimate a time-varying Hong-Kong premium					×

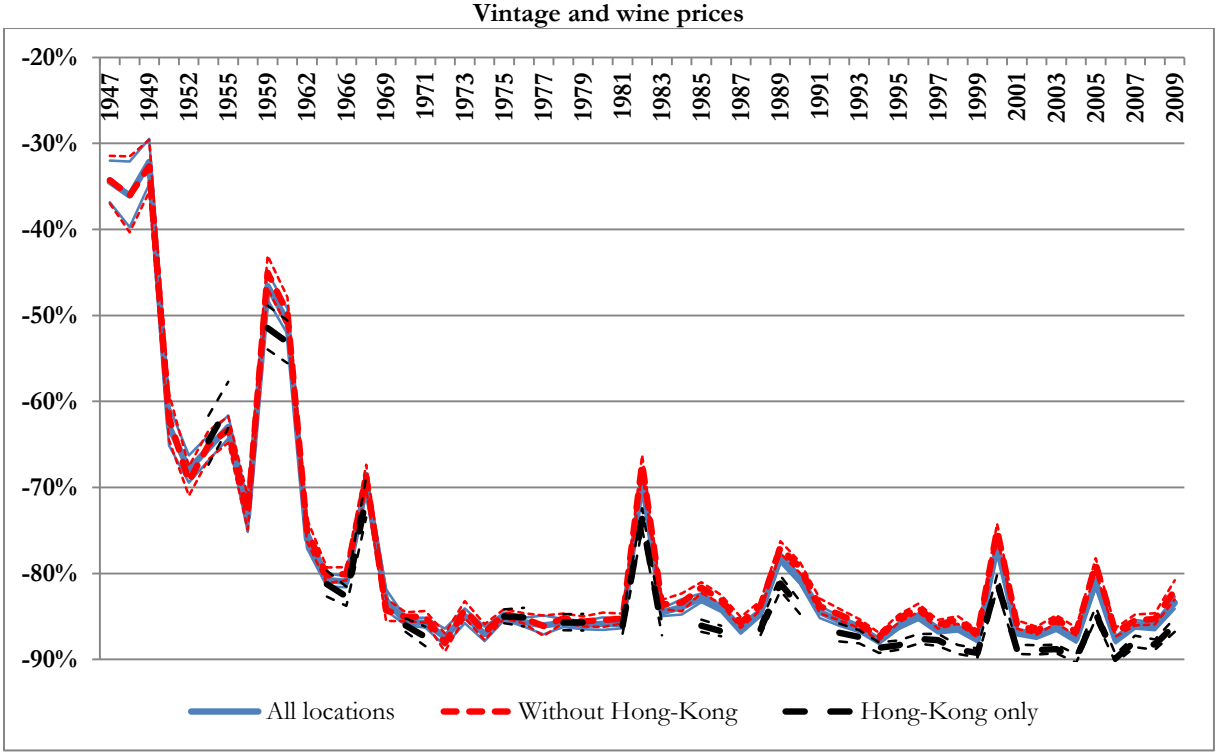
Note 1: we consider five particular hedonic regression specifications; the variables used in each specification are indicated in the column denoted as "used in specification".
Note 2: specification 1 is applied to three datasets. The first dataset includes all observations (1a), while the second includes observations from all auction venues except those in Hong-Kong (1b). The third uses only observations from auctions taking place in Hong-Kong (1c).
(*): the Hong-Kong dummy variable is used in specification 1 (it would be collinear with the other variables in specifications 2 to 5).

