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Emmanuel Paroissien
and Michael Visser

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The Causal Impact of Medals on Wine Producers' Prices and the Gains From Participating in Contests*

Emmanuel Paroissien† Michael Visser‡

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Abstract

The objective of this paper is threefold. First, we estimate the causal effect of wine medals on producers' prices. Second, we calculate the expected profit obtained by producers from participating in competitions. Third, we investigate the efficiency of wine competitions by measuring to what extent the attributed awards are good quality indicators. Our dataset combines information on transactions between wine producers and wholesale traders (these data are registered by a wine broker who acts as a middleman in this market), with the records from eleven important wine competitions. Our identification strategy exploits a particularity in our data, namely that medals are not only awarded before the transaction dates but sometimes also thereafter. Under weak restrictions, a regression of price on dummies indicating past and future medals (plus controls) allows to uncover two interesting features: i) the difference in the respective dummy estimates identifies the causal effect of a medal, ii) the estimate of the future medal coefficient identifies the correlation between unobserved quality and medal. We find a strong medal impact: our preferred estimate indicates that producers of medaled wines can increase their price by 13%. The impact for gold is much larger than for silver and bronze, but we cannot reject that the correlation with quality is the same across the three colors. Only a minority of contests attribute medals that are significantly correlated with quality (primarily the ones founded a long time ago, and whose judges are required to evaluate relatively few wines per day). Our profit calculations show that the incentives to participate in wine contests are high.

Keywords: Medals; Prices; Quality; Wine competitions.
JEL classification: D22; D49; L15; L66.

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†LAREFI, University of Bordeaux and CREST, ENSAE, University of Paris-Saclay. Email: emmanuel.paroissien@ensae.fr.
‡CREST, CNRS, ENSAE, University of Paris-Saclay and CRED, University of Paris 2. Email: michael.visser@ensae.fr.

1 Introduction

There are many goods whose quality is unknown until actual consumption. For instance, a book's content is uncertain until the text is read. Similarly, a film's story is only revealed when it is seen in a movie theater, and the pleasure procured by a bottle of wine can not be judged before it is uncorked, smelled, and tasted. Producers of such so-called experience goods (Nelson (1970)) face the challenge that potential purchasers must somehow be informed about the *ex ante* unknown quality. To reduce the information asymmetry between consumers and producers, the latter can spend money on advertising and marketing. The movie industry, for example, devotes substantial budget resources to promote films before they are released to the public. Consumers themselves can also contribute to spreading product information by word-of-mouth: they speak with their friends and relatives about the latest music album they have listened, or add their personal opinion on on-line music blogs. In some cases (partial) information dissemination is mandatory because laws and regulations oblige firms to disclose features of their products. Wine producers (in France and in many other countries), for instance, are required to put on the bottle labels whether sulfites have been added to the wine during the fermentation process. Finally, hidden characteristics of goods may be revealed through awards attributed at competitions: literature lovers learn that the novel receiving the Man Booker prize is the jury's preferred one among the hundreds of new novels published each year, a signal for them that the winning book is likely of high quality. Movie fans can make analogous inferences regarding films awarded at the Oscar ceremonies or the Cannes festival.

The producers we study in this paper are Bordeaux wine makers, and for them there is basically just one way in which they can inform potential purchasers about the quality of their goods, and that is by participating in wine competitions (and win medals). One reason for this is that French laws either forbid or severely restrict the different forms of alcohol publicity. Local rules in Bordeaux also regulate what producers are allowed to write on the bottle labels. Furthermore, the wines we are analyzing are mostly still very young and unavailable to consumers, thereby limiting customer-to-customer transmission effects. But the main reason is that the focus of our study is not the top-end segment of the market (made up of a small number of world-famous châteaux like Latour, Haut-Brion, Margaux, Mouton-Rothschild, Yquem, etc.), but the vast majority of lesser known wines. Unlike the top-notch wines, they are not actively traded in auctions throughout the world, nor are they commented and evaluated by influential critics such as Robert Parker or Jancis Robinson. In the absence of these vehicles of information transmission, the less known clarets can only hope to differentiate themselves from their numerous competitors by winning awards. Anecdotal evidence suggests that medals have strong price effects. According to *La Revue du Vin de France* (issue 600, March 2006), a leading French wine magazine, winning a medal at a wine competition allows a producer to increase its price by between 10 and 15%; in the same vein, the organizers of the *Concours de Bordeaux*, the most important competition for Bordeaux wines, state that a gold medal from this contest allows the recipient to augment its price by up to 30%.[1]

Using new data on individual transactions from a large Bordeaux-based broker (containing information on

[1] See https://www.lenouveleconomiste.fr/lesdossiers/les-concours-14338 (downloaded May 2017).

contract dates, prices and quantities, and characteristics on producers and wines) that we matched with the records of eleven important wine competitions (winners by medal color, and contest features), this paper addresses three questions. First, what is the causal impact of medals on wine producers' prices? By answering this question we formally analyze whether the above claims match the empirical findings. Identifying the causal impact of awards is challenging because there are potentially unobserved quality determinants that affect both prices and the probability to win medals. A regression of the wine price on a medal dummy (indicating whether the wine has obtained a medal prior to the transaction) would then lead to an estimate confounding the true medal effect and the effect of unobserved quality. To circumvent this omitted-variable bias, we exploit an unusual feature in our data: among the prize-winning wines in the sample, about 19% received a medal *after* the transaction. The idea is now to regress the price not just on the before-transaction medal dummy, but also on a post-transaction medal dummy. It turns out that we can consistently estimate the causal impact by taking the difference in the two dummy estimates. Two relatively weak restrictions are required to obtain this identification result. One is that the post-transaction dummy must be irrelevant for explaining the expected price of wine, once we have controlled for unobserved quality, the before-transaction dummy, and possibly other control variables. Using the terminology of Wooldridge (2002), the former dummy is thus assumed to be redundant in the structural price equation. The other restriction needed is that in the projection of quality on the medal indicators, the corresponding two projection coefficients should be equal. Loosely speaking, we assume here that the quality of a wine is the same regardless of whether it receives a prize before or after the transaction.

Second, what are the expected profits that wine producers get from participating in wine competitions? Addressing this question requires the calculation of expected costs and benefits. The former are obtained using available information on the participation fees charged by competitions, the price of medal stickers, and the costs of transporting wine samples from Bordeaux to the contest venue; the latter are obtained using observed prices, transaction volumes, our estimates of the causal impact of medals, and different values for the probabilities of winning medals (we take both small and large values, and the empirical proportions of wines awarded in each contest). The contests in our sample are quite heterogeneous. Some of them are state-owned, while others are privately run ones, and they differ in prestige, the number of participants they attract, the entry fees, the proportion of wines being awarded, and the manner in which their juries evaluate wines. It is therefore of particular interest here to show our profit calculations separately for the different competitions.

Third, are juries making efficient choices in attributing medal awards? We answer this question simply by estimating the coefficients on the post-transaction medal dummies (to account for the diversity of the competitions described above, we include in the model a dummy for each contest). Under our identification restrictions, these coefficients can be interpreted as the partial correlation between quality and the medal dummies. Checking whether the judges of a given competition make decisions that are efficient and informative amounts then to testing whether the corresponding medal indicator is statistically significant.

The empirical literature on certification and quality disclosure has so far paid little attention to the price effect of awards. It has instead primarily focused on whether disclosure modifies the behavior of consumers and producers (see the survey by Dranove and Zhe Jin (2010)). We are aware of only a couple of papers that look at the impact of certification effects on prices. Wimmer and Chezum (2003) compare auctions of certified and non-certified race horses and find that the former are sold at higher prices. Dewan and Hsu (2004) study stamp auctions and document that buyer prices at eBay are lower than at a specialty stamps auction (where there is lower quality uncertainty). Lima (2006) finds that wines are more expensive when they have received medals from Californian tasting events. He does not, however, account for the possible endogeneity of medal indicators.

Two closely related papers, Hadj Ali et al. (2008) and Dubois and Nauges (2010), look at the effect of grades assigned by Parker on Bordeaux wine prices. To correct for the omitted-variable bias the first paper takes advantage of a natural experiment: in one year the critic did not evaluate the wines and producers had to set prices without knowledge of his opinion. The second paper tackles the problem differently by assuming that unobserved quality is a polynomial of observed scores. Grading by wine critics differs from contest certification in the sense that the decision to evaluate a given good is taken by the experts and not the producers themselves.

