Trade, Taxes, and Terroir

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Abstract

We use data on the French wine market to show that excise taxes on quantity generate significant barriers to entry. We show that high internal tax rates generated Alchian-Allen effects that biased consumption and production towards local producers selling higher priced wine. We test this hypothesis using quasi-experimental variation in local taxes generated by a policy change in 1901 to show that producers in regions which lowered their wine taxes by more were more likely to go out of business. Consistent with the Alchian-Allen Theorem, these effects were larger in departments producing higher priced wine.

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1. Introduction

There is an extensive literature on how national tariffs restrict market integration and competition. More recently, there has also been work on how border taxes can alter preferences.[1] By contrast, there has been relatively little work on how *internal* tax barriers affect market structure and preferences.[2] One reason for this omission is probably because most internal taxes today do not discriminate at the point of origin of traded goods. They are excises, collected on consumption regardless of where a good is from, rather than pure internal tariffs, like tolls to cross a border or use a river (or, for that matter, transportation costs). In this paper we present evidence that internal excise taxes may play an important role in determining the extent of markets within a country. We argue that when excises are collected on the quantity of a good being traded, they can generate Alchian-Allen (1972) effects which bias consumption towards more expensive, locally produced, goods. This bias in consumption, in turn, impedes market integration by supporting relatively inefficient (high price) local producers at the cost of outside (low price) competitors. We support our claims using data on the wine market in France around the turn of the twentieth century. Because wine and alcohol taxes were assessed locally on a per hectoliter basis, rather than on value, the dramatic and differential drop in regional wine tax rates following the national law of 1901 establishing a single tax on wine permit us to identify these effects.

Nineteenth century France provides an interesting case study on the importance of internal of taxes to economic development.[3] It also offers a unique window into how economic policy and national culture interact with each other. There is a long tradition of explaining French institutions and economic performance as being due to an innate Gallic preference for things that are small and local.[4] This preference is often referred to as *terroir*, which, according

[1] On market integration, see for example Jacks (2006), Irwin (2000, 2002) and the references therein. For evidence of how tariff policy affected preferences regarding drink during the Early Modern period and into the nineteenth century, see Nye (2007).

[2] There are notable exceptions, like Dincecco (2009)'s work on internal tariff barriers and state budgets during the Early Modern Period.

[3] Early modern France already had very high internal taxes. See for example Bosher (1964) on the eighteenth century debate on the Single Duty Project.

[4] For example, Arthur Young (1792) famously pointed to the prevalence, and "great evil", of the small farmer in France relative to Britain. The argument that during the nineteenth century small family farms impeded French

to one pithy definition, is a "taste for place".[5] *Terroir*, in turn, is often invoked as an explanation for France's extensive system of food regulations and, more generally, the preference exhibited by French citizens for large government.[6]

In this paper, we present evidence that the causality between a cultural preference for *terroir* and economic policy goes both ways. To the extent that internal taxes encouraged local production by small producers for much of the nineteenth century, *terroir* was as much an outcome as a causal factor in generating the French institutions we observe today. More generally, by highlighting the role played by internal taxes in reinforcing existing interests, we offer an explanation for why regulations tend to proliferate in a country as the transaction costs of trade go down and markets become more integrated.[7]

One of the main difficulties in testing whether high internal taxes generated protection for local producers of wine is that the tax rate chosen by the locality may be endogenous to the factor endowments or industrial organization of wine production in that region. For example, it is possible that the phylloxera blight, which struck the wine producing regions of France after 1865 and lasted into the 1890's could have induced policy makers to both lower taxes (as they did temporarily) and driven wine farmers out of business (as it did, temporarily). This would create a negative correlation between the number of wine producers and tax rates. However, it would say nothing about the causal effect of taxes on entry, exit, and competition.

We attempt to minimize endogeneity by taking advantage of the decrease in local tax rates due to a 1901 policy change initiated by the national government. Since there was significant variation in wine tax rates across departments[8] before 1901, the "treatment" generated

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economic growth by starving the industrial sector of the labor it needed to expand was advanced by scholars such as Boserup (1965) and Lévy-Leboyer (1978). Later work, like that exemplified by Grantham (1975) and Siscic (1992), however, argued that there was little evidence for this labor scarcity. Instead, as Heywood (1981) suggests, other likely explanations for the disproportionate French reliance on the "traditional sector" in the nineteenth century exist.

[5] This definition is often attributed to Slate columnist Jay Mcinerney.

[6] For recent examples see Steinberger (2009) and Colman (2008).

[7] The relationship between market integration and the rise of regulation has been most frequently observed and analyzed with respect to the United States during the Progressive Era. See, for example, Kim and Law (2005) Glaeser and Shleifer (2003), Masten (2010) and the citations therein.

[8] Departments are administrative divisions of the French territory which were created in 1790.

by the binding tax rate ceiling varied across departments as well. We create a department level panel data set on wine tax rates, wine consumption, number of wine farmers (*récoltants*), the value of wine production, the proportion of tax exempt wine consumed on farms (*en franchise*) as opposed to purchased on formal markets, and total output between 1896 and 1905. Using a differences-in-differences framework we then show that when local taxes decreased after 1901 more wine was traded on markets and the number of wine farmers in previously high tax regions decreased. Furthermore, consistent with the Alchian-Allen (1972) hypothesis, we show that these effects were larger in departments that produced higher-priced wine from 1896 to 1900. We also show that after the tax decrease wine production increased in departments producing cheap wine and decreased in those producing expensive wine. Taken as a whole, these results are consistent with internal taxes impeding specialization and trade at the turn of the twentieth century.

The remainder of this article is as follows. Section 2 provides an historical review of wine production and taxation in nineteenth century France, followed in Section 3 by a discussion of the Alchian-Allen hypothesis with respect to market integration. Section 4 presents the data and Section 5 provides the empirical analysis. Section 6 concludes.

2. Wine Production and Taxation in Nineteenth Century France

2.1. Wine Production in nineteenth century France

Relative to the "New World", present-day France is a country of small wine producers. In the United States, approximately 70% of wine is produced by the five largest estates. In France, the comparable number is only 10% (Simpson, MS, p. 2). The situation was not much different during the nineteenth century.[9] As Figure 1 shows, between 1896 and 1900 most of the departments in France were producing wine. During that period, the amount of wine produced by an average *vigneron* was about 21 hectoliters.[10] This compares to the average annual (taxed)

[9] Simpson points to improved transportation and greater competition in the twentieth century as driving forces behind consolidation and rationalization of production in the wine industry.

[10] In French, the word *vigneron* is used to describe a farmer who cultivates grapes for the purpose of wine production. *Viticulteur* refers to someone who uses grapes to produce wine. During the period of our study it was common for one to be both a *vigneron* and a *viticulteur* (indeed, this is a significant part of our argument about "on the farm production").

consumption of wine of about .9 hectoliters per person during the same period. This means that each farm was producing enough wine for about 23 people.[11]

One corollary to the observation that there were a large number of small wine producers in nineteenth century France is that there was also relatively little specialization and trade. Stated another way, there was an overreliance on locally produced wine to satisfy consumption needs. This wine was not traded long distance on formal markets, but rather was produced for consumption "on the farm" and was exempt from taxation (*en franchise*). According to data from the French government published in the *Annuaire Statistique de la France* (Statistical Yearbook of France - henceforth, *Annuaire*), between 1896 and 1900 in the average wine producing department fully 20% of consumption of wine was not transacted on formal markets (std. dev. = 0.15). In some departments that produced very cheap wine, like Hérault in the south, the proportion of off-market consumption was closer to 50%.

It is unlikely that it was efficient for so many French peasants to be involved in the wine business. Imperfect competition due to high transactions costs is consistent with the highly variable production costs observed across regions. Figure 2 shows the market value per hectoliter of wine across departments between 1896 and 1900. The range goes from 17 francs per hectoliter in the South (the *Midi*) where cheap wine was produced using industrial technologies, all the way to 86 francs per hectoliter in northern regions producing champagne (*e.g.* the Marne). Of course, some of the variation in cost was due to differences in quality, but not all. As we will discuss below, not every department had soil and weather suited to the production of cheap wine using the new technologies that were introduced during the second half of the century. And, as we will also show below, the French had no qualms about consuming this cheap wine once it was available.

These facts are consistent with wine markets not being fully integrated in nineteenth century France. However, it is difficult to construct the counterfactual. "Not fully integrated compared to what?" If we lowered the costs of internal trade, would "on the farm" consumption increase? Would the number of wine producers in high cost regions go down? And, would production increase in low cost regions and decrease in high cost regions?

[11] The numbers are the authors' calculation using data from the *Annuaire Statistique* de la France. This is probably an underestimate, since we do not include untaxed consumption, called consumption "on the farm", in the calculation.

These are difficult questions to answer because most of the factors that determine the cost of trade evolve relatively slowly and continuously. As James Simpson has argued, before the full development of the European railway network, the wine trade was marked by high transport costs and high taxes and most wine was produced for domestic consumption. Also, urban growth and income *per capita* were increasing throughout the nineteenth century, which is significant as demand for wine is elastic with respect to income (cf. Simpson Ch. 1, 2010 and the citations therein). Finally, a major influence on the organization of wine production during the second half of the nineteenth century was the Phylloxera epidemic and the consequent adoption of technologies conducive to an increase in the economies of scale of grape cultivation and wine making.