Table 5
The Hong Kong premium

	1a) All auctions		1b) Without Hong-Kong		1c) Hong-Kong only	
	Coeff.	**p-value**	**Coeff.**	**p-value**	**Coeff.**	**p-value**
Intercept	6.23	<0.01%	6.14	<0.01%	7.37	<0.01%
Ausone	1.05	<0.01%	1.01	<0.01%	1.09	<0.01%
Cheval Blanc	0.95	<0.01%	0.99	<0.01%	0.83	<0.01%
Haut Brion	0.75	<0.01%	0.77	<0.01%	0.69	<0.01%
Lafite Rothschild	1.37	<0.01%	1.34	<0.01%	1.38	<0.01%
Lafleur	1.22	<0.01%	1.25	<0.01%	1.13	<0.01%
Latour	1.01	<0.01%	1.02	<0.01%	0.98	<0.01%
Margaux	0.80	<0.01%	0.83	<0.01%	0.74	<0.01%
Mission Haut Brion	0.43	<0.01%	0.46	<0.01%	0.34	<0.01%
Mouton Rothschild	0.83	<0.01%	0.83	<0.01%	0.82	<0.01%
Pavie	-0.09	<0.01%	-0.10	<0.01%	-0.09	<0.01%
Pétrus	2.16	<0.01%	2.17	<0.01%	2.11	<0.01%
Le Pin	2.23	<0.01%	2.22	<0.01%	2.21	<0.01%
Yquem	0.64	<0.01%	0.70	<0.01%	0.43	<0.01%
Zachy's	-0.03	<0.01%	0.02	<0.01%	-0.17	<0.01%
Acker Merrall Condit	0.03	<0.01%	0.09	<0.01%	-0.09	<0.01%
Sotheby's	0.02	<0.01%	0.03	<0.01%	-0.05	<0.01%
Bonhams	-0.11	<0.01%	-0.08	<0.01%	-0.24	<0.01%
Europe	0.02	<0.01%	0.05	<0.01%		
Hong-Kong	0.18	<0.01%				
Quantity	-0.00	<0.01%	-0.01	<0.01%	-0.00	<0.01%
OWC-12	0.02	<0.01%	0.04	<0.01%	0.01	10.91%
Parker's rating?	0.51	<0.01%	0.49	<0.01%	0.50	<0.01%
Parker score	0.40	<0.01%	0.41	<0.01%	0.39	<0.01%
Parker score^2	0.04	<0.01%	0.04	<0.01%	0.05	<0.01%
Observations :	92538		63947		28229	
R^2 :	0.85	<0.01%	0.84	<0.01%	0.87	<0.01%

This table indicates results for specification 1. The reference (intercept) is Château Angélus 1945 sold in North America at Christie's in January 2007.

Figure 1
Vintage and wine prices



The figure is based on specification 1 and illustrates the prices of wines traded for each vintage in the sample. It includes 95%-confidence intervals.

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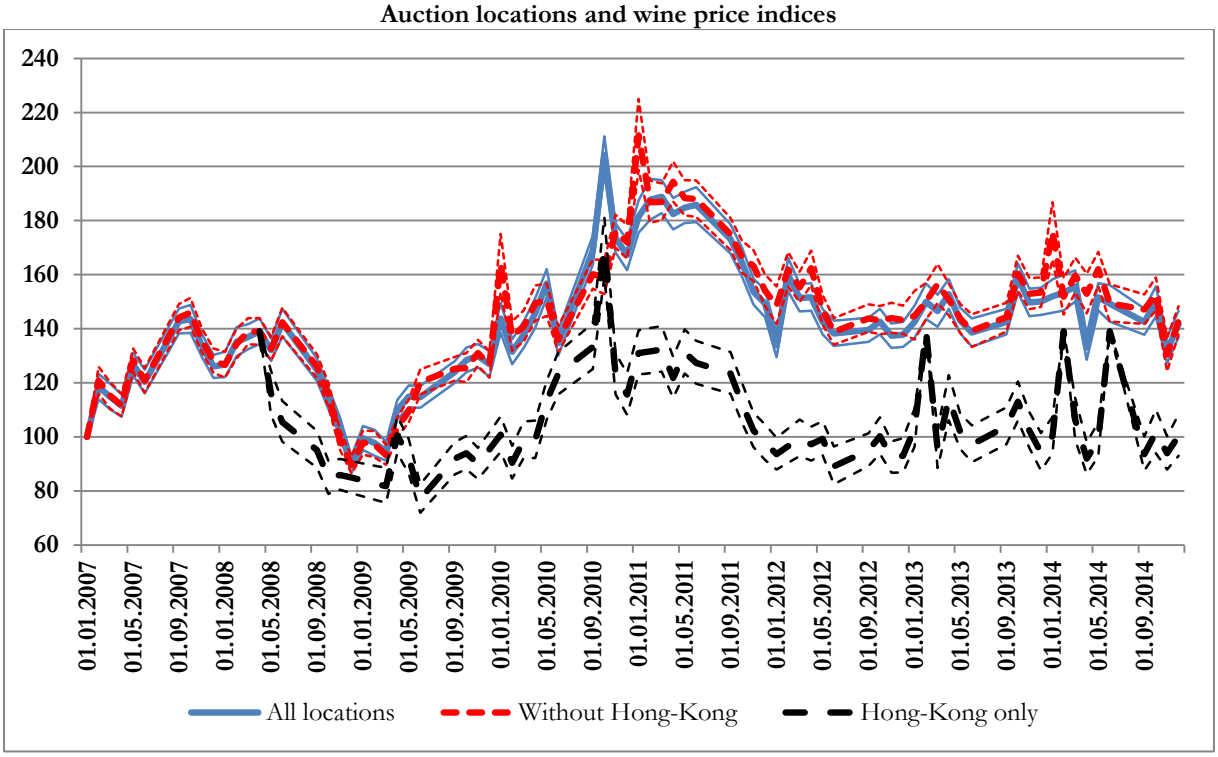
Figure 2
Auction locations and wine price indices