Our paper also contributes to a literature documenting that decisions taken by juries and evaluation committees are frequently influenced by factors unrelated to the quality of the objects being evaluated. Ginsburgh and Van Ours (2003) show that the random order in which pianists perform at the Queen Elisabeth competition affects their ranking. Redelmeier and Baxter (2009) find that students have a lower chance of getting admitted at the university of Toronto's medical school when interviews take place on rainy days. According to Goldin and Rouse (2000), the likelihood that female musicians get hired by symphony orchestras increases when juries use screens to conceal the gender of candidates. Our paper is also related to a series of articles showing that even highly experienced connaisseurs have difficulties in identifying and detecting the high-quality products under double-blind conditions. Fritz et al. (2012) find that professional violonists prefer new-technology violins over instruments by Stradivari and Guarneri del Gesu. Hodgson (2008) organized an experiment at a Californian wine competition in which judges had to evaluate fligths containing replicates of exactly the same wine. Only a small minority of judges were able to assign the same medal to the otherwise identical wines. Unlike these papers, we do not offer a direct test of the inefficiency of jury choices, but only an indirect one through the estimation of the post-transaction medal coefficients.

In Section 2 we briefly describe the Bordeaux wine market and the organization of the different contests. We also explain there what are the possible reasons for observing post-transaction medals in our data. Section 3 contains a descriptive analysis of our data. Section 4 describes our estimation method and in particular our identification strategy. Section 5 present the results, and Section 6 concludes.

2 Institutional setting

In Section 2.1 we briefly present the organization of the Bordeaux wine market and the role played by brokers. In Section 2.2 we describe how wine contests are organized, focusing on the eleven competition from which we retrieved the medal information. Section 2.3 explains why it is possible that post-transaction medals are observed in the data.

2.1 The Bordeaux wine market and the role of brokers

Nowadays there are roughly 7,000 individual wine producers in the Bordeaux region, including two or three hundred very prestigious and internationally acclaimed châteaux (retail price of more than 50 € per bottle), and a large majority of lesser known wine-makers. Most of these producers sell their wines not directly to retailers but to local wine wholesalers called *négociants*, of which there are currently about 300 in Bordeaux. The transactions between the producers and *négociants* are typically handled by brokery offices (there are approximately 80 of them). A wine broker is a middleman who facilitates the matching between producers and *négociants*. Contrary to the latter, brokers maintain a close relationship with the producers, by regularly paying visits to the wine estates and giving advice on all aspects of wine production. While a producer treats in most cases with two or three brokers, each broker deals with hundreds of different producers and *négociants*. The everyday job of a broker is to collect the demands of the *négociants*, each demand referring to a more or less specific quality, volume and price, and to find a suitable lot within his portfolio of producers. When a broker finds a lot that possibly meets a demand, he delivers a sample of the wine to the *négociant* for tasting. If quality is satisfactory, the precise terms of the transaction are negotiated by the broker separately with the producer and the wholesaler, the main issues being the price, the quantity and the delay before the wine is available and can be delivered. Based on a historical consensus, brokers are usually remunerated at 2% of the value of each transaction they conclude. Our transaction data come from one of the largest Bordeaux-based brokers. The volume of wine traded by this broker represents about 20% of the total volume handled by all Bordeaux-based brokers, and 10% of the annual production in Bordeaux.

Given the large number of suppliers, the Bordeaux wine market is very atomistic and competition is fierce, especially among the lesser known producers. Unlike the prestigious châteaux owners, they have few possibilities to alleviate the effects of this fierce competition and to differentiate themselves from their direct competitors.[2] One way to strengthen their market position is to join a cooperative winery.[3] This allows them not only to acquire more bargaining power vis à vis the brokers and the *négociants*, but also to share various fixed costs (e.g., the costs of harvesting machines) with other members of the cooperative. The wines are marketed under their own château names, but sales are coordinated and managed by the cooperation. The annual sale revenue is shared among the adherents depending on the quality and quantity of wine each one brought to the pool. This cooperative system offers numerous producers a form of protection while remain-

[2]Since the early 1990s French laws severely restrict publicity for alcohol products (it is forbidden on television and in cinemas, while it is limited on radio and in the written press). Wine producers belonging to the top-end quality segment benefit, however, from several types of indirect publicity. Many of them are classified (e.g., according to the 1855 classification of Médoc wines, or to the 1955 classification of Saint-Emilion wines), and the rankings are mentioned on the bottle labels. Furthermore, these high-flyers are actively traded at auctions throughout the world, and get extensive media coverage from influential wine experts who taste and grade their wines. In contrast, the less known châteaux have few opportunities to advertise their products: their labels are less informative (typically only the producer name and the appellation are mentioned), and these wines are neither sold at auctions nor evaluated by the influential experts. At best some of them get mentioned and recommended in wine guides.

[3]In 2016, about half of the producers took part in one of the 36 existing cooperative wineries.

ing somehow independent from each other. As mentioned in the introduction, the primary way for the less known wine makers to increase their market shares is to participate in wine contests and win medals.

2.2 Wine competitions

About 130 official wine competitions are held annually in France.[4] They are organized in early spring, allowing producers to vinify the wines of their latest harvest, and participate in the competitions soon thereafter. For historical reasons, many of these contests focus exclusively on wines from a specific region of France. For instance, the *Concours de Bordeaux* is only devoted to Bordeaux wines, and the *Concours des Ligers* only to wines of the Loire region. Other competitions, such as the *Concours Général Agricole*, are nation-wide and open to wines from the whole of France. Finally there are international contests open also to non-French wines, such as the *Challenge International du Vin*, held in Blaye, a city near Bordeaux.

Interestingly, the wine contests in France differ in many other respects as well. There is first of all variation in terms of the jury compositions. Most of the juries recruited in the French competitions are entirely made up of wine professionals (sommeliers, winemakers, oenologists, or *négociants*), but some contests deliberately choose to include amateur tasters as well. It is argued by the latter contests that amateurs have judgments which better reflect the tastes of everyday consumers, and that they are less prone to conflicts of interest than professionals. The contests also differ in the number of wines that each judge has to evaluate per day. This is an important issue because the accuracy of a judge is likely to decline with the number of wines that have to be tasted in a given amount of time. This is especially true if the judge is an amateur, which is perhaps why in general amateurs have less wines to taste than professional judges.

Yet another feature that distinguishes the competitions is their degree of selectivity, as measured by the share of wines that get awarded, and the proportion of medals attributed to each type of medal. Since 2013 French regulations prohibit contests to award more than 33% of the participating wines. Some competitions stick closely to this limit but others are more selective. The share of each type of medal also varies across competitions: some attribute for instance relatively few gold medals, while others completely ban bronze medals. Finally, the competitions vary in terms of the costs that have to be incurred by participants (participation fee, price of the medal stickers[5]), the selection of the samples,[6] and the procedures adopted by the juries to award wines. Regarding this last feature, although basically all competitions evaluate the wines in the same manner,[7] there is variation in the way judges choose winners. After evaluating the wines within a given flight, either all judges deliberate and agree orally on the laureates (attribution of awards by consensus), or they make their decisions based on the numerical grades assigned by each judge on a tasting grid (attribution

[4]Since 2000 about three new French contests have been launched each year, indicating that this is a profitable business.

[5]Medal winners who wish to disseminate this information to consumers have to pay the stickers that are put on the bottles.

[6]The samples are either chosen and sent directly by the producers, or the competition officials go to the châteaux themselves and pick the samples there. In the latter case the possibility of any manipulation of the samples is reduced.

[7]Seated at a table, the judges of a jury are served with flights of up to a dozen wines each. To the extent possible, the wines within a flight are of the same vintage and region, and the products are blind-tasted (except for the vintage and region the judges know nothing of the wines).

by scoring).[8]

For this paper we have collected data from eleven wine competitions. Nine of them are organized in France, and two abroad. These contests are arguably the most important contests where Bordeaux wines are allowed to compete, and taken together they are responsible for about 90% of the medals that these wines win each year. The eleven competitions (abbreviations in parentheses) are: the *Concours de Bordeaux* (BOR), a regional contest devoted exclusively to Bordeaux wines; the *Concours Mondial de Bruxelles* (BRU), a Belgian international contest held each year in a different country; the *Challenge International du Vin* (CHA), an international contest held in the Bordeaux region; the *Concours des Vignerons Indépendants de France* (CVI), a nation-wide contest only for individual and independent winemakers; the *Decanter World Wine Award* (DEC), a recent but large international competition organized in London by the Decanter magazine; the *Concours Mondial des Feminalise* (FEM), a recent contest that went international in 2015 and where all judges are women; the *Concours International de Lyon* (LYO), a recent international contest held in Lyon; the *Concours des Grands Vins de France à Mâcon* (MAC), an old national contest held in Mâcon; the *Concours Général Agricole* (PAR), the oldest and largest French wine contest, held in Paris; the *Vinalies Nationales* (VIN), a national contest where all judges are professional oenologists; the *Vinalies Internationales* (VII), the international counterpart of VIN.