Phylloxera, which was first noticed in 1863, was caused by an aphid which attacked the roots of the common wine root stock *vinis vinifera*. Between 1863 and 1890 the disease accounted for the destruction of close to 40% of vineyards in France. Between 1868 and 1900 it cost close to 35 billion Francs to uproot damaged vines and replant with resistant strains (Galet 1988).

As a result of phylloxera, new sources of scale economies were introduced in both viticulture (grape growing) and viniculture (wine making) (Simpson, 2010, p. 85). In viticulture, new, high yielding, grape varieties, such as the Aramon, were introduced in the South of France and Algeria. More artificial fertilizer was necessary to keep the newly grafted, phylloxera resistant, vines healthy and deep soil, steam operated, plows were introduced to facilitate the planting of the new vines. All of these substituted labor for capital at a time when wages were increasing and the price of wine was decreasing (Bayet 1997, *Annuaire Statistique de la France*, 1933, pp. 62-3; Simpson, 2010, p. 76).

In viniculture the main advances occurred in fermentation technology that allowed large scale producers in the South of France and in Algeria to flourish. The high yield Aramon grape used in the South produced a thin and watery wine with good acidity but low alcohol content. Nonetheless, the resulting product was excellent for blending with high alcohol wine from Spain, and after the tariff of 1892 closed that market, from Algeria. But, Algeria is hot and fermentation there occurs too fast. This problem was addressed by Paul Brame's 1887 invention of a system to pump fermenting wine must through tubes immersed in cold water. Another method that was

introduced pumped sulphur anhydroxide through the must. Both of these techniques were expensive, but allowed for large scale, low cost, production of a consistent quality wine.[12]

One consequence of these scale economies was that the share of large scale, "industrially" produced wine from Southern France came to increasingly dominate wine production towards the end of the nineteenth century. In 1852 wine from the *Midi* was about 21% of French production. In the 1870's it was about 30%, and during the first decade of the twentieth century, it was 40% (Lachiver 1988 pp. 606-9; Annuaire Statistique de la France, 1934 pp. 179-80). A key issue, however, is that economies of scale cannot be exploited unless there is a large integrated market in which to sell the increased output. In fact, if the internal tax system acted as a constraint on the exploitation of these economies of scale, we would expect production in the low cost *Midi* departments to increase and production in the more expensive departments to decrease once taxes were lowered. As we will show below, this is exactly what happened.

At the end of the nineteenth century there were many small wine producers distributed throughout France. This situation persisted despite the fact that technologies allowing for greater economies of scale, along with the accompanying increase in specialization and trade, were already in place. Why? Preference for small production? Possibly. But if preferences are not aligned with material incentives, then we would expect them to change. Our claim is that the tax system generated incentives that kept the wine sector fractionalized. Namely, the tax system generated high transaction costs which prevented newly "industrialized" producers from taking advantage of the lower transport costs and the increases in demand generated by urban growth and income growth to fully challenge traditional *vignerons*.

2.2. Wine Taxation in Nineteenth Century France

We focus on two types of local wine taxes, the *octrois* whose rates were set by individual cities and other indirect taxes whose rates were determined by the national government. Ironically, the *octrois* taxes originated during the reign of Louis XI (r. 1461-1483) who, by fifteenth century standards, was a free market advocate. Louis XI promoted trade fairs in Lyon, exempted towns from the onerous *tailles* taxes, and generally issued decrees in favor of the wealthy bourgeoisie (Wolfe, *Fiscal System of Renaissance France*, p. 57-8). He also forced loans

[12] Simpson (ms p 89 footnote 64) claims that in 1903 the cost of building a 200 hectoliter wine cellar was about 6 francs per square meter. By contrast, the cost of a 20,000 hectoliter cellar was about 4 francs per square meter.

from the towns, however, and when they could no longer lend him money, he granted (fr. *octroyés*) them the right to collect *octrois* taxes on goods moving through their gates. Like many Old Regime taxes, these eventually morphed from temporary to permanent status and grew in importance as a vital source of local public finance for the towns.

The *octrois* were roundly criticized in the *cahiers des doléances* before the Revolution and the National Assembly had them abolished in 1791.[13] When cities started running out of money for education and police, however, there were petitions for the reinstatement of the taxes and by Year VII (1798-99) new levies were introduced which, eventually, survived the Revolution and came to be called *octrois* once more (Cohen, 1998, p. 44). In 1818 the *octrois* comprised 68% of the revenues for Bordeaux, 91% for St. Etienne, 85% for Toulouse, and close to 100% for Lyon (Cohen, 1998, p. 45).

By the early nineteenth century, there was a list of five different categories of consumer items that the *octrois* could be collected on (Block, 1898, "*Octrois*", p. 1333-1349). We focus on the most important category for most cities, alcoholic beverages.[14] Individual cities were given broad authority to set rates according to their needs, provided the taxes were collected on the quantity of a good being traded (as opposed to *ad valorem* taxes on the price of a good) (Block, 1898, "*Octrois*", p. 1333-1349). Originally, cities were also allowed to set the rates on the *octrois. They could discriminate on the point of origin of a product so that the octrois acted as traditional internal tariffs*. However, by a decree of 1870 (Block, 1898, "*Octrois*", p. 1333-1349) this practice was forbidden and the *octrois* were technically consumption excises.

In addition, three other indirect taxes had an impact on the price of wine.. They differed from the *octrois* because the national government set the rules under which they were collected. However, they retained two vital similarities. First , their rates varied a great deal across departments; Second they were collected on quantity as opposed to price. Before 1901, the three taxes were the *droit de circulation*, the *droit d'entrée*, and the *droit en détail*. The *droit de circulation* (circulation tax) was collected on wine traded between cities which were obligated to pay a certain amount per hectoliter. There was a schedule of per hectoliter tax rates for cities set by the national government that depended on the value of wine produced in the department in

[13] The *cahiers des doléances* were lists of grievances compiled by each of the three estates (the clergy, the nobility, and the rest of the French population) on the eve of the Revolution in 1789.

[14] The other four categories were "food", "fuel", "building materials", and "miscellaneous".

which the city was located. According to the regulations, wine traders had to pay the tax rate in the city to which it was destined to be sold (Block, 1898, "*Boissons*", p. 242).[15] The *droit d'entrée* (entry tax) was paid when bringing wine through a city or town's gates. The rate per hectoliter varied according to the population of the city and the average value of wine in the department in which the city was located (Block, 1898, "*Boissons*", p. 243). Finally, the *droit en détail* (retail tax) was an *ad valorem* tax of 15% on the price of wine sold which was collected from merchants at the point of sale (Block, 1898, "*Boissons*", p. 243).

These were the three main indirect taxes, however, any town with a population between 4,000 and 10,000 persons had the option to convert the *droit d'entrée* and the *droit en détail* into a single tax, known as the *droit de taxe unique* (single tax), which would be collected at the city gates along with the *droit de circulation*. Importantly for our story, the *droit de taxe unique* had a per hectoliter rate (as opposed to an *ad valorem* rate) that depended on the average value of the *droit d'entrée* and the *droit en détail* for the previous three years before its implementation. Finally, the conversion to the *droit de taxe unique* was obligatory for any town with a population greater than 10,000 (Block, 1898, "Boissons", pp. 243-244).

2.3. The Effects of the 1901 Law

By the end of the nineteenth century, the combined local tax rates on wine were not only very high, but also varied a great deal across departments.[16] All were assessed per volume and not *ad valorem*. Figure 3a shows the sum of the *octrois* and other indirect tax rates for every department in France between 1896 and 1900.[17] The average tax rate across departments is about 7 francs per hectoliter of wine. To put this in perspective, the price of an average hectoliter of wine in France *after* taxes were lowered during the 1901-1905 period, was 17 francs.[18] If we assume the supply of wine was perfectly elastic (so that any tax increase is reflected by an increase in the price paid by the consumer), then this implies a tax rate of about 30% on the

[15] If this were not the case, then the *droit de circulation* would be more like an *ad valorem* tax, which would weaken any Alchian-Allen effects (see Section 3 below).

[16] The combined tax rate equals the sum of the rates on the (*octrois* + *droit de circulation* + *droit d'entrée* + *droit en detail*). The actual way this number is calculated is explained in Section 4.1. For our analysis below we will simply call this number the "tax rate".

[17] We exclude Corsica and the overseas departments from the analysis since some data are missing.

[18] Data on prices is from Rémy Pech (1975, Appendix).

average hectoliter of wine. Between 1901 and 1905 the highest priced wine was about 28 francs and the lowest was 13 francs per hectoliter. The tax rates on these would have been, on average, 20% and 35% respectively.

Of course, the numbers above are the implied tax rates assuming the wine is being consumed in a department whose *octrois* and other indirect taxes were average. There was, in fact, a great deal of variation in wine tax rate across departments. From Figure 3a it is clear that this variation followed a roughly North-South axis, with the highest tax departments in the North and the lowest in the South. For example, in most Northern departments the combined wine tax rate was between 10 and 20 francs per hectoliter. In Paris, by far the greatest consumer center, the tax rate was 19 francs per hectoliter. Taking the average price for a hectoliter of wine, this implies a tax rate of over 50% in the capital. By contrast, in the South, tax rates ranged between 2 and 5 francs per hectoliter, thereby implying a tax rate of between 10% and 20%.[19] This local variation in tax rates is a vital component of our strategy to identify the effect of internal taxes on wine market integration.