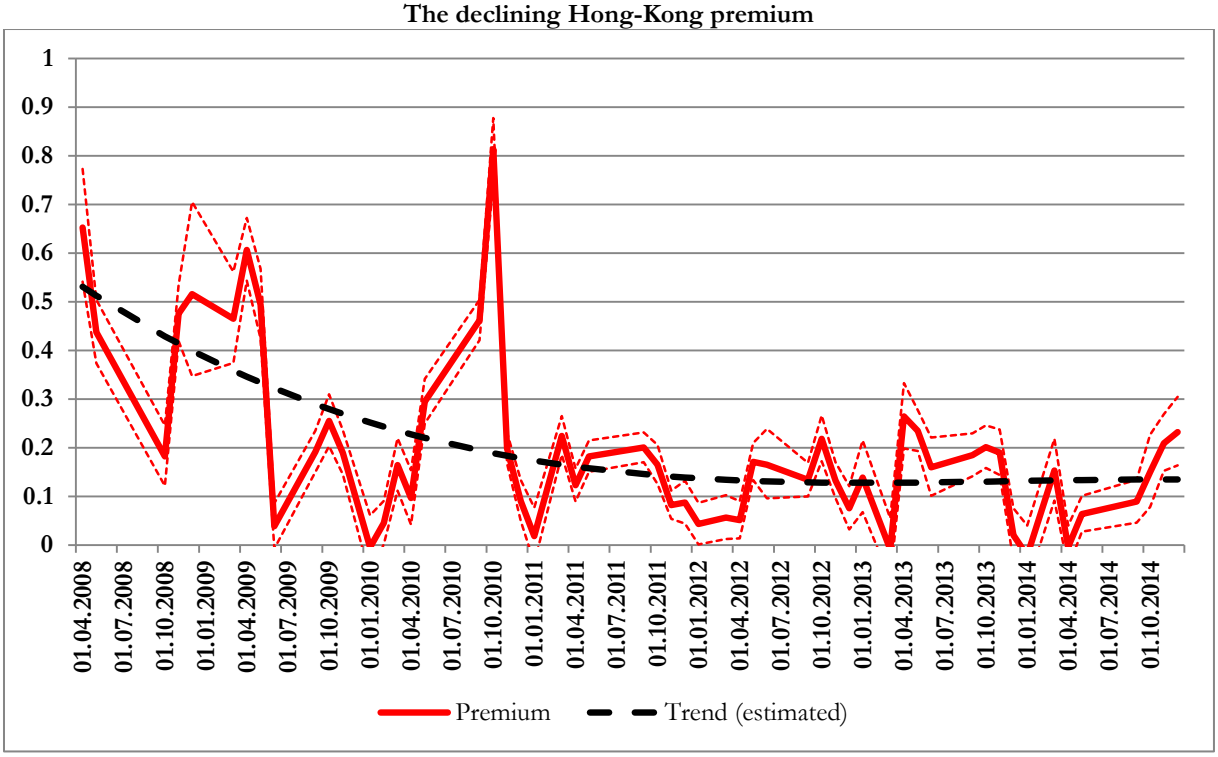
The figure is based on specification 1 and illustrates the evolution of wines traded at different auction locations. It includes 95%-confidence intervals.