Table 1 gives more details about these competitions (figures prevailing in 2016). Row 1 lists the year of creation of each contest. The most recently created ones are DEC, FEM, and LYO (about 10 years ago), while BOR and PAR are the two oldest ones, founded in respectively 1956 and 1870. Row 2 gives the scope of each competition. Six of them (including the two foreign competitions, BRU and DEC) are international and accept wines from all countries, four only accept French wines, and one only accepts wines from the Bordeaux region (BOR). Row 3 indicates whether the medals are granted by oral consensus or by scoring. BOR, CVI and PAR attribute the medals by consensus, and the rest of the competitions use a scoring process. Row 4 shows how the contest officials select the samples. BOR and PAR pick the samples directly in the tanks or barrels of the producers, and the other competitions have the samples sent directly by the producers.[9]

The number of wines evaluated in 2016 is given in Row 5. It varies from approximately 3,000 for VIN and VII to more than 16,000 for PAR. Row 6 gives the total share of awarded wines in 2016. All nine competitions held in France respect the 33% restriction: PAR is the most selective contest (24% of wines are awarded), and FEM the least (33%). For the two foreign competitions (recall that they are not concerned by this French regulation), BRU and DEC, the fractions are 30% and 59% respectively. The shares of each type of medal are listed in rows 7, 8, and 9. We see that BOR, FEM and LYO award relatively many gold medals (between 12% and 14% of the wines competing in these contests get gold), while DEC, VIN and VII are the ones that give few (between 3% and 7%). Three contests, BRU, LYO, and VII, give no bronze medals at all, while DEC attributes bronze to almost 40% of its participating wines. Finally, BRU and VII are the most generous with silver (respectively 19% and 22% of their wines get this medal).

[8] All wines with an average score above a certain threshold get a medal, and the higher the score the better the medal. The thresholds are mostly determined at the end of the competition so as to enforce the 33% rule.

[9] BOR and PAR are state-owned competitions, so that it is easier for them to find agents to visit the producers and collect the samples. The other competitions are organized by private firms or associations.

Table 1: Description of the eleven wine contests (figures for 2016)

	BOR	BRU	CHA	CVI	DEC	FEM	LYO	MAC	PAR	VIN	VII
Year of creation	1956	1994	1976	1990	2006	2007	2010	1954	1870	1982	1995
Scope	Region	World	World	France	World	World	World	France	France	France	World
Consensus or Scoring	C	S	S	C	S	S	S	S	C	S	S
Samples: Picked or Sent	P	S	S	S	S	S	S	S	P	S	S
# wines	3,804	8,570	4,162	5,904	15,869	3,817	5,800[a]	10,000[a]	16,754	3,050	3,500[a]
% medals	30%	30%	31%	25%	59%	33%	30%	30%	24%	27%	29%
% gold	12%	10%[m]	9%	9%	3%	13%	14%[m]	10%	10%	7%	7%
% silver	13%	19%	10%	10%	16%	11%	16%	7%	10%	12%	22%
% bronze	6%	0%	12%	7%	39%[m]	9%	0%	13%	4%	8%	0%
Jury composition	Pro.	Pro.	Mix.	Amat.	Pro.	Mix.	Mix.	Mix.	Mix.	Oen.	Oen.
# judges	1,000[a]	320	704	2,200[a]	133	700[a]	600[a]	2,080	3,227[f]	75[f]	133
# days	1	4	2	5	1	1	1	1	2[f]	2[f]	5
# wines/(# judges × # days)	3.8	6.7	3	2.7	13.2	5.5	9.7	4.8	1.6[f]	6.1[f]	5.3
Participation fee (€)*	70.8[+]	150-138	93-73	51.2	161	37.5	37	57.5	86-69	60	135-125
Sticker price (€/1,000)**	25-20	35-22	27-21	20-13	70-35	56-42	30-14	20	23-19	33.9	48

[a]: Approximate statistic.
[m]: The few grand gold medals awarded by BRU and LYO (in 2012 and 2013) have been merged with the gold medals. The medals with the mention "commended", awarded by DEC, have been merged with the bronze medals.
[+]: The medal winners must also pay an additional charge: 0.6/0.4/0.25 €/100L for a gold/silver/bronze medal.
[f]: PAR and VIN organize regional playoffs where 60% of participants were preselected for PAR and 30% for VIN. The figures are only for the national final.
*: If there are two entries the fees decrease with the number of wine samples sent by the producer, varying between high amount (first sample) and low amount (each additional sample).
**If there are two entries the marginal cost per 1,000 stickers depends on the quantity of stickers ordered, varying between the low amount and the high amount.

Row 10 indicates whether the jury is composed of wine professionals only (pro.), amateurs only (amat.), a combination of the two (mix.), or professional oenologists only (oen.). The juries of five competitions (CHA, FEM, LYO, MAC, and PAR) are mixed, and the juries of BOR, BRU and MAC are completely made up of professional judges; the juries of CVI are exclusively composed of amateurs, while those of VIN and VII only contain oenologists. Row 11 shows that the number of judges per competition ranges between 75 (VIN) and 3,227 judges (PAR), and row 12 that the contests in our sample lasted between 1 and 5 days. Row 13 gives, for each contest, the number of participating wines, divided by the number of judges times the number of days. Although this ratio does not exactly measure the number of wines tasted per judge on a given day (since each wine is typically evaluated by several judges),[10] it is a good measure of the difficulty of the task faced by judges. The ratio is smallest for PAR, and largest for DEC. Finally, the last two rows give the participation fees and the prices for the medal stickers of each competition. Both figures are reported before taxes. The entry fees are not that high and range between 37 € (LYO) and 161 € (DEC). The cost of 1,000 stickers varies between 20 (CVI, MAC) and 57 € (DEC). [11]

2.3 Rationale for post-transaction medals

Before turning to the descriptive analysis of the data we wish to explain why, for a substantial fraction of wines in the sample, medals are attributed *after* the transactions. This feature of the data plays an important role in our identification strategy, but may seem somewhat surprising and counterintuitive at first sight. Indeed, it is not clear what are the incentives for producers to participate in contests after having sold their wine. There are four possible reasons for the phenomenon. First, wine makers typically do net sell their total production in one shot, through one broker, but mostly via multiple brokers. It can then be rational for a wine maker to sell part of the production soon after the harvest (e.g., because cash is urgently needed), say in January, participate in the competitions in spring, and sell the rest once the contest outcomes are known, say in July. Assuming that the January sale was negotiated by the broker that shared its data with us, and that in addition a a medal was obtained, this wine maker would appear in our sample as having sold its wine before obtaining an award. Second, even for wine makers who sell their total output before the contests, it may be of interest to participate in contests not to win medals but to get feedback about the quality of their latest vintage (think of producers having introduced new vinification techniques). Third, *négociants* have the right to enter wine competitions with lots they have bought from the producers (some competitions forbid this practice), and, here again, this results in the latter showing up as receiving medals after the transactions take place. Fourth, a small fraction of the transactions take the form of written contracts between producers and *négociants*, stipulating that the latter pay a price-markup to the former in case medals are awarded between

[10] The number of judges tasting each wine varies across contests (and even within contests) and is unknown in the data. Taking 4 judges as (a reasonable) estimate, the ratio for CHA would imply that each judge in this contest tastes 12 wines per day.

[11] Some contests charge entry fees that decrease with the number of wine samples sent by the producer. BRU, for example, asks between 150 (first sample) and 138 € (each additional sample). Similarly, sticker prices may vary with the quantity demanded. If multiple entries are given in the table, it means that the marginal cost of 1,000 stickers varies between the lower and the higher amount.

the transaction date and the date of delivery/payment.[12] Such contingent contracts allow producers to sell their wines early in the season but nonetheless earn extra income in case they win prizes later on.

3 Descriptive Statistics

We have collected the records of our eleven wine contests for the years 2006 to 2016. For each contest and year we observe the date of the competition, the identities of all winners (i.e., the names of the châteaux and the names of the wine producers),[13] the color (bronze, silver, gold) of the medal received by each winner, and some additional competition characteristics (described in Table 1). The transaction data set made available to us by the broker covers the period 2005-2016. The broker excluded from the data all transactions regarding the elite châteaux mentioned in the previous section. Since these producers never participate in wine competitions, it is not problematic that they are discarded from the analysis. For each transaction we observe the exact transaction date, the volume of wine sold, the price of this volume, the vintage, the appellation, the type of packaging (bottled, bulk, or bottled when collected (BWC[14])), and the type of producer (individual wine maker, or wine maker belonging to a cooperative winery). From the initial sample we only kept the transactions corresponding to the 2005-2014 vintages, i.e., we excluded wines from 2015 and 2016, and those from 2004 and earlier.[15] We then matched the transaction and medal data sets on the identities of the wines, resulting in a sample of 16,399 observations.

Table 2 contains descriptive statistics on some of the main variables in our data set. The average price per 0.75 liters (the quantity contained in a standard bottle)[16] is 2.24 €, the minimum (resp. maximum) price is 0.05 € (40 €); 99% of prices are below 8.6 €/0.75L, and 90% below 4.9 €/0.75L, confirming that we are dealing here with the low-price segment wines. We emphasize that these prices are the ones paid by the *négociants*, final consumers pay about 30 to 40% more at retailers. The quantities sold through the broker are substantial: on average, producers sell almost 50,000 liters. Among wines which received at least one medal prior to the transaction, the average duration between the moment the medal is awarded and the transaction is almost 14 months (if multiple medals are attributed, we pick the one such that duration between these two moments is shortest). Among those awarded at least once after the transaction, the average duration separating the transaction and award is almost 8 months (in case of multiple awards we pick again the one such that the duration is shortest).