Our strategy is illustrated by a comparison of the tax rates in Figure 3a for the 1896-1900 period to the tax rates in Figure 3b for 1901-1905. As these Figures make clear, there was a dramatic decrease in the departmental wine tax rates such that virtually all departments had rates below 5 francs per hectoliter after 1900. We interpret the change in local tax rates between 1896-1900 and 1901-1905 as a treatment that may have impacted the degree to which local producers were insulated from competition. The size of this treatment varied from department to department according to how high its taxes were during the 1896-1900 period. If this treatment was unrelated to other factors affecting wine production and consumption in a department, then we can be confident that changes in the number of wine producers or market participation between the two periods were also caused by the change in the tax rate.

In fact, the decrease in rates was even more sudden than what is conveyed by Figures 3a and 3b. As Figure 4 shows, almost all of the decrease occurred between 1900 and 1901. The reason why rates went down so suddenly is the same reason we believe we can interpret the decrease as exogenous to local conditions in the departments. There was a change in tax policy

[19] These examples are just that, examples to emphasize the tremendous variation in local tax rates across the country. It is important to keep in mind that the true rate of taxation on *locally produced* wine (as opposed to an *average* bottle imported from another department) depends on the price of local wine, not the national average.

initiated at the national level that went into effect on 1 January 1901. This policy reform was initiated by the Radical party which came to power in 1897 and whose members were influenced by "progressive" voices who wanted Frenchmen to stop consuming "harmful" drinks, such as brandy and other forms of distilled alcohol, in favor of wine, which they referred to as "*boissons hygiéniques*" (Marion, 1927, vol. 6, p. 209 and Veber and Millerand, 1899).

The law of 29 December 1897 required that the *octrois* on all *boissons hygiéniques* be lowered according to the type of drink. For wine, depending on the population of the city, the *octrois* rate could not exceed a value between 0.55 and 4.00 francs per hectoliter. For cider and mead the maximum tax was between 0.35 and 1.50 francs per hectoliter, and for beer 5 francs (Marion, vol. 6, p 210). Furthermore, towns and cities were forbidden from introducing new taxes on alcoholic drinks and were obligated to create new taxes to make up revenues equal to the anticipated reduction due to the reforms. Finally, consistent with the progressive intent of the legislation, the tax on hard alcohol was increased significantly to 109 francs per hectoliter.[20]

As written into the original legislation, none of the tax rate ceilings were binding on municipalities for two years. However, as is wont to happen in democratically elected legislative bodies, the unpopular decisions embodied in the legislation of 29 December 1897 were duly avoided for longer than that. The first unpopular decision was the raising of the tax on hard alcohol in order to offset the lost revenues from the lowering of the *octrois* on *boissons hygiéniques*. The only way these increased taxes would make a difference was if the thousands of peasant farmers who engaged in "moon shining" but were exempt from taxation, known as *bouilleurs de cru*, were brought back into the tax base. The second major obstacle was that the 29 December 1897 law was opposed by regional urban leaders. It required them to make hard choices on how to replace the lost revenues from the lowered octrois, but the other indirect taxes (*droit de circulation, droit d'entrée,* and the *droit en détail*) collected by the National government were left untouched. Why should the mayor of a small city risk his political career when the members of Parliament would not?

It was not until the first semester of 1899, under the leadership of the radical republican minister Charles Dupuy, who relied for much of his political support on the wine producers of the South, that both of these issues were resolved (Marion, 1927, vol. 6, p. 235). The exemption of the *bouilleurs de crus* was maintained (for production of hard alcohol less than 20 liters). The

[20] The full text of the 29 December 1897 law is reproduced in Veber and Millerand (1899) .

tax on large producers of hard alcohol (*fabricants*), was, in effect, raised by introducing a new tax on the sugar used in distillation (Marion, 1927, vol. 6, p. 236). As for the indirect taxes, the *droit d'entrée* and the *droit en detail* were both suppressed entirely while the *droit de circulation* was lowered to 1.5 francs per hectoliter of wine regardless of the location or size of the city of destination (Marion, 1927, vol. 6, p. 237; Cointet, 1901). Finally, as a concession to the mayors who would have to create new taxes to replace the old *octrois*, the lower house of parliament postponed the implementation of the 29 December 1897 law until 1 January 1901.

The effect on wine tax rates of the binding ceiling introduced on 1 January 1901 across French departments is clear from Figure 4. But why should this reduction have had any effect on internal trade? These taxes were all *consumption* taxes, not border tariffs, after all. They did not discriminate on the point of origin of wine, and thus, did not directly add to the costs of internal trade. In the next section we argue that since the wine taxes were collected on quantity rather than price they potentially generated Alchian-Allen effects which resulted in significant market distortions.

3. Alchian-Allen Effects and Market Integration

The intuitive premise of the Alchian-Allen effect, often called the "third law of demand" by economists, is that if there are two goods of different qualities, one with a high price and the other with a low price, then a fixed charge applied to both products will lower the relative price of the more expensive good (Alchian and Allen, 1972). The most common application of Alchian-Allen is to international trade, where high transportation costs can bias exports towards higher quality goods (the so-called "shipping the good apples out" phenomenon). Nonetheless, this simple theoretical observation generates all sorts of counter-intuitive predictions as well. For example, parents paying a fixed fee for baby-sitting services will tend to go to more expensive restaurants and buy more expensive tickets at the theater. If a region has a relatively high property tax in place, the businesses that operate there will tend to sell higher quality goods (think of downtown shopping centers, or more generally, the lack of "big box" stores in high tax European countries). Alchian-Allen effects based on transportation costs have been found empirically in markets as diverse as that for slaves in nineteenth century America (Pritchett and Chamberlain, 1993) and for wine consumed in Australia and the United States (James and Alston, 2002; Ljunge, 2006).

Since the *octrois* and other indirect wine taxes were unit taxes (collected on *quantity* consumed) they were theoretically equivalent to transportation costs and potentially generated significant Alchian-Allen effects.[21] Intuitively, this is obvious just by looking at some basic descriptive statistics. During the 1896-1900 period, the average price of a hectoliter of wine across all of France was about 24 Francs. In the South of France, where more cheap wine was produced using industrial techniques, the average price of wine during this period was about 18 Francs. This implies a relative price of cheap imported to expensive locally produced wine of about 0.74. After the tax rate decrease in 1901, the average price of wine in France was about 18 Francs and Southern wine was about 12 Francs, which implies a decline in the relative price of cheap imported wine of 8%. This decline increases to about 20% if we exclude 1902 and 1903 from our calculations which were bad production years.[22]

Figure 5 provides another way to observe how the Alchian-Allen effect relates to the wine tax reforms implemented in January 1901. We graph the five year average of the log of the relative price of cheap Southern *Midi* wine to the national average. This relative price series may be interpreted as the average rate which cheap Southern wine had approached or deviated from the national average (base year: 1888). The price data show a striking decrease in the relative price of cheap wine around 1901. By 1905, cheap wine had decreased in price by about 25% relative to the national average. Furthermore, this decrease was mostly reversed after 1906, right on the heels of costly anti-competitive legislation passed in 1905 designed to reduce fraud and adulteration in the wine market (we discuss these regulations in greater detail in Section 6). As the series on wine production in Figure 5 illustrates, at the same time that the relative price of cheap wine is decreasing, there is also an increase in the overall amount of wine produced in France (though this increase is consistent with the long term trend of recovery after the Phylloxera epidemic). Taken together, the relative price and production data imply that the wine tax reforms of 1901 may have had a stimulating impact on the wine trade in France. However, before we begin our formal analysis, it is worth asking how exactly we would expect the Alchian-Allen effect to impact participation in wine markets and, more generally, the industrial organization of wine production.

[21] See Hummels and Skiba (2004) for a discussion of taxes, transport costs, and Alchian-Allen effects.

[22] In years of bad production, there were shortages and prices increased. Even if this happened for both the South and the North, it would push the relative price of regional wine closer to unity.

Our theoretical argument regarding Alchian-Allen effects is not about substitution between very high end wines (e.g. clarets from Bordeaux) and lower quality table wine. Wines at the very high end were, in any case, a very small proportion of production and often exported. Rather, we hypothesize that high unit taxes biased consumption towards more expensive, locally produced table wine (or *vins ordinaires*). There are two channels through which this effect likely operated. First, the Alchian-Allen effect directly operated when more expensive but locally produced table wine was perceived as being of higher quality than cheaper table wine produced farther from the point of consumption. The false perception that local wine was thought to be of "higher quality" was due to the lack of reliable signals or branding. Indeed, there is ample evidence from the end of the nineteenth century that wine adulteration (*e.g.* adding extra sugar to raise alcohol content) and fraud (*e.g.* misleading labeling) were widespread and had a significant impact on the buying decisions of consumers (Stanziani, 2003). Cheap wine produced in the South of France was especially often singled out for accusation (Warner, 1975, pp. 12-14).

Second, the Alchian-Allen effect might have driven the transactions for cheaper table wine off formal markets in order to avoid paying taxes altogether.[23] Crucially, however, cheap wine imported from other regions could not be transacted (or at least not easily transacted) anywhere but on formal markets. Thus, to the extent that local taxes discourage formal market transactions for wine, this would also bias consumption towards more expensive, locally produced wine and away from cheaper imports.