Table 6
The Hong Kong premium and wine visibility

Specification 2			Specification 3			Specification 4		
Parker score	**Coeff.**	**p-value**	**Château**	**Coeff.**	**p-value**	**Brand power**	**Coeff.**	**p-value**
Not rated	0.355	<0.01%	Angélus	0.171	<0.01%	Hong-Kong	0.233	<0.01%
50 - 79	0.574	<0.01%	Ausone	0.288	<0.01%	Hong-Kong × Liv-ex rank	-0.006	<0.01%
80 - 89	0.320	<0.01%	Cheval Blanc	0.065	<0.01%			
90 - 95	0.187	<0.01%	Haut Brion	0.132	<0.01%			
96 - 98	0.112	<0.01%	Lafite Rothschild	0.263	<0.01%			
99	0.041	<0.01%	Lafleur	0.100	<0.01%			
100	0.205	<0.01%	Latour	0.198	<0.01%			
			Margaux	0.121	<0.01%			
			Mission Haut Brion	0.106	<0.01%			
			Mouton Rothschild	0.220	<0.01%			
			Pavie	0.168	<0.01%			
			Pétrus	0.196	<0.01%			
			Le Pin	0.203	<0.01%			
			Yquem	-0.015	26.15%			

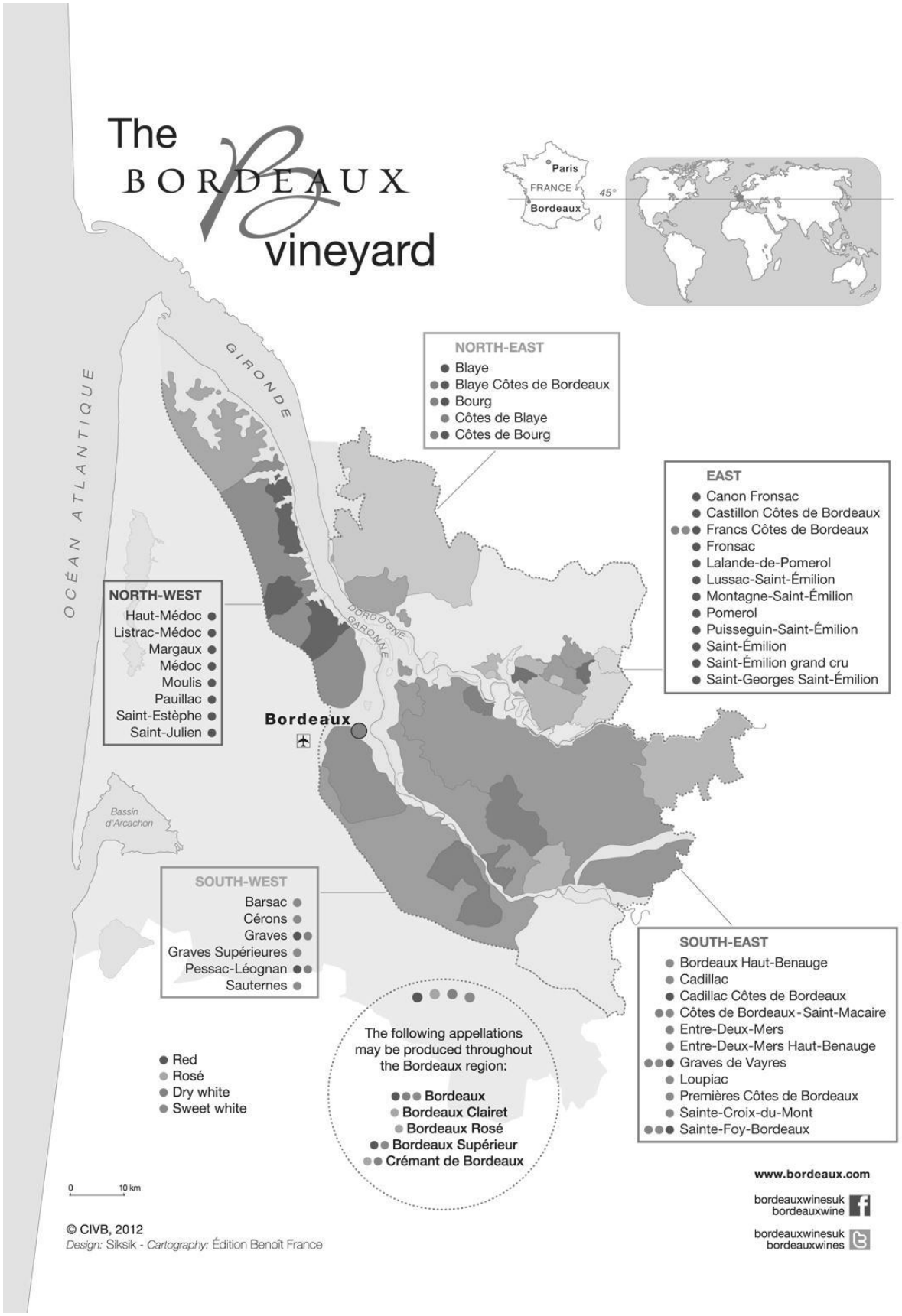
This table indicates results for specifications 2 to 4. The reference (intercept) is Château Angélus 1945 sold in North America at Christie's in January 2007. The coefficients that are common with specification 1 are not reported but are very close to those reported in Table 4.