[12]The average delay between the signature of the contract and the date of delivery is about 100 days. Payment is due 60 days after delivery.

[13]Unfortunately we have no information on the contest losers.

[14]In Bordeaux, wines are not delivered by the producers but collected by the *négociants*. When a wine is not sold in bottles, either the *négociants* come with a truck and pump up the wine from the producers' reservoirs (bulk), or bottle the wines directly at the château using bottling trucks (BWC).

[15]Each year the eleven contests attribute prizes primarily to wines of the two latest vintages (for example, in 2012, BOR awarded 87% of its prizes to the 2010 and 2011 vintages). Given that our medal data base covers the years 2006-2016, this explains why it is sufficient to drop among the recent vintages only those from 2015 and 2016. Similarly, it explains why we need to exclude all wines from 2004 and earlier.

[16]This price is calculated as the ratio of total amount paid (in euros) and volume (in liters) times 0.75.

Table 2: Descriptive statistics

Variable	Mean	Sd. error	Min	Max
Price (€ /0.75L)	2.24	1.98	0.05	40
Volume (1,000L)	48.58	66.69	0.01	1,155.56
Delay between prior medal and transaction* (months)	13.92	14.63	0	89.9
Delay between transaction and future medal* (months)	7.97	9.28	0.03	103.11
Age (months)	18.86	17.11	0	129
Vintage	2009.6	2.76	2005	2014
Delay between transaction and delivery (months)	3.11	3.35	0	37.06
Type seller: Cooperative winery	0.17	0.37	0	1
Type seller: Individual wine maker	0.83	0.37	0	1
Type packaging: Bottled	0.24	0.42	0	1
Type packaging: Bulk	0.62	0.49	0	1
Type packaging: BWC	0.14	0.35	0	1
N		16,399		

*: If the wine obtained several medals before or after the transaction, we consider the medal for which the award date is closest to the transaction date.

The remaining variables in Table 2 act as our control variables in the empirical analysis.[17] The wine's age (month of transaction minus September of vintage year) is around 19 months on average, with a minimum of 0 months (corresponding to a wine sold during the harvest month) and a maximum of 129 months (almost 11 years). As explained above, the transactions in our data are chosen such that all wines are from the 2005-2014 vintages. Producers deliver their wines quickly after the transaction: on average the *négociants* receive the products slightly more than 3 months after signature of the contract. The large majority of wines (83%) are produced by individual wine makers, while the remaining 17% are made by wine makers who have joined a cooperative.[18] The last three lines indicate the type of packaging: 24% of wines are already bottled at the transaction date, 62% are sold in bulk, and 14% are BWC.

Table 7 in the appendix gives a cross-tabulation of the number of medals awarded before and after the transaction. We see that 13,298 wines in the sample have not won a medal at all in the eleven competitions. Among the 3,101 prize-winning wines (16,399-13,298), 2,711 got at least one medal before the transaction,[19] while 587 got at least one medal after the transaction. Note that there are wines that received multiple awards: for instance, 612 wines got two medals before they being sold, and 102 wines got awarded twice after the transaction date. Finally, there is a small number of wines that got prizes both before *and* after the transaction date (for example, 129 got one medal before and one after the date of sale).

[17] Our controls also include appellation dummies, but since there are more than 50 of them the descriptive statistics are omitted.

[18] This fraction is much smaller than the global fraction of producers belonging to cooperatives (see footnote 3) because many cooperatives bypass the brokers and sell the wine directly to the *négotiants* (or even directly to large retailers).

[19] The transaction data set also contains information on past medal awards. The broker did not systematically and exhaustively record this information in its archives: for 939 observations (out of 2,711) only the contest data set indicates that medals have been awarded. However, for 261 observations only the transaction data set indicates past medal awards (this concerns essentially wines awarded at MAC, a contest that only releases the producers' names of the winners (not the châteaux names), rendering matching more difficult). Our estimation results are not qualitatively different when the 261 wines are treated as if they have won no medals before the transaction date.

Table 8 in the appendix lists, for each contest, the total number of medals awarded to the wines in our sample, together with the number of awards separately for gold, silver, and bronze. We distinguish medals given before the transaction from those given thereafter. BOR is by far the competition that awarded the highest number of medals: between 2006 and 2016 it attributed a prize to 1,119 wines before they were sold, and to 178 wines after they were sold. Other competitions with many awards are MAC (735 medals before and 112 after the transaction) and PAR (727 and 69). VII is the contest which awarded the least number of medals during the observation period (30 and 11). Note that the fraction of medals attributed to the three colors is quite similar to the aggregate medal proportions reported in Table 1.

Table 3: Average price by number and type of medals before/after transaction

Timing	Characteristic	Number of medals			Type of medal		
		0	1	2+	Bronze*	Silver	Gold
Before the transaction	Average Price (€ /0.75L)	2.05	2.99	3.6	3.58	3.21	3.21
	Frequency	13,688	1,688	1,023	1,109	1,239	1,312
After the transaction	Average Price (€ /0.75L)	2.21	3.05	3.67	3.43	3.18	3.19
	Frequency	15,812	449	138	232	260	204

*: "Commended" medals given by DEC have been merged with bronze medals.

Table 3 gives average prices and frequencies by number (columns 1-3) and type (columns 4-6) of medals received. The statistics are reported separately for wines sold before and after the transaction. Among the 14,212 wines which did not receive a medal before the transaction, the average price is 2.05 € /0.75L. Among the 1,688 wines with exactly one award before the transaction, the average is 2.99 € (an increase of 46%), and among the 1,023 wines with 2 awards or more 3.6 € (76%). The average price for the 15,812 wines without post-transaction prize is 2.21 € . Note that this subsample includes 2,514 wines having received a prize before the transaction (see Table 7), explaining why these wines are a bit more expensive (relatively to wines without prizes before the date of sale). Among the 449 wines with exactly 1 medal after the transaction, the average price is 3.05 € , and among the 128 wines with 2 medals or more, 3.67 € . Looking at the statistics by type of medal, we see that for the 232 post-transaction winners with at least one bronze medal the average price is 3.43 € . Surprisingly, the average price for producers winning at least one silver (resp. gold) medal is 3.18 € (resp. 3.19 €). We cannot reject, however, that mean prices differ in a statistically significant manner across the three colors. The figures are similar for producers winning prizes before the date of sale. However, the average for bronze (3.43 €) is now significantly larger than for silver and gold (both 3.21 €). In Section 5 we will see that this counterintuitive result disappears once we control for additional wine characteristics.

4 Estimation strategy

In this section we present our estimator for the causal impact of medals on prices. It is convenient to start the presentation by assuming that there are no other observed price determinants besides the medals. We thus exclude, for the moment, that variables such as the age of the wine, its appellation, or its packaging, are observed. We also assume that there exists just one type of medal and only one competition, i.e., we ignore for the moment that medals come in different colors (bronze, silver, gold), and that in practice several wine competitions coexist. Finally it is assumed that a given wine can only win a single medal before the transaction date, and/or a single medal in the future. The possibility that multiple medals of different types can be awarded will be accounted for later on.

Let the price P be generated by the following model:

$$ln(P) = \alpha_0 + \alpha_M M + Q + \epsilon = \alpha_0 + \alpha_M M + \xi \tag{1}$$

where M is a binary variable equal to 1 if the wine has obtained a medal before the transaction date and 0 otherwise, Q represents unobserved quality of the wine, ϵ is an error term capturing the effect of other unobserved price determinants, and $\xi = Q + \epsilon$. The parameters α_0 and α_M represent the intercept and the causal effect of the medal, respectively. Let F be a binary variable equal to 1 if the wine will get a medal somewhere after the transaction and 0 otherwise. We assume that the error term ϵ is mean-independent of M, Q, and F: $E(\epsilon|M,F,Q) = 0$. Without loss of generality it is furthermore assumed that $E(Q) = E(\epsilon) = 0$. Note that quality Q is defined in such a way that the coefficient associated with this variable is normalized to one. Note also that P is assumed to be determined only by the before-transaction medal indicator M and Q, i.e., the post-transaction medal indicator F does not affect price. To the extent that F is by definition unknown at the time of transaction, it seems natural to exclude this variable from the structural model (1). Note finally that our model structure is similar to the one adopted by Dubois and Nauges (2010), except that they do not observe the equivalent of the dummy F.

Let $\hat{\alpha}_M^{OLS}$ denote the OLS estimator of α_M. Since M and Q are potentially positively correlated, we expect that the probability limit of $\hat{\alpha}_M^{OLS}$ exceeds α_M. The OLS estimator is only consistent under the additional assumption that the medal indicator and unobserved quality are uncorrelated. Although this assumption is unlikely to hold in practice, we nonetheless report OLS estimates in the next section, but merely as benchmark results, which will be compared with the results produced by our estimator.