We can formalize the relationship between average departmental wine tax rates and the relative consumption of expensive local wine to cheap imported wine. This will allow us derive predictions about what factors, other than the tax rate, should affect the size of the Alchian-Allen effect. We start with a Hicksian compensated demand function for wine in department *i*,

$$q_{ig} = h\left(p^{*}_{iH}, p^{*}_{iL}, p_{ic}\right), \quad g = H, L \tag{1}$$

where q is the quantity demanded and g indexes the type of good and i indexes department. p_{iH} represents the price of the high quality, expensive, locally produced wine. p_{iL} represents lower quality, cheap, imported wine. p_{ic} is the price of the composite good. We assume that the price of wine facing the consumer in department i includes a common trade cost of τ_i. We further assume that this charge is assessed on quantity rather than quality; as such, we can suppress the

[23] More expensive wine would have been less affected by this tendency since its relative price actually decreased with higher taxes.

quality subscripts and write $p_i^* = p_i + \tau_i$. In the absence of transportation costs, τ_i may be interpret as the unit tax rate in department *i*.

Alchian and Allen (1972) suggest that in the presence of unit charges, demand will be skewed towards the higher quality product. This can be shown formally by examining the effect of a change in τ_i on the relative compensated demands for the high and low quality goods.[24]

$$\frac{\partial\left(q_{iH}/q_{iL}\right)}{\partial\tau} = \frac{q_{iH}}{q_{iL}}\left[\left(\eta_{HH}-\eta_{HL}\right)\left(\frac{1}{p_{iH}^*}-\frac{1}{p_{iL}^*}\right)+\left(\eta_{LC}-\eta_{HC}\right)\frac{1}{p_{iL}^*}\right] \qquad (2)$$

where η_{HH} is the own price elasticity of the high quality good, η_{LH} is the cross price elasticity of the low quality good for the high quality good, η_{LC} is the cross price elasticity of the low quality good with respect to the composite good, and η_{HC} is the cross price elasticity of the high quality good for the composite good. The first two terms of equation (2), $\left(\eta_{HH}-\eta_{LH}\right)\left(\frac{1}{p_{iH}^*}-\frac{1}{p_{iL}^*}\right)$, represent the direct substitution effect of the change in the tax rate and are positive as long as high and low quality wine are substitutes $\left(\eta_{LH}>0\right)$ and the high quality good has a higher price than the low quality good. The last term is an indirect substitution effect with the composite good. The standard assumption in the literature is that $\left(\eta_{LC}=\eta_{HC}\right)$ and that this effect can be safely ignored (or at least is of second order).

There are two insights we can take away from equation (2). First, the distortionary effect of the tax rate increases as the difference in price between high and low quality goods increases. We have been interpreting the high quality good as locally produced, expensive wine, and the low quality good as imported, cheap, wine. If we make the additional assumption that the data we collected on the market value of production per hectare reflects the average price of a department's wine $\left(p_{iH}^*\right)$, we can use these data to proxy for how much a given department's locally produced wine price exceeds the cheap imported wine price (that is, how negative the expression $\left(\frac{1}{p_{iH}^*}-\frac{1}{p_{iL}^*}\right)$ is for department *i*). In the empirical analysis in Section 5 we will rely on this theoretical insight to investigate the interaction between the change in a department's tax

[24] We use the derivation of Hummels and Skiba (2004). They, in turn, follow closely the derivation of Borcherding and Silberberg (1978).

rate and the post-tax price of wine that department. The more expensive the wine produced by a given department (after taxes), the larger the marginal effect Alchian-Allen effect should be.

4. Data

Our data were collected from various issues of the *Annuaire Statistique de la France* (Statistical Yearbook of France - henceforth, *Annuaire*) and, where necessary, from the *Bulletin de Statistique et de Legislation Comparée* (Bulletin of Statistics and Comparative Legislation - henceforth, *Bulletin*).[25] We create a department level panel spanning 1896 to 1905 that will allow us to test whether high internal wine tax rates impeded competition and specialization and trade at the end of the nineteenth century in France.

We construct two samples, one in which all wine producers are included (76 out of 87 departments). We also construct a restricted sample in which the lowest ten percent of wine producers (as measured by departmental production between 1896 and 1900) are dropped. This results in a restricted sample of 69 out of 87 departments.

Descriptive statistics for all the variables used in both the full and restricted samples are given in Table 1. In the full sample, we note that the *DiffWineTaxRate* variable has a mean of -0.92 which indicates that, on average, tax rates decreased across the departments by about 92% as a result of the government's reform. The average number of wine producers decreased by 3.6% and the amount of wine transacted on informal markets decreased by 7% (mean *DiffRecoltants* = -0.036 and mean *DiffPropEnFranchise* = -0.07). Thus the effects of the 1901 reform are potentially large.

We perform Kolmogorov-Smirnov tests on each variable comparing the normalized variable's distribution against a hypothetical normal distribution. We repeat these tests on the natural log of these variables. In all cases the logged version of the variable is more normally distributed. As such, we use the log-differenced versions of all the variables for our analysis. This also facilitates interpretation of the output as growth rates and is consistent with the approaches used by others to test the Alchian-Allen theorem (Ljunge, 2006).

4.1. Dependent Variables

[25] The *Bulletins* were published by the Treasury and contain many of the series upon which the *Annuaires* are based.

We focus on three dependent variables which should have been affected by Alchian-Allen effects as described in Section 3. The first variable measures the degree to which markets were used to transact wine. The *Annuaires* report data on the estimated consumption of "taxed" wine and of wine "*en franchise*", i.e., which was untaxed. Technically, wine was only exempt from taxation if it was consumed "on the farm" and not sold. In this case, winemakers reported to the Treasury agents that their production would be for their personal consumption. We generate a variable which is the proportion of wine consumed *en franchise* to measure non-market transactions. It is calculated as

$$\left(\text{propenfranchise} = \frac{\text{wine consumed "on farm"}}{\text{total wine consumption}} \right).$$

Our second dependent variable is an estimate from the *Bulletins* of the number of wine farmers, or *récoltants*, in a given department each year. We can use this to measure whether there was entry or exit from the wine sector after the tax rate was lowered. Exit from a given department's wine sector would imply that the wine taxes were protecting those farmers from competition.[26]

Our third dependent variable is simply a measure of the total annual production of wine, in hectoliters, for each department from the *Annuaires*. If internal taxes were impeding specialization and trade in wine then we would expect, according to equation (2), output to increase in departments that produce cheap wine and decrease in departments producing expensive wine. In other words, after the costs of trade decline, departments should specialize according to their comparative advantages.

4.2. Explanatory Variables

In our study, the most important explanatory variable is the department level wine tax rate. It required the construction of two separate rates, one for the wine *octrois* and another for

[26] We should note that one potential problem with our measures of *propenfranchise* and *recoltants* is that they are both based on estimates government officials working for the Third Republic. That said, we did check to make sure each variable was not a simple function of another, directly observed, variable. For example, consumption *en franchise* is not simply 20% of taxed consumption (as Rémy Pech (1975) implies). There is plenty of variation across time and space in both estimated variables. Furthermore, we collapse the variables into 5 year averages, which should smooth out year to year errors in the estimates.

the other indirect taxes (*droit de circulation, droit d'entrée,* and the *droit en détail*). There are no consistent records of any of these rates in the government data. However, for the *octrois*, the *Annuaires* contains data on tax receipts for each department in every year. The *Annuaires* also contain data on wine consumption that was subject to taxation (*consommations imposées*) and wine consumption that was done "on the farm" (*en franchise*), which was not taxed. Assuming the data on taxed wine consumption in a department corresponds to the tax base for the *octrois*, we then backed out the *octrois* wine tax rate as

$$\left(\text{octrois tax rate} = \frac{\text{octrois tax revenues}}{\text{quantity of wine taxed}}\right).$$

Calculating the tax rate for the indirect taxes was easier in that the *Annuaires* include data on both aggregate revenues and consumption specifically for those taxes, at the departmental level before 1901.[27] However, for most years after 1900, there is no data on consumption, which is a major issue since, for the *droit de circulation*, consumption and revenue data do not necessarily match up. Fortunately, since the legislation that went into effect in January 1901 eliminated all of the indirect taxes except the *droit de circulation*, which was lowered to 1.5 francs per hectoliter for all towns and cities, we can simply use this figure as the rate for indirect taxes after 1900.[28] Thus, the indirect tax rate for the period 1896-1900 is calculated as

$$\left(\text{indirect tax rate} = \frac{\text{indirect tax revenues}}{\text{quantity of wine taxed}}\right)$$ and 1.5 francs per hectoliter after 1901.

Since the tax rates are measured as nominal francs per hectoliter, we convert them to real variables using the agricultural price level series in Levy-Léboyer and Bourguignon (1985).[29] We use the sum of the *octrois* and indirect tax rates as our primary independent variable.

According to equation (2) another important determinant of the size of the Alchian-Allen effect should be the value of wine produced in a department. To proxy for this, we use the annual data in the *Annuaires* on the value of wine output per hectare for each department. This

[27] We cannot back out the tax rates for the individual components of the indirect taxes since the data in both the *Bulletins* and the *Annuaires* simply refers to *taxes indirectes: vins*.

[28] We confirmed that 1.5 was, indeed, the rate for the indirect taxes on wine after 1901 using data from the 1906 *Annuaire* (p. 244), which by chance, includes a series on consumption of wine for the indirect taxes.

[29] We also undertook our analysis without adjusting for the price level with hardly any affect on the results.

is the average sale price (after taxes) of the wine produced in the department. It corresponds to $\left(p_{iH}^{*}\right)$ in equation (2).