Figure 3
The declining Hong-Kong premium



This figure illustrates results for specification 5. It includes 95%-confidence intervals. The trend was estimated using a polynomial model of degree 3.

Appendix 1


The BORDEAUX vineyard
Paris
FRANCE
Bordeaux
45°
OCÉAN ATLANTIQUE
GIRONDE
DORDOGNE
GARONNE
Bassin d'Arcachon
NORTH-EAST
Blaye
Blaye Côtes de Bordeaux
Bourg
Côtes de Blaye
Côtes de Bourg
EAST
Canon Fronsac
Castillon Côtes de Bordeaux
Francs Côtes de Bordeaux
Fronsac
Lalande-de-Pomerol
Lussac-Saint-Émilion
Montagne-Saint-Émilion
Pomerol
Puisseguin-Saint-Émilion
Saint-Émilion
Saint-Émilion grand cru
Saint-Georges Saint-Émilion
NORTH-WEST
Haut-Médoc
Listrac-Médoc
Margaux
Médoc
Moulis
Pauillac
Saint-Estèphe
Saint-Julien
Bordeaux
SOUTH-WEST
Barsac
Cérons
Graves
Graves Supérieures
Pessac-Léognan
Sauternes
SOUTH-EAST
Bordeaux Haut-Benauge
Cadillac
Cadillac Côtes de Bordeaux
Côtes de Bordeaux - Saint-Macaire
Entre-Deux-Mers
Entre-Deux-Mers Haut-Benauge
Graves de Vayres
Loupiac
Premières Côtes de Bordeaux
Sainte-Croix-du-Mont
Sainte-Foy-Bordeaux
Red
Rosé
Dry white
Sweet white
The following appellations may be produced throughout the Bordeaux region:
Bordeaux
Bordeaux Clairet
Bordeaux Rosé
Bordeaux Supérieur
Crémant de Bordeaux
0
10 km
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Appendix 2

Appellations

- Overall, the Bordeaux wine-growing region can be broadly divided into two distinctive parts: the left bank and the right bank of the Gironde River. The best known appellations for red fine wines are situated in the North-West (Medoc, Margaux, Pauillac, St. Julien, St. Estephe) for the left bank and the East (St. Emilion and Pomerol) for the right bank. For sweet wines the most prestigious wines emanate from the South-West (Barsac and Sauternes). Next to these most prestigious appellations several other appellations exist that constitute the 60 appellations of the Bordeaux regions.
-

Ranking:

- The Medoc & Pessac appellations have a ranking that is unchanged since 1855 (with the only exception of Mouton Rothschild which got promoted to first growth in 1973). Overall, it classifies the best 61 wines into first to fifth growths.
- St. Emilion has had a ranking since 1954 that is updated more or less every 10 years. The last update was conducted in 2012 with 72 wines categorised into first growth A (2) and B (13) and classified growth (57) wines.
- In Pomerol no official ranking exists, however, some wines have consistently shown superior quality such as Petrus, Lafleur or Le Pin.
- Sweet wines from Sauternes and Barzac are classified as First growth Superior (Yquem), first (11) and second (15) growths.