To define our estimator, we consider the linear projection of Q on F and M (see for example Wooldridge (2002) for the definition and properties of linear projections):

$$Q = \beta_0 + \beta_M M + \beta_F F + \mu \tag{2}$$

where β_0, β_M, and β_F are the linear prediction coefficients. The error term μ satisfies, by definition of a linear projection, $cov(M,\mu) = cov(F,\mu) = 0$. Replacing Q in equation (1) by (2) gives:[20]

$$ln(P) = (\alpha_0 + \beta_0) + (\alpha_M + \beta_M)M + \beta_F F + \epsilon + \mu. \quad (3)$$

Since the composite error term $\epsilon + \mu$ is uncorrelated with both M and F, the OLS estimators $(\widehat{\alpha_M + \beta_M})$ and $\hat{\beta}_F$ consistently estimate $(\alpha_M + \beta_M)$ and β_F. Under the identifying restriction $\beta_M = \beta_F$, the difference in OLS estimators is thus a consistent estimator of the causal effect α_M. This estimator is denoted $\hat{\alpha}_M^{DIF}$ (the superscript DIF to indicate that it is based on a difference in two estimators) and is defined as

$$\hat{\alpha}_M^{DIF} = \widehat{\alpha_M + \beta_M} - \hat{\beta}_F.$$

Remarks: 1) Our estimator does not require M and Q to be uncorrelated (the identifying restriction necessary to interpret the OLS estimate as the causal effect of a medal).[21] Instead, we need to impose the more natural and plausible restriction that the partial correlation between M and Q equals the partial correlation between F and Q. 2) The variable F is not what Wooldridge (2002) calls a proxy variable for the endogenous variable M. Although we assume that F is redundant in (1) (like a proxy variable), we only impose $\beta_M = \beta_F$ (while a proxy variable requires $\beta_M = 0$). F is not an instrumental variable for M either since it is correlated with Q. 3) Our procedure allows to estimate the medal effect on bulk prices observed at the transaction date. Our data do not allow to determine what is the medal effect on prices observed at later stages of the sales chain (e.g., retail prices). From the perspective of wine producers, the medal effect we identify is, however, of utmost importance since this parameter is required to calculate their expected gains from participating in a competition. Based on such calculations producers can then decide whether entering a competition is worthwhile or not.

Let us now turn to the more general case where wines can win multiple medals, of different colors, and possibly from different contests. We now also account for the possibility that prices can be influenced by a vector of observable characteristics, denoted X. The analogue of the price equation (1) becomes

$$ln(P) = \alpha_0 + \sum_{j=1}^{J} \alpha_{M_j} M_j + \alpha_X X + Q + \epsilon \quad (4)$$

and the linear projection (2) becomes

$$Q = \beta_0 + \sum_{j=1}^{J} \beta_{M_j} M_j + \sum_{j=1}^{J} \beta_{F_j} F_j + \beta_X X + \mu \quad (5)$$

Here M_j equals 1 if the wine has obtained a medal of type j (i.e., of a certain color and from a specific com-

[20]The idea to replace Q by its projection on a set of regressors is reminiscent of Chamberlain's (1982) approach to unobserved effects models.

[21]Using (2), we have $cov(M,Q) = \beta_M var(M) + \beta_F cov(M,F)$. Under $\beta_M = \beta_F$, we get $cov(M,Q) = \beta_M cov(M, M+F)$, which generally differs from zero except when $\beta_M = 0$ and/or when the last covariance equals zero.

petition) before the transaction, and 0 otherwise. The indicators F_j are similarly defined, and J represents the total number of different types of medals that can be awarded. All parameters have analogous interpretations as above. The error term μ is by definition of a projection uncorrelated with all past/future medal indicators, and with X, and has expectation equal to zero. The error terms in (4) are still assumed to be centered around zero: $E(Q) = E(\epsilon) = 0$. The error ϵ is now assumed to be mean-independent of all medal indicators, Q, and X: $E(\epsilon|X, Q, M_j, F_j, j = 1, ..., J) = 0$. Finally we assume that Q and X are uncorrelated: $E(Q|X) = 0$.

Estimation by OLS leads to inconsistent estimators for the same reason as previously: the indicators M_j are expected to be correlated with Q (capturing the impact of unobserved quality components after controlling for X and the J medal indicators). In particular the OLS estimators $\hat{\alpha}^{OLS}_{M_j}$ are thus likely to be inconsistent.

To define the generalized version of our difference estimator, we substitute (5) in (4) and get

$$ln(P) = (\alpha_0 + \beta_0) + \sum_{j=1}^{J}(\alpha_{M_j} + \beta_{M_j})M_j + \sum_{j=1}^{J}\beta_{F_j}F_j + (\alpha_X + \beta_X)X + \epsilon + \mu.$$

Given our assumptions, the error term $\epsilon + \mu$ is uncorrelated with all regressors, and hence the OLS estimators of this regression model are consistent. As previously, the estimator is defined as the difference of OLS estimators: $\hat{\alpha}^{DIF}_{M_j} = \widehat{\alpha_{M_j} + \beta_{M_j}} - \hat{\beta}_{F_j}$. Under $\beta_{M_j} = \beta_{F_j}$, $j = 1, ..., J$, it is a consistent estimator of α_{M_j}. Note that the estimator of the coefficient associated with X does not allow for consistent estimation of the causal effect α_X.

An interesting byproduct of our method is that it also provides an estimate of β_{F_j} for all j. This coefficient measures the partial correlation between F_j and Q, and, given the identifying assumption, also the partial correlation between M_j and Q. Testing the hypothesis $\beta_{F_j} = 0$ then amounts to checking whether quality is uncorrelated with M_j, and testing $\beta_{F_j} > \beta_{F_{j'}} > 0$ is equivalent to checking whether the before-transaction medal indicator of type j is more strongly correlated with quality than the one of type j'.

If one is willing to make the additional assumption that μ is mean-independent of X and all medal indicators,[22] then the sum $\alpha_{M_j} + \beta_{M_j}$ has a nice interpretation. More precisely, under $H_\mu : E(\mu|X, M_j, F_j, \forall j) = 0$, we have:

$$\begin{aligned} E(\Delta ln(P)) &\equiv E(ln(P)|X, M_j = 1, M_{j'} = 0, \forall j' \neq j, F_j, \forall j) - E(ln(P)|X, M_j = 0, F_j, \forall j) \\ &= \alpha_{M_j} + E(Q|X, M_j = 1, M_{j'} = 0, \forall j' \neq j, F_j, \forall j) - E(Q|X, M_j = 0, F_j, \forall j) \\ &= \alpha_{M_j} + \beta_{M_j}. \end{aligned} \quad (6)$$

The expected (logarithmic) price gap between wines with a medal of type j and wines without any medal at all (conditional on X and all Fs), denoted $E(\Delta ln(P))$, can be decomposed as the sum of the causal effect of this medal, α_{M_j}, and the difference in quality between these two types of wines, β_{M_j}. Note also that our

[22] Since (5) is a projection, μ is by construction centered around zero. But this error term is not necessarily mean-independent of the regressors.

identifying restriction has a more transparent interpretation under H_μ: the expected wine quality is the same for wines receiving a medal of type j before and after the transaction.[23]

5 Empirical results

In Section 5.1 we start presenting aggregate estimation results, obtained under the assumption that medal effects are the same across the different medal colors and wine competitions. These initial results also rely implicitly on the hypothesis that winning two or more medals has the same impact as winning a single one. In Section 5.2 we relax these simplifying restrictions and allow for the possibility that wines can win multiple and different types of medals. This allows us to analyze how the impact of medals varies by color (bronze, silver, gold), and type of competition (prestige, participation fee, tasting method) at which they are awarded. Finally, Section 5.3 uses the estimated medal effects to calculate producers' expected profits from participating in a wine competition.

5.1 Aggregate results

All estimation results presented in this section are collected in Table 4. Column 1 reports the two estimates of α_M (using OLS and our alternative method), together with standard errors in parentheses, assuming that prices are generated by model (1). Here P is the bulk price (in € per 75 cl of wine) observed at the transaction date, $M = 1$ if at least one medal has been awarded to the wine prior to the transaction date, and $M = 0$ otherwise. Note that the observed wine characteristics are not included in the model. We also report in column 1 the OLS estimates of $\alpha_M + \beta_M$, and β_F, i.e., the parameters associated with M and F in (3), where $F = 1$ if at least one medal will be awarded after the transaction date, and 0 otherwise. The estimate $\hat{\alpha}_M^{OLS}$ is significant at the 1% level, and suggests that a producer can get 52.4% more per bottle of wine when his product has won at least one medal before the transaction. The estimate $\hat{\alpha}_M^{DIF}$ is substantially smaller, and implies that the price-increase for medal winners is 19.3% (also significant at the 1% level). The OLS estimates $\widehat{\alpha_M + \beta_M}$ and $\hat{\beta}_F$ equal 0.512 and 0.319, respectively (both are strongly significant). Recall that the difference between the two corresponds to $\hat{\alpha}_M^{DIF}$. The R^2 in model (3) is 0.081.