In addition, we generate two control variables. From the *Annuaires* we collect yearly data on total departmental railroad mileage in order to control for the change in transportation costs during the sample period. We also collect yearly data on wheat (*froment*) production from the same source in order to control for department level agricultural shocks that affect wine production and consumption.

4.3. Instrumental Variables

To account for the possibility that the size of the tax rate change is correlated with some unobserved, department level, variable that varies with time and is related to the treatment we find instruments for the change in the tax. We base our choice of instruments on the observation that departments with higher initial tax rates in the before period, will also experience larger decrease after the policy change. We thus focused our search on finding variables that are correlated with the initial tax rate of the department, but uncorrelated with other factors that would potentially affect the number of wine producers or the ratio of market to non-market transactions. The most obvious candidates relate to the cost of providing public goods for the cities in the department. Following this logic, our first instrument is a measure of the average cost of building a secondary school (*lycée*) in 1894. The higher the cost of school construction, the higher tax rates should have been in a department.

Another possible candidate is related to the politics confronting the department when choosing what kind of taxes to collect. Regions with a comparative advantage in wine production would be unlikely to have a very high initial wine tax rate since wine producers would object. Instead, they taxed beer, hard alcohol, or other consumption goods (like wood or cooking oil). We can proxy for the comparative advantage of a department by using the average price of the wine they produced after taxes were lowered. Definitions and descriptive statistics for both instruments are provided in Table 1.

5. Empirical Analysis

5.1. Econometric model

The counter-factual scenario, "How much more specialization and trade would there have been in the absence of high internal tax rates?" is difficult to construct. This is precisely why most studies of market integration which ask the question "Are markets integrated by such and such time?" have difficulty in pinning down causality. We avoid some of these problems by asking a different question: "Compared to similar departments that do not have their taxes lowered (the 'control group'), do departments that experience a decrease in wine tax rates (the 'treatment group'), also experience an increase in market participation or a decrease in the number of wine producers?". Since the lowering of local wine taxes on 1 January 1901 was initiated that the National level, we argue that its timing was exogenous to local conditions determining market participation, entry and exit, and production.

This reinterpretation of the market integration question leads naturally to a relatively clean empirical design allowing estimation of the effect of the tax treatment on differences in the dependent variables. This differences-in-differences approach is immune to bias due stemming from time-invariant omitted variables (*e.g.* geography, cultural characteristics of the departments, or, ingrained political and economic institutions). It also controls for unobserved variables that vary with time, but that affect all wine producing departments identically (*e.g.* recovery from phylloxera, or, nation-wide business cycles/crop failures).

It has been shown that difference-in-difference models using data with more than two time periods run a substantial risk of generating biased standard errors (Bertrand et al., 2004). Furthermore, theory offers very little guidance on the predicted lag structure of our independent variable. For example, we do not know how many years it takes for a change in the local tax rate to result in producers exiting from the wine sector. Indeed, it is likely that these effects would be spread over several years. For both of these reasons, we choose to follow the advice of Bertrand et al. (2004) and collapse our panel into two time periods corresponding to pre and post-treatment years (1896-1900 and 1901-1905). Five years should be long enough for the effects of the tax rate decrease to show up in our dependent variables and to smooth over year-to-year agricultural shocks unique to individual departments. But it is a short enough time period that we minimize the impact of unobserved variables which change relatively slowly over time that may affect market integration for a specific department (*e.g.* a new road being built through a region).

The underlying model we wish to estimate is,

$$y_{it} = \alpha + \beta t + \delta \tau_{it} + X'_{it}\Lambda + \phi_i + \varepsilon_{it}, \quad t = 1,2 \tag{3}$$

where y_{it} is one of our three dependent variables, t is a time indicator, ϕ_i is a vector of department fixed effects, X' is a vector of control variables, and ε_{it} is an *i.i.d.* error term. The control variables we include are the total amount of railway mileage and output of wheat in each department. The first controls for time variant department level transportation costs and the second for time department level agricultural supply shocks which affect all crops in a similar way (e.g. the weather). The variable of interest is the inflation adjusted departmental wine tax rate, τ_{it} and the coefficient δ is the differences-in-differences estimate.

We choose to estimate (3) as a cross section in differences specified as,

$$\Delta y_i = \beta + \delta \Delta \tau_i + \Delta X'_i \Lambda + \Delta \varepsilon_i \tag{4}$$

If $E(\Delta \tau_i, \Delta \varepsilon_i) = 0$, then our OLS estimates of (4) will be consistent. However, our estimates of δ will be biased if the size of the tax rate change is correlated with some unobserved, department level, variable that varies with time and is related to the treatment. To minimize this possibility, we also estimate (4) using limited information maximum likelihood methods along with the instrumental variables described in Section 4.3.[30]

According to the theory presented in Section 3 and the expression for the marginal effect of a change in the tax rate on the size of the Alchian-Allen effect given by equation (2), we expect the size of the treatment effect to vary according to the value of wine produced in a department. As such, we also estimate a series of models in which we allow the initial value of wine from a department to interact with the tax treatment. According to equation (2), the effect of a decrease in the unit tax on the relative demands for expensive local wine and cheap imported wine should be greater in departments producing more expensive wine initially. We model this as,

$$y_{it} = \alpha + \beta t + \pi v_{i1} t + \delta \tau_{it} + \gamma (v_{i1} \cdot \tau_{it}) + X'_{it}\Lambda + \phi_i + u_{it}, \quad t = 1,2 \tag{5}$$

where v_{i1} represents the initial value of wine production for department i. We explicitly allow the initial value of wine production to have a time varying direct effect on the dependent variable

[30] We also run all the instrumental variables regressions using 2SLS, but report only the LIML results since first stage F-stats suggest the possibility that our instruments are weak. As expected, the more efficient 2SLS estimates are similar to the unbiased LIML results, but more significant.

in addition to its indirect influence through the tax treatment. Again, we choose to estimate (5) as a cross section in differences,

$$\Delta y_i = \beta + \pi v_{i1} + \delta \Delta \tau_i + \gamma \left(v_{i1} \cdot \Delta \tau_i \right) + \Delta X' \Lambda_i + \Delta u_i \tag{6}$$

The differences-in-differences estimate is equal to the combined direct effect of the tax treatment and of the indirect effect of the treatment mediated by the initial value of wine production.

$$\frac{\partial \Delta y_i}{\partial \Delta \tau_i} = \delta + \gamma \cdot v_{i1} \tag{7}$$

The standard error of (7) is,

$$\sigma = \sqrt{\operatorname{var}\left(\hat{\delta}\right) + \left(v_{i1}\right)^2 \operatorname{var}(\hat{\gamma}) + 2\left(v_{i1}\right)\operatorname{cov}\left(\hat{\delta} \cdot \hat{\gamma}\right)} \tag{8}$$

which obviously varies with the initial value of production per hectare in the department.

5.2. Results

In Table 2 we report the results of estimating (4) using the proportion of "on the farm" transactions as our dependent variable. We predicted that high local taxes may have forced local producers of relatively expensive wine to avoid formal markets, an option importers of cheaper wine would not have had. In specification (1) we report the coefficient on the difference in the wine tax rate from estimating equation (4) on the full sample without any controls. As expected, the sign is positive indicating that a decrease in the wine tax rate leads to a decrease in "off market" consumption. The reported coefficient, 0.42, is also statistically significant at the 1% level and economically significant. According to the estimate, a one standard deviation change in the tax rate would lead on average to a third of a standard deviation decrease in the amount of wine transacted on informal markets. In columns (2) and (3) we introduce the control variables and restrict the sample so that departments with relatively little wine production are excluded. The estimated coefficient on the change in the tax rate decreases slightly but remains significant at the 1% level.

Furthermore, the instrumental variables estimates of equation (4) are presented in columns (4) and (5) of Table 2. In the preferred specification in which we include control variables and restrict the sample to exclude the smallest producers of wine, the coefficient estimate on the change in tax rate just about doubles compared to the OLS estimates and continues to be significant at the 1% level. Furthermore, in the (unreported) first stage

regression the coefficients on education spending and before tax value of production enter with the correct signs (negative) and are significant. The shea-partial r-squared indicates that the instruments jointly explain about 28% of the variation in the change in the tax rate. We also report the p-value associated with the Hansen-J statistic from the overidentification test of the validity of our instruments. We fail to reject the null hypothesis that the instruments are valid. Finally, we perform a Hausman test of the exogeneity of the variable of interest in order to establish whether IV methods are appropriate in the first place. This test fails to reject the null that the change in the tax rate is exogenous, suggesting that our original OLS estimates were unbiased.

In Table 3 we estimate specification (4) using the difference in the number of wine farmers as our dependent variable. Theory predicts that if *récoltants* were protected from market forces by high local tax rates, then there should be an exit of the marginal producers once tax rates were lowered (the coefficient on the difference in the tax rate should be positive). This is precisely what we see in columns (1), (2), and (3). All estimates of δ have a positive sign and are significant at the 1% level. According to the estimates in column (3), which includes control variables and uses the restricted sample, a one standard deviation decrease in the department's tax rate results in a decrease in the number of wine farmers by about a quarter of a standard deviation.

We also report LIML estimates for the coefficient on change in tax rate using the change in wine producers as the dependent variable in Table 3. Again, focusing on specification (5) which includes controls and throws out small producers or wine, we find that the coefficient of interest increases in size and is significant at the 5% level. The p-value associated with the Hansen-J statistic indicates we cannot reject the null that the instruments are valid. Furthermore, as with the regressions on *PropEnFranchise*, the Hausman test indicates that the variable of interest is exogenous and we do not need to worry about time varying, department level, unobserved variables biasing our estimates.

We also run specifications in Tables in 2 and 3 in which we transform the continuous difference in tax rate variable into a dichotomous variable that is equal to one if the change in the department's tax rate was less than (decreased by more than) the mean decrease across all the departments. This should, again, minimize any potential endogeneity arising from departments with extremely high initial tax rates driving the results. We report these results in column (6) in

both tables. The estimates are consistent with the other specifications, although the sign flips because larger decreases in the tax rate are now represented by an *increase* rather than a *decrease* in the variable of interest.

As an additional robustness check on the results in Tables 2 and 3, we perform a falsification test to verify that the timing of the 1901 reform is not correlated with unobserved variables which may bias our coefficient estimates (see Bertrand et al. 2004). The procedure randomly assigns placebo reforms to departments in random years and then re-estimates Equation (3). We repeat these steps a thousand times. If we find that the coefficient associated with these randomly-generated reforms is significant at the 5% level in roughly 50 out of the 1000 iterations, we can conclude that our results are unlikely to stem from pure coincidence. In other words, our results would validate the exogeneity of the 1901 reform.

The results of the falsification test on the specifications from Columns (1) to (3) in Tables 2 and 3 are shown in Table 4 where we report the percentage of times our randomly-generated reforms were significant at the 5% level, as well as its standard error in parentheses. The tests of the OLS regressions in Columns (1) to (3) in Table 2 show that the randomly-generated reforms are respectively significant 2.3%, 1.9% and 2.1% of the times (with standard errors of 0.0047, 0.0043 and 0.0045). Moreover, the randomly-generated reforms in the falsification test for the OLS regressions in Columns (1) to (3) in Table 3 are significant 0.2%, 10.3% and 1.8% of the times (with standard errors of 0.0014, 0.0096 and 0.0042). Hence, five out of six results in this falsification test suggest that there is less than a 5% chance that the results which we obtain stem from pure coincidence. This provides additional support for our contention that the 1901 reform had a causal impact on the increase in wine consumption and the exit of wine producers.

Finally, in Table 5 we report results from estimating equation (6) in which we allow the initial value of wine production to have a time varying direct effect on the dependent variables in addition to its indirect influence through the tax treatment. Thus, in columns (1) and (2) of Table 5, we present the interaction results using the decrease in off-market consumption as the dependent variable. We also graph in Figure 6a the differences-in-differences estimate in (7), which is equal to the combined direct effect of the tax treatment and of the indirect effect of the treatment mediated by the initial value of wine production, and the 95% confidence intervals generated by (8) for our preferred estimates which include all the control variables and exclude the low wine producing departments

The results are consistent with the predictions of the Alchian-Allen effect. Departments which produced more expensive wine experienced a larger marginal effect on market use from the reduction in the tax rate. To illustrate, consider the size of the predicted overall effect in three departments with different initial values of output. *Hérault*, located along the Mediterranean Sea in the South of France produced cheap wine worth about 18 francs per hectare. In the middle is *Gironde*, located on the east coast and where many *haut cru* (high quality) wines come from today. This department had an average value of production of about 28 francs per hectare. Finally, *Marne* in the North of France is where Champagne is made. Its average value of production was a whopping 82 francs per hectare. In low-value *Hérault*, the lowering of tax rates had, in effect, no predicted statistical or economic impact on the use of formal markets. In the *Gironde*, a one standard deviation decrease in the tax rate is predicted to lead to a decrease in the use of informal markets close 0.60 of a standard deviation. In high value producers like *Marne*, this number increases to over 3 standard deviations.

Furthermore, Columns (3) and (4) of Table 5 present the interaction results using the change in number of wine producers as the dependent variable while we graph in Figure 6b the corresponding difference-in-difference estimates and the 95% confidence intervals generated by (7) and (8). As predicted by theory, more wine producers went out of business in departments with higher initial values of production. For a low value department like *Hérault*, the number of producers is actually predicted to increase such that a one standard deviation decrease in the tax rate would lead to a 0.84 standard deviation *increase* in wine producers. In higher value departments like *Gironde* and *Marne*, however, the comparable numbers are a 0.67 and 3.50 standard deviation *decrease* in wine producers respectively.

In the last two columns of Table 5 we estimate equation (6) using the total production of wine as the dependent variable. We also present in Figure 6c the corresponding difference-in-difference estimates and the 95% confidence intervals given by (7) and (8). The results are roughly in line with the theoretical prediction that low value/cost departments should increasingly specialize in wine production as trade barriers are lowered. In low cost *Hérault*, a one standard deviation decrease in the wine tax rate leads to about a 0.67 increase in output. By contrast, in *Gironde* and *Marne* the same one standard deviation decrease in tax rates is predicted to decrease output by 0.56 and 2.9 standard deviations respectively.

Overall, our formal analysis strongly supports the hypothesis that high internal taxes on wine impeded market development and prevented internal specialization and trade within France during the nineteenth century.

6. Discussion and Conclusions

After internal taxes were lowered, France did not whole-heartedly embrace free market competition. Indeed, the shocked (and often violent) response of wine farmers confronted by market forces -- red in tooth and nail as it were -- was sufficient to convince politicians to impose a new set of restrictions on internal trade. No sooner had France shed its old system of high internal *taxes* on wine, than it imposed new wine *regulations* restricting adulteration and fraud.

There can be little doubt that the citizens of France had benefited from lower wine prices. As Figure 4 makes clear, consumption skyrocketed after the lowering of the *octrois* and other internal wine taxes. Opposition came from producers rather than consumers. And the rhetorical mode in which this opposition was advanced was in terms of fraud and adulteration by new entrants, as opposed to the "traditional" production techniques of those wine makers who had trouble competing in the newly opened markets. High end producers with strong reputations in regions like Burgundy and *Gironde* were not very troubled by the flood of cheap wines. Instead, it was the small, traditional producers of table wine in these regions and, more importantly, producers in the south who felt their livelihoods being threatened (Simpson, 2005, p. 538). In the southern departments of *Aude* and *Hérault* there were a series of strikes by wine workers beginning in 1902 which culminated in the extreme violence of 1907, when the government of Georges Clémenceau sent in troops to suppress rioting in Marseille resulting in the deaths of hundreds (Harvey, 1978).

There were two institutional innovations which emerged as a response to producer pressures after 1901. First, regulations were passed in August 1905 and June 1907 making it illegal to produce "adulterated" wine (Warner, pp. 41-42).[31] Among the requirements imposed by these regulations were rules on what sorts of additives could be used in wine production and requirements that wine producers report how much wine they produce, the weight of harvested

[31] The focus was on "sugar wine", which was an extremely popular way in which to transform the weak second, third, or even fourth, pressings of wine must into a drinkable product with an acceptable (to the consumer) alcohol content.

grapes, the quantity of musts (unfermented wine) they shipped, etc…. There were also vague prohibitions against the production of wine that was not "natural". Which wines were artificial and which natural was open to the interpretation of whoever enforced the laws. This leads to the second, and equally important, development after the collapse in wine prices: the rise of wine trade associations. Organizations like the *Confédération Générale des Vignerons du Midi* (CGV – General Confederation of Midi Winemakers), were largely responsible for actually enforcing the laws against adulteration and fraud being created by the National Government. A telling indication of the importance of the CGV in pursuing those it considered guilty of fraud (*fraudeurs*) is that in 1912 it spent 412,000 francs in the South of France alone on the identification and prosecution of illegal wine, whereas the entire government budget for enforcing anti-fraud legislation was 1,143,000 francs for the whole of France (Warner, 1975, p. 47). In addition to the CGV in the South, unions arose across all of the wine producing regions of France in the years before World War 1.[32]

The effect of these new regulations, largely enforced by syndicates of "traditional" wine producers, coincided with a gradual increase in the price of wine across France that began after 1907. As Figure 5 shows, one result of this was that the relative price of cheap southern wine to the wine produced in the rest of France gradually rose and returned to its pre-tax reform levels. The issues raised by this process of tax decrease leading to market integration, and then accusations of fraud causing a wave of government regulation, culminating in prices rising again, resonate with debates about the role of markets, adulteration, and regulation in the U.S. Progressive Era.[33] We reserve speculation on the "French Progressive Era" for further research, though we note that the wine policy experiment of 1901 provides, in many ways, an ideal test of the role of market integration in triggering the political forces that ultimately led to the system of French food regulation that persists to this day.[34] Market integration and the resulting competitive pressures it promoted, as opposed to changing technology or preferences, appear to have played a causal role in constructing the "modern" French regulatory state.

[32] In 1909, there were the *Confédération des Vignerons du Sud-Est*, the *Confédération des Associations Viticoles de Bougogne*, the *Fédération des Syndicats de la Champagne Viticole*, the *Ligue des Viticulteurs de la Gironde*, and the *Fédération des Associations Viticoles Régionales de France* (Warner, 1975, p. 48).

[33] See Glaeser and Shleifer (2003).

[34] See Colman (2008).

There are two main conclusions that we take from this study. The first is historical. Our results provide strong evidence that high internal taxes retarded French wine market integration in the nineteenth century. There is no doubt that tax policy protected local producers and discouraged the use of formal markets. On a more speculative note, it is also likely that the same taxes which protected local wine producers were, if not responsible for the gradual development of the oft remarked upon French preference local production using natural means (sometimes referred to as *terroir*), they certainly reinforced its tendencies.