Column 2 reports estimates when the wine/producer characteristics X are added to the model, i.e., the specification we consider now is $P = \alpha_0 + \alpha_M M + \alpha_X X + Q + \epsilon$, where M is defined as above. The variables included in X are: the age of wine at the transaction date (in months); the delay separating the transaction date and the delivery of the wine to the purchaser (in months); the producer type (a dummy indicating that the producer is an individual wine maker); the type of packaging (a dummy indicating that the wine is sold in bulk, and another one indicating that it is sold bottled); and 45 dummies indicating the appellation of each wine. Controlling for these characteristics leads to a substantial drop in the OLS estimate of α_M (it now equals 0.192); the DIF estimate remains relatively stable compared to column 1 (now 0.157). Both remain

[23] Given H_μ, the restriction $\beta_{M_j} = \beta_{F_j}$ is equivalent to $E(Q|X, M_j = 1, M_{j'} = 0, \forall j' \neq j, F_j = 0, \forall j) = E(Q|X, F_j = 1, F_{j'} = 0, \forall j' \neq j, M_j = 0, \forall j)$.

Table 4: Estimates of α_M

Estimate	(1)	(2)	(3)
$\hat{\alpha}_M^{OLS}$	0.524	0.192	0.173
	(0.014)	(0.007)	(0.007)
$\hat{\alpha}_M^{DIF}$	0.193	0.157	0.132
	(0.036)	(0.013)	(0.012)
$\widehat{\alpha_M + \beta_M}$	0.512	0.191	0.172
	(0.014)	(0.007)	(0.007)
$\hat{\beta}_F$	0.319	0.035	0.04
	(0.032)	(0.011)	(0.01)
Characteristics X	No	Yes	Yes
Fixed effects	No	No	Yes
N	16,399	16,399	16,399
R^2	0.081	0.904	0.924

strongly significant. The estimates $\widehat{\alpha_M + \beta_M}$ and $\hat{\beta}_F$ (obtained from estimating by OLS the regression model (3) to which $(\alpha_X + \beta_X)$X is added) have also sharply dropped. Controlling for the characteristics of wine and producer substantially augments the R^2 (now 0.904). Column 3 lists the results when fixed effects for the transaction-year and vintage are added to the price equation. Controlling for these fixed effects reduces the magnitude of the two estimates of α_M estimates yet again, but the drop is modest compared to those reported in column 2. The estimate of $\alpha_M + \beta_M$ has slightly decreased, while the estimate of β_F has slightly increased. All estimates remain strongly significant, and the R^2 now equals 0.924.

Overall, the conclusion from Table 4 is that OLS produces larger estimates of α_M than our alternative method, especially when we do not control for the wine characteristics X and the fixed effects. This is consistent with our point of view that OLS overestimates the causal effect of medals while our method at least mitigates this bias. All estimates $\hat{\alpha}_M^{DIF}$ are significantly positive, implying that, ceteris paribus, a wine is more expensive when it is medaled. Even our most conservative estimate (in column 3) suggests that medal winners can augment prices by no less than 13%. Note that this estimate is between 10 and 15%, the interval of values within which the causal effect should lie according to wine magazine cited in the introduction. All OLS estimates of α_M are, however, above this interval. Since β_F is positive and significantly different from zero in all three specifications, quality and the dummy indicting a future medal award are positively correlated. Apart from column 1, $\hat{\beta}_F^{DIF}$ is much smaller than $\hat{\alpha}_M^{DIF}$. Recalling the decomposition formula (6), most of the expected price difference between medaled and non-medaled wines comes from the causal impact of the certification, not from the difference in quality of these wines. More precisely, taking the estimates of α_M and β_F reported in column 3, the expected price difference is 17.2%, of which 13.2 percentage points can be attributed to certification, and only 4 percentage points to quality heterogeneity.

5.2 Results by number of medals, color, and competition

In columns 1-3 of Table 5 we report estimation results for a price model which explicitly allows the medal effect to differ by the number of awards received. Specifically, we assume that prices are modeled according to (4), with $J = 3$ and three dummies, M_1, M_2, and M_{3+}. Here M_1 (resp. M_2) equals 1 if a wine has obtained exactly one medal (resp. two medals) prior to the transaction, and 0 otherwise; M_{3+} equals 1 if at least three medals are obtained before the transaction, and 0 otherwise. The variables F_1, F_2, and F_{3+} are defined analogously. We only report the results with X (defined as above) and fixed effects added to the specification.

Table 5: Estimates of α_M by number and color of medals

Estimate	Number of medals			Color of the medal		
	M_1	M_2	M_{3+}	M_{gold}	M_{silver}	M_{bronze}
$\hat{\alpha}^{OLS}_{M_j}$	0.166	0.2	0.256	0.194	0.077	0.075
	(0.007)	(0.01)	(0.014)	(0.008)	(0.007)	(0.008)
$\hat{\alpha}^{DIF}_{M_j}$	0.123	0.124	0.245	0.13	0.044	0.042
	(0.013)	(0.027)	(0.038)	(0.018)	(0.017)	(0.016)
$\widehat{\alpha_{M_j} + \beta_{F_j}}$	0.163	0.201	0.257	0.194	0.077	0.076
	(0.007)	(0.01)	(0.014)	(0.008)	(0.007)	(0.008)
$\hat{\beta}_{F_j}$	0.04	0.077	0.012	0.063	0.032	0.035
	(0.011)	(0.025)	(0.036)	(0.017)	(0.015)	(0.014)
Characteristics X		Yes			Yes	
Fixed effects		Yes			Yes	
N		16,399			16,399	
R^2		0.925			0.925	

The OLS estimates of α_{M1} (coefficient associated with M_1), α_{M2} (M_2), and α_{M3+} (M_{3+}) exceed the DIF estimates of these parameters, again suggesting that the medal indicators are not exogenous, leading OLS to overestimate the causal effects. Our results show that it is relevant to let medal effects differ by the number of awards received: $\hat{\alpha}^{DIF}_{M1}$ and $\hat{\alpha}^{DIF}_{M2}$ are both around 0.12 (slightly smaller than $\hat{\alpha}^{DIF}_{M}$ in column 3 of Table 4); $\hat{\alpha}^{DIF}_{M3+}$ is 0.25 (substantially larger). For each of the three coefficients we strongly reject the null hypothesis that they are equal to zero. Furthermore, the hypothesis $\alpha_{M2} = \alpha_{M3+}$ is rejected, but $\alpha_{M1} = \alpha_{M2}$ is not. The price markup is thus the same for wines having either one or two medals, but is significantly higher for those with at least 3 medals. The parameter β_{F2} is significantly larger than β_{F1} implying that the dummy indicating two future medals is, as expected, more strongly correlated with quality than the dummy indicating one future medal. Surprisingly, we cannot reject the null hypothesis that β_{F3+} equals zero, but this may be due to the small number of wines in the sample with three or more awards after the transaction (see Table 7).

Columns 4-6 of Table 5 give estimation results for model (4) in which medal effects differ across color. The specification again includes $J = 3$ dummies, here defined as M_{Gold}, M_{Silver}, and M_{Bronze}, with $M_{Gold} = 1$ if a wine has won at least one gold medal in the past, and 0 otherwise, and M_{Silver} and M_{Bronze} defined analogously. The OLS estimates of α_{Mgold}, $\alpha_{Msilver}$, and $\alpha_{Mbronze}$ again exceed our alternative estimates. The latter imply that winning at least one gold medal allows the producer to augment its price by 13%; the price increases associated with silver and bronze are much smaller, at 4.4% and 4.2%, respectively. These estimates are each significantly different from zero, and we strongly reject the null hypothesis $\alpha_{Mgold} = \alpha_{Msilver} = \alpha_{Mbronze}$ (α_{Mgold} is significantly larger than $\alpha_{Msilver}$, but $\alpha_{Msilver} = \alpha_{Mbronze}$ cannot be rejected). The β_Fs are also significantly different from zero, but the hypothesis $\beta_{Fgold} = \beta_{Fsilver} = \beta_{Fbronze}$ cannot be rejected (p-value is 0.09).[24] Under H_μ the expected price gap between gold-medaled wines and non-medaled wines is 19.3%, of which 13 percentage points is due to certification and 6.3 percentage points to quality heterogeneity. The decompositions for silver and bronze are similar to each other: for both the gap is around 7.5%, with 4.5 points attributable to certification and 3.5 to quality differences. The different equality tests reported just above suggest that the larger price gap for gold is primarily due to a larger effect of certification, the effects of quality heterogeneity are statistically indistinguishable across the three types of medals and/or economically small.