Our second main conclusion is theoretical. Excise taxes collected on quantity, rather than price, may provide protection for high cost, local, producers. This is true even if the taxes do not discriminate on point of origin. To our knowledge, this is a theoretical point that has strong foundations in the Alchian-Allen theorem, but has not been identified in the literature. A corollary to this observation is that researchers should pay more attention to *internal* trade within countries as opposed to *external* trade between countries since the types of transaction costs which result in low internal trade are broader than previously imagined.

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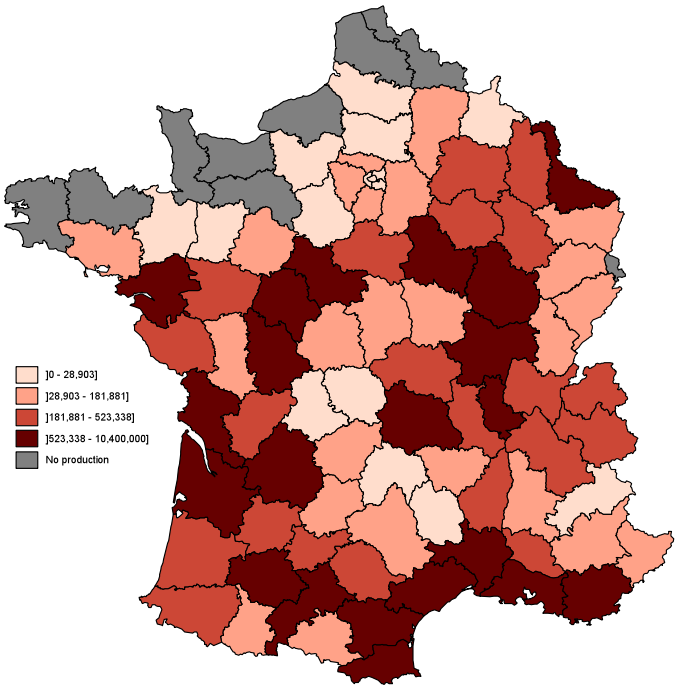
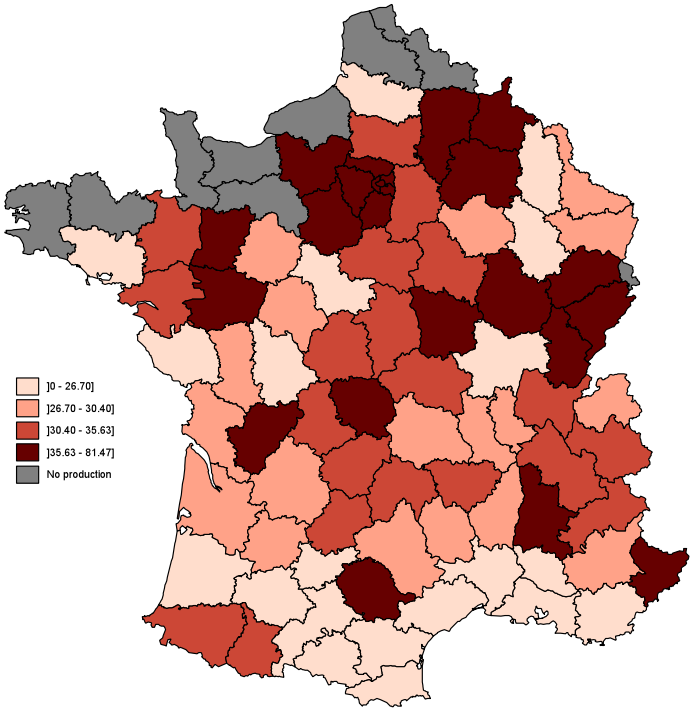
Figure 1: Departmental Wine Production, 1896-1900



Note: Wine production in hectoliters, broken down by quartiles. Source: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906.

Figure 2: Value of Wine Production by Department, 1896-1900



Note: Value of Wine Production in French francs, broken down by quartiles. Source: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906.

Figures 3a-b: Departmental Wine Tax Rate Before and After Law of 1901

Figure 3a: Wine Tax Rate, 1896-1900

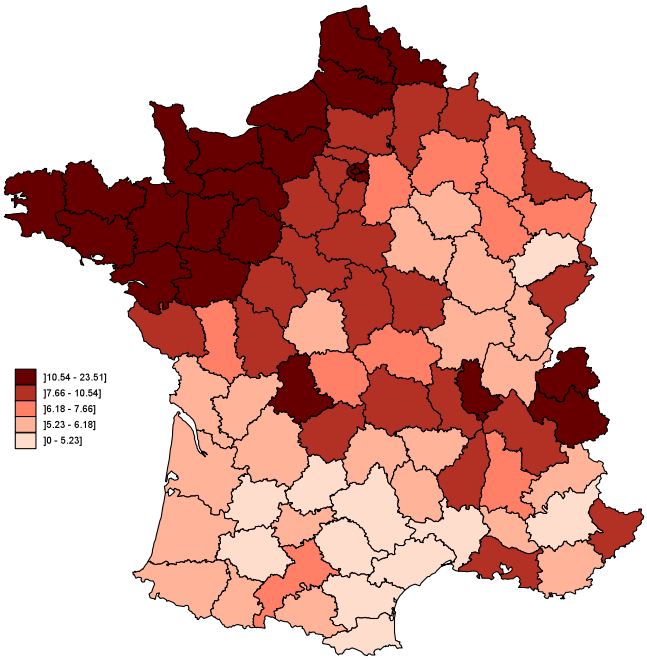
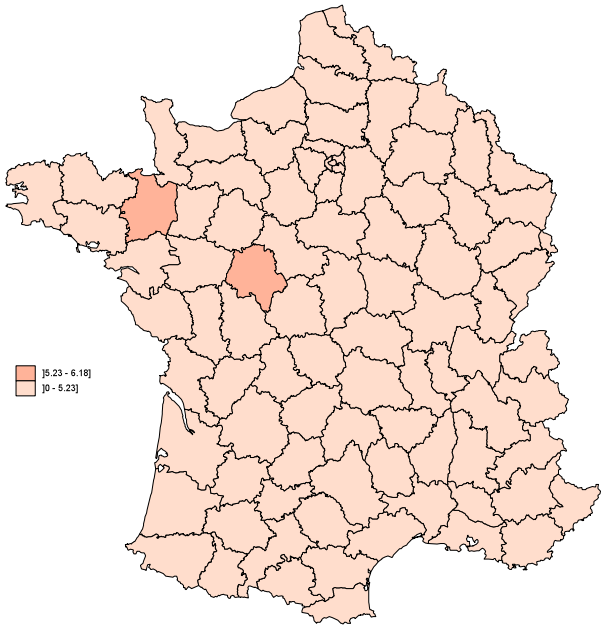
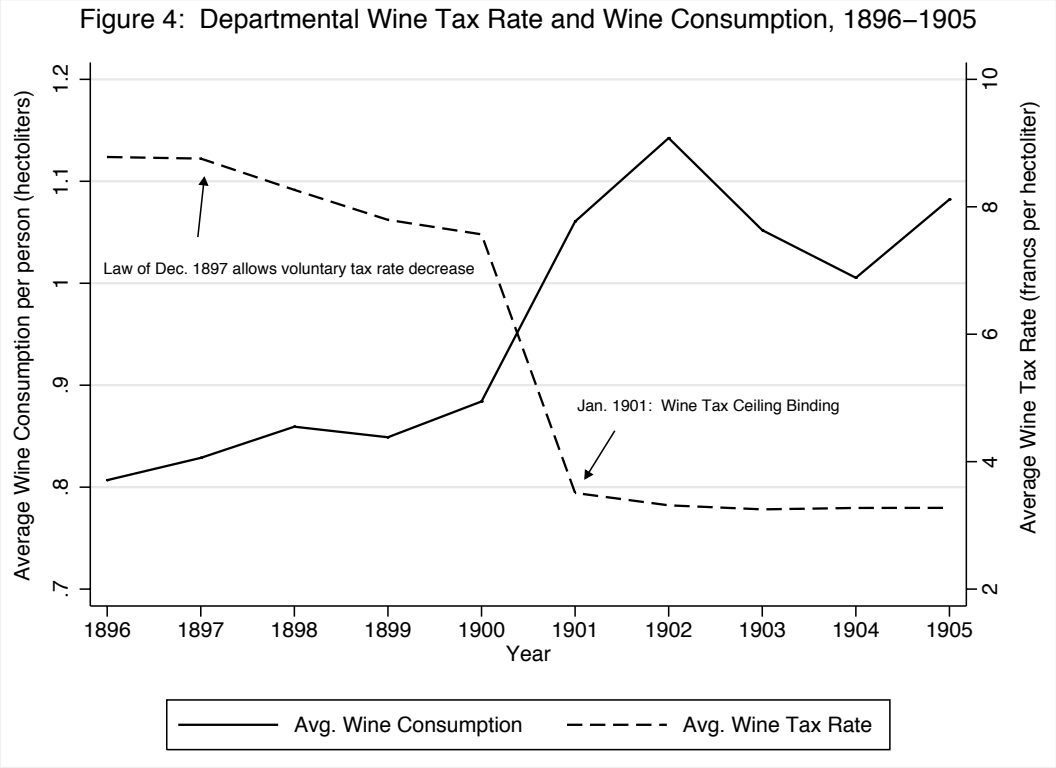