Table 6 lists estimation results of model (4) allowing the impact of medals to vary across the different competitions. Hence the specification now includes $J = 11$ dummies, M_{BOR},..., M_{VII}, where, for instance, M_{BOR} equals 1 if the wine has won a medal at the contest of Bordeaux prior to the transaction, and 0 otherwise.[25] The Fs are defined analogously. A close look at the results reveals that three groups of competitions can be distinguished. A first group includes four competitions (BOR, CHA, DEC, PAR). For each of these contests the estimates of both α_M and β_F are significantly different from zero. The estimates $\hat{\alpha}_M^{DIF}$ range between 0.07 (for BOR, CHA, PAR) and 0.1 (DEC), and $\hat{\beta}_F$ between 0.04 (CHA,DEC) and 0.07 (PAR).

Table 6: Estimates of α_M by competition

Estimate	M_{BOR}	M_{BRU}	M_{CHA}	M_{CVI}	M_{DEC}	M_{FEM}	M_{LYO}	M_{MAC}	M_{PAR}	M_{VIN}	M_{VII}
$\hat{\alpha}_{M_j}^{OLS}$	0.12	0.07	0.11	0.11	0.14	0.04	0.03	0.07	0.14	0.01	-0.06
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.05)
$\hat{\alpha}_{M_j}^{DIF}$	0.07	0.01	0.07	0.09	0.1	0.15	0	0.07	0.07	-0.1	-0.13
	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.02)	(0.03)	(0.07)	(0.08)
$\widehat{\alpha_{M_j} + \beta_{M_j}}$	0.12	0.07	0.11	0.11	0.14	0.04	0.03	0.07	0.14	0.01	-0.07
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.05)
$\hat{\beta}_{F_j}$	0.05	0.06	0.04	0.02	0.04	-0.11	0.03	0	0.07	0.11	0.06
	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.06)	(0.06)
Characteristics X						Yes					
Fixed effects						Yes					
N						16,399					
R^2						0.924					

The second group is made up of two contests (CVI, MAC). The estimates of α_M are still significant, and of the same magnitude compared to those of the first group. Unlike the first group, however, we can no

[24]Neither the hypothesis $\beta_{Fgold} = \beta_{Fsilver}$, nor $\beta_{Fsilver} = \beta_{Fbronze}$, can be rejected. However, β_{Fgold} is significantly larger than $\beta_{Fbronze}$.

[25]There are no wines in the sample with more than one medal awarded from the *same* competition. The medal dummies are therefore appropriately defined.

longer reject the null hypothesis $\beta_F = 0$. The third group contains the remaining five contests (BRU, FEM, LYO, VIN, VII). For BRU, LYO, VIN, and VII we can neither reject the null hypothesis $\alpha_M = 0$ nor the null $\beta_F = 0$ at conventional significance levels. For FEM we reject $\alpha_M = 0$, but the results are surprising and counterintuitive here as $\hat{\beta}_F$ is significantly negative.

Since the number of competitions in our data is limited it is not possible to formally show how contest characteristics relate to group membership. Therefore we cannot establish that say contests charging high entry fees have a statistically higher probability to belong to a particular group. What we can do, however, is to check which characteristics are shared by all (or most) contests within each given group, and thereby determine, informally, a link between group membership and contest features.

A common feature of the contests in the first group is that they were founded a relatively long time ago (DEC is the only exception – see Table 1),[26] and have acquired a solid reputation since their first appearance. According to wine professionals, BOR and especially PAR are the most prestigious competitions. For wholesale traders in France the medals given in these two competitions are the most valuable and sought-after awards for Bordeaux wines. DEC is regarded by many as the most influential non-French wine contest in the world, while CHA is the best known international competition in France. Another common feature of the four contests is that their jury members have to evaluate relatively small number of wines on a given day (DEC is again an exception – see line 13 of Table 1). BOR and PAR are the only two contests where the samples are chosen and selected by the organizers themselves. Besides CVI, they are also the only ones whose judges grant medals by oral consensus.

The two contests in the second group have juries that are either fully made up of amateurs, or a mix of amateurs and professionals, and they charge the lowest entry fees and sticker prices. The five contests of the third group tend to attract the lowest number of participants (except BRU) and are, as indicated in Table 1, among the most recently founded competitions. The juries of VIN and VII are completely composed of oenologists, and three contests of this group (BRU, LYO, VII) do not award bronze medals, i.e., their award procedure is relatively coarse. Compared to the first group, jury members are required to evaluate more wines per day. This may diminish the accuracy of their judgments, which may in turn explain the non-significance of the quality indicator β_F for this group.

Table 9 in the appendix, the last one discussed in this section, presents results of model (4) wherein medal effects are allowed to vary simultaneously by color and competition. It is difficult to precisely estimate the parameters now because for many medal/competition combinations the number of medal awards before and after the transactions is not sufficiently high (see Table 8). We therefore only allow the two main French contests, BOR and PAR, to have specific medal-color effects, and for all remaining contests these effects are restricted to be the same (resulting in a specification with $J = 9$ dummies). The table only reports the results for BOR and PAR. Our alternative method produces an estimate of $\alpha_{M_{BORgold}}$ equal to 0.134, and the hypothesis that this parameter equals zero is strongly rejected. We thus find a causal effect of a gold medal from BOR that appears well below the upper bound of the prediction interval claimed by the organizers

[26] Although DEC was first launched only in 2006, the Decanter magazine that organizes this competition dates from 1975 and has acquired a solid reputation as a major wine critic, mostly for top-end wines.

of this contest (they indicated a markup for gold of up to 30% – see the introduction). To the extent that the objective of these organizers is to attract as many competitors as possible, it seems understandable though that they somewhat exaggerate the influence of their medals. The estimate of $\alpha_{M_{PARgold}}$ implies that producers receiving a gold medal from PAR can raise their price by 13.5%. This is compatible with the contents of a contingent contract we got from the broker. This contract concerned the sale of a red wine from the appellation *Bordeaux*, produced in 2014, and sold in 2015 without being bottled yet. It stipulated the following conditions: producer gets 1,300 € /900l if wine receives no medal or a bronze medal between sales date and delivery date (regardless of the competition); 1,350 € /900l for a silver medal and 1,375 € /900l for a gold medal (both regardless of competition); 1,500 € /900l for gold from PAR.[27] The bonus for a gold medal from PAR amounts to a price increase of 15%, just above our estimate. The bonus for silver amounts to a price markup of 3.8%, again close to our estimate (4.4% – see Table 5). The bonuses for bronze and gold (0% and 5.7%) are, however, lower than our estimates of the respective causal effects (4% and 13%). The fact that the contract conditions and our estimates are (at least partly) in line may seem as natural, if one is willing to assume that contingent contracts have been used for wines that are representative of all wines in our sample. But it is nonetheless reassuring and gives credence to our identification strategy.

5.3 Producers' expected profits from participating in contests

In order to decide whether to compete in wine contests or not, producers need to compare the costs and benefits of contest participation. More precisely, this decision requires a calculation of the profit from participating in a competition. This profit is *ex ante* unknown to the producer since it depends on whether a medal will be won, and on the color of the medal. Producers can therefore only calculate the expected profit. Given that we cannot estimate sufficiently precisely the three medal-color effects separately for each contest, we shall for simplicity assume that the three types of medal have the same impact for each given contest. This amounts to saying that that there are just two states of the world: either a producer wins a medal at a competition, or wins no medal. The expected profit for producer i at a given competition is then given by

$$E(Profit_i) = \pi V_i \left[P_i(e^{\alpha_M} - 1) - C_s\right] - C_0 \qquad (7)$$

where V_i is the quantity of wine i sold through the broker (measured as the number of bottles of 75 cl), P_i the price of wine i for 75 cl, C_s the cost per sticker, C_o other (fixed) costs of participating in a contest, and π the probability of winning a medal. We cannot estimate producer-specific probabilities of winning a prize, and instead we consider different values of π. The term $P_i(e^{\alpha_M} - 1)$ corresponds to the causal impact of the medal on the price of wine i (the expression is non-linear in α_M because the price in model (4) is defined in logarithms).

We have calculated $E(Profit_i)$ for all wines i in the sample,[28] for each of the four contests belonging to the

[27] The broker from which we obtained the transaction data did not possess other examples of such contracts (not surprising given that they are handled and negotiated by the *négociants* and producers), but assured us that the contract conditions described in the text are representative and not atypical.

[28] For wines having received a medal prior to the transaction, we have divided the transaction price by e^{α_M}. We excluded the 2,105

first group. We have taken the corresponding estimates of α_M reported in Table 6, and the sticker prices C_s reported in Table 1.[29] Other costs C_o are defined as the participation fee (also reported in Table 1), plus 60 € for DEC (representing the costs charged by this contest of sending the samples from Bordeaux to London).

Table 10 reports statistics on $E(Profit)$, separately for the four competitions, and different values of π: 0.05; 0.10; 0.20; and the empirical proportion of medaled wines as reported in Table 1. In the first three cases the results are comparable for BOR, CHA, and PAR (as expected, because all parameters determining expected profits are then similar for these contests), while those corresponding to DEC stand apart. When $\pi = 0.05$, the mean of $E(Profit)$ is positive and small in the case of BOR, CHA and PAR (around 50 €), but negative in the case of DEC (-43 €). The proportion of producers with negative expected profits is slightly higher than 50% for BOR, CHA, and PAR, and around 75% for DEC. Increasing the probability of winning a medal leads to a substantial improvement of these figures. When $\pi = 0.20$, for instance, the mean of $E(Profit)$ is around 500 € in the case of BOR, CHA, and PAR, and 570 € in the case of DEC; the fraction of producers getting negative expected profits is around 14% for the former three contests, and 36% for the latter. Replacing π by the empirical proportion of medaled participants medals in each competition (bottom panel of Table 10), we see that the mean of $E(Profit)$ now ranges between 609 € (PAR) and 2,148 € (DEC), while the fraction of producers with negative expected profits is small, varying between 7.5% (CHA) and 16.7% (DEC). For the representative wine producer it seems thus highly attractive to participate in these wine contests.[30]

6 Conclusion

In this paper we first of all obtain the causal effect of medals on producers' wine prices. We adopt a novel but simple approach consisting in regressing prices on both before-transaction and post-transaction medal indicators. Under natural identifying restrictions, the difference in the estimates of the associated coefficients identifies the causal effect. Our preferred estimate indicates that a producer whose wine received a medal can augment his price by 13%. The impact for gold turns out to be much larger than for silver and bronze. When we allow the medal effect to differ across competitions, we find that only for a small group of contests there is a statistically significant effect. This group is made up of the most prestigious competitions that have been founded a long time ago. Interestingly, their judges are required to evaluate relatively few wines per day, and they grant medals by oral consensus. Next we have calculated the profit producers may expect to get from participating in these competitions. We find that that the incentives to participate in competitions is high.

transactions for which V is below 1,000 liters. All four contest refuse participation of wine makers with production levels below this threshold. Implicitly we have therefore excluded all wines for which we are sure that only a fraction of the harvest was sold through our broker (augmenting thereby the likelihood that we are focusing on wines i such that V_i represents the total production). The calculations are thus based on 16,399-2,105=14,294 observations.

[29] For notational simplicity, the marginal cost per sticker is assumed constant in (7). However, in our calculation of $E(Profit)$ we allow the marginal cost to be a decreasing step function of V (see Section 2.2).

[30] Since a fraction of the producers do not pay the stickers themselves (they are paid instead by the *négociants*), we have also calculated the profit statistics under the assumption that producers do not bear these costs (i.e., $C_s = 0$). Naturally this shifts expected profits upwards, and compared to the previous table the attractiveness of the four contests increases. Details on these additional results can be obtained from the authors upon request.

Finally we contribute to a literature that sheds doubt on the reliability of juries and evaluation committees in all sorts of contexts. We find that only a minority of contests attribute medals that are significantly correlated with wine quality.

References

CHAMBERLAIN, G. (1982): "Multivariate regression models for panel data," *Journal of Econometrics*.

DEWAN, S. AND V. HSU (2004): "Adverse Selection in Electronic Markets: Evidence From Online Stamp Auctions," *Journal of Industrial Economics*, 52, 497–516.

DRANOVE, D. AND G. ZHE JIN (2010): "Quality Disclosure and Certification: Theory and Practice," *Journal of Economic Literature*, 484, 935–963.

DUBOIS, P. AND C. NAUGES (2010): "Identifying the effect of unobserved quality and expert reviews in the pricing of experience goods: Empirical application on Bordeaux wine," *International Journal of Industrial Organization*, 28, 205–212.

FRITZ, C., J. CURTIN, J. POITEVINEAU, P. MORREL-SAMUELS, AND F.-C. TAO (2012): "Player Preferences Among New and Old Violins," *Proceedings of the National Academy of Sciences*, 109, 760–763.

GINSBURGH, V. A. AND J. C. VAN OURS (2003): "Expert Opinion and Compensation: Evidence from a Musical Competition," *The American Economic Review*, 93, 289–296.

GOLDIN, C. AND C. ROUSE (2000): "Orchestrating Impartiality: The Impact of Blind Auditions on Female Musicians," *American Economic Review*, 90, 715–741.

HADJ ALI, H., S. LECOCQ, AND M. VISSER (2008): "The impact of Gurus: Parker grades and en primeur wine prices," *Economic Journal*, 118, F158–F173.

HODGSON, R. T. (2008): "An Examination of Judge Reliability at a major U.S. Wine Competition*," *Journal of Wine Economics*, 3, 105–113.

LIMA, T. (2006): "Price and Quality in the California Wine Industry: An Empirical Investigation*," *Journal of Wine Economics*, 1, 176–190.

NELSON, P. (1970): "Information and Consumer Behavior," *Journal of Political Economy*, 78, 311–329.

REDELMEIER, D. A. AND S. D. BAXTER (2009): "Rainy Weather and Medical School Admission Interviews," *CMAJ*, 181, 933.

WIMMER, B. S. AND B. CHEZUM (2003): "An Empirical Examination of Quality Certification in a Lemons Market," *Economic Inquiry*, 41, 279–291.

WOOLDRIDGE, J. (2002): *Econometrics Analysis of Cross Section and Panel Data*, MIT Press.

Appendix

Table 7: Number of medals per wine before/after transaction

		After				
		0	1	2	3+	Total
Before	0	13,298	302	62	26	13,688
	1	1,517	129	32	10	1,688
	2	612	13	7	0	632
	3+	385	5	1	0	391
	Total	15,812	449	102	36	16,399

Table 8: Number of medals across competitions, before and after transaction date

Competition	Before transaction date				After transaction date			
	# Medals	# Bronze	# Silver	# Gold	# Medals	# Bronze	# Silver	# Gold
BOR	1,119	294	410	415	178	42	74	62
BRU	214	0	129	85	60	0	37	23
CHA	358	99	141	118	125	56	45	24
CVI	171	70	45	56	30	13	8	9
DEC	233	84	21	5	68	36	9	0
FEM	248	88	95	65	48	9	25	14
LYO	258	26	71	161	44	5	15	24
MAC	735	300	195	240	112	36	39	37
PAR	727	109	274	344	69	12	27	30
VIN	145	86	51	8	24	15	7	2
VII	30	0	28	2	11	0	10	1

Table 9: Estimates of α_M simultaneously by color and competition

Estimate	$M_{BORgold}$	$M_{BORsilver}$	$M_{BORbronze}$	$M_{PARgold}$	$M_{PARsilver}$	$M_{PARbronze}$
$\hat{\alpha}^{OLS}_{M_j}$	0.206	0.093	0.052	0.225	0.062	0.103
	(0.012)	(0.011)	(0.013)	(0.013)	(0.014)	(0.022)
$\hat{\alpha}^{DIF}_{M_j}$	0.134	0.073	-0.015	0.135	-0.029	0.113
	(0.028)	(0.031)	(0.04)	(0.05)	(0.046)	(0.048)
$\widehat{\alpha_{M_j} + \beta_{M_j}}$	0.206	0.092	0.054	0.221	0.057	0.104
	(0.012)	(0.011)	(0.013)	(0.013)	(0.013)	(0.022)
$\hat{\beta}_{F_j}$	0.072	0.019	0.068	0.086	0.086	-0.009
	(0.026)	(0.028)	(0.037)	(0.046)	(0.044)	(0.039)
Characteristics X	Yes					
Fixed effects	Yes					
N	16.399					
R^2	0.925					

Table 10: Distribution of expected profit in euro, including stickers costs

Competition	π	Mean	S.d.	Min	Max	p25	p75	$\%E(Profit) < 0$
Bordeaux	0.05	61	212	-166	5,034	-48	88	0.518
Challenge	0.05	50	220	-154	5,121	-66	81	0.563
Decanter	0.05	-43	315	-337	7,256	-209	-2	0.751
Paris	0.05	45	212	-189	5,029	-64	72	0.574
Bordeaux	0.10	208	423	-247	10,153	-11	261	0.294
Challenge	0.10	212	441	-196	10,353	-21	273	0.322
Decanter	0.10	160	630	-428	14,758	-172	241	0.548
Paris	0.10	193	423	-275	10,161	-25	247	0.339
Bordeaux	0.20	500	847	-409	20,392	62	606	0.135
Challenge	0.20	535	881	-280	20,818	70	658	0.14
Decanter	0.20	566	1,260	-610	29,762	-98	727	0.36
Paris	0.20	490	847	-446	20,425	53	597	0.154
Bordeaux	0.30	793	1,270	-571	30,630	135	952	0.079
Challenge	0.31	891	1,366	-373	32,329	170	1,081	0.075
Decanter	0.59	2,148	3,717	-1321	88,275	189	2,624	0.167
Paris	0.24	609	1,016	-515	24,530	84	737	0.122