Figure 3b: Wine Tax Rate 1901-1905



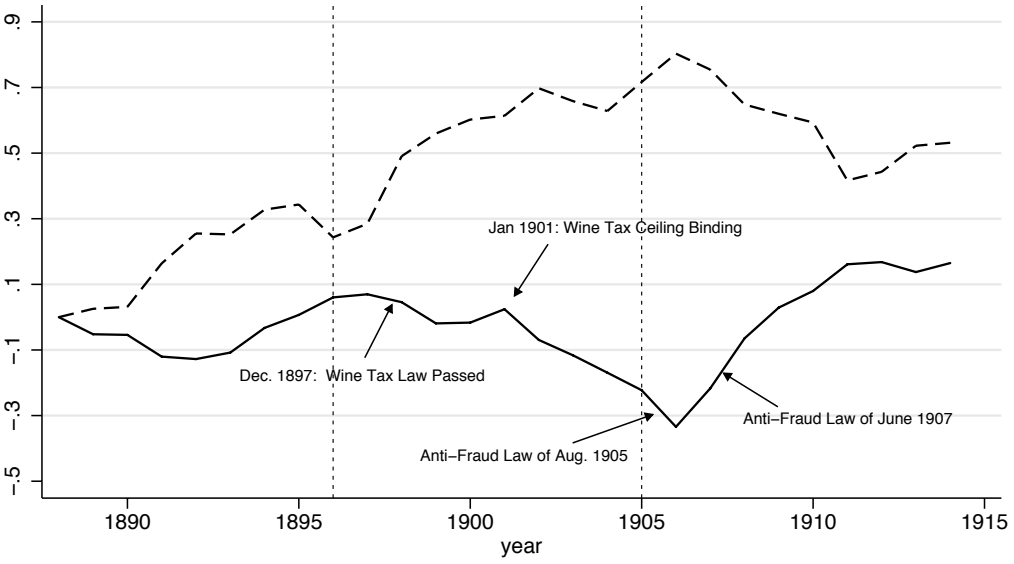
Note: Wine tax rates before and after 1901, broken down in quartiles.

Source: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906.

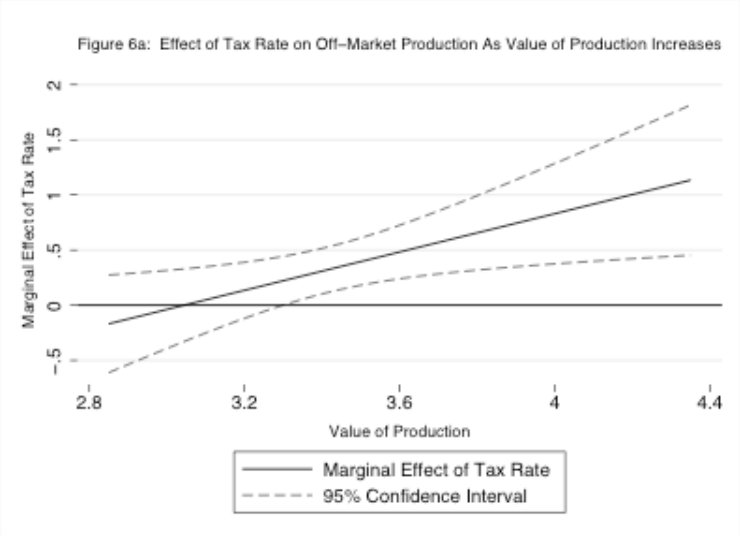


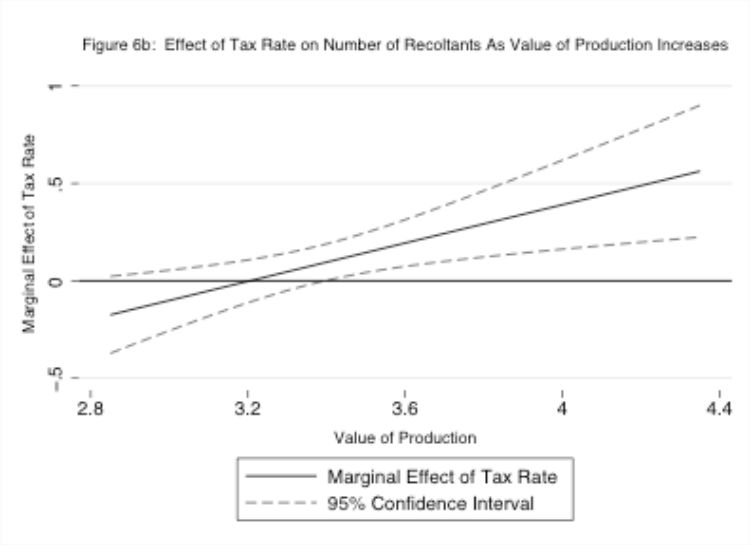
Source: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906.

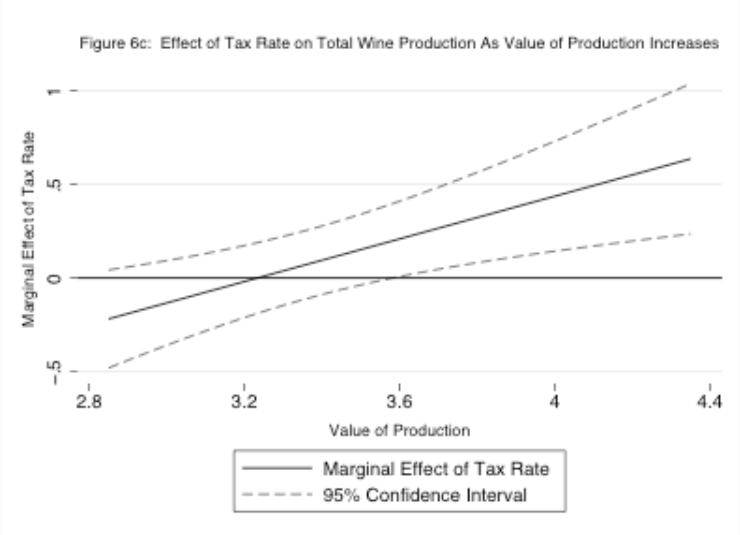
Figure 5: Production and the Relative Price of Midi Wine, 1888–1914



Notes: Data from various years of the Annuaire Statistique. Five year moving averages. Scale of wine production is log(hectoliters). Midi departments are Herault, Pyrenees Orientales, Gard, and Aude.







Note: Figures 6 (a) 6 (b) and 6 (c) plot the results of specifications (2), (4), and (6) in Table 5. Source: see text.

Table 1: Descriptive Statistics

Panel A: Full Sample

Variable Name	Description	Obs	Mean	Std. Dev.	Min	Max
DiffWineTaxRate	Difference in Log of Real Wine Tax Rate (real francs per hectoliter)	76	-.9236778	.3684129	-2.308709	-.3553174
DiffRecoltants	Difference in Log Number of Wine Producers	76	-.035529	.2425459	-1.131271	.4351196
Dichotomous Tax Rate Treatment	= 1 if change in tax rate < mean change	76	0.2894737	0.4565315	0	1
DiffPropEnFranchise	Difference in Log of Proportion of Consumption on Farm	76	-.0718824	.5273625	-1.54889	1.692301
DiffProduction	Difference in Log of Wine Production (hectoliters)	76	.2471274	.3978446	-.7130041	1.646446
DiffRailways	Difference in Log of Railway Track (kilometers)	76	566003.6	208329.7	191381.9	1129018
DiffProdWheat	Difference in Log of Froment Production (hectoliters)	76	0.036609	0.1641917	-0.4102945	0.3985596
CostSchool	Log of Average Cost of Lycee Construction (Francs)	76	10.03598	.2947274	8.894258	10.57103
CostWine	Log of Value of Production After Tax Decrease (francs)	76	3.170917	.3076361	2.326357	4.146908
InitialValueProd	Log of Initial Value of Production per Hectare (francs), 1896-1900	76	3.415602	.3165157	2.80336	4.400236
Interact	(DiffWineTaxRate) x (InitialValueProd)	76	-3.180655	1.354271	-7.432475	-1.053794

Panel B: Sample Restricted to top Ten Percent of Wine Producers

Variable Name	Description	Obs	Mean	Std. Dev.	Min	Max
DiffWineTaxRate	Difference in Log of Real Wine Tax Rate (real francs per hectoliter)	69	-.8931228	.3647416	-2.189009	-.3553174
DiffRecoltants	Difference in Log Number of Wine Producers	69	-.017552	.2097907	-.571013	.4351196
Dichotomous Tax Rate Treatment	= 1 if change in tax rate < mean change	69	.2463768	.4340574	0	1
DiffPropEnFranchise	Difference in Log of Proportion of Consumption on Farm	69	-.0600449	.4454439	-1.358215	.8135283
DiffProduction	Difference in Log of Wine Production (hectoliters)	69	.2186733	.3409205	-.6116948	1.036441
DiffRailways	Difference in Log of Railway Track (kilometers)	69	562462.1	207596.1	191381.9	1129018
DiffProdWheat	Difference in Log of Froment Production (hectoliters)	69	.027373	.165124	-.4102945	.3985596
CostSchool	Log of Average Cost of Lycee Construction (Francs)	69	10.02538	.3030428	8.894258	10.57103
CostWine	Log of Value of Production After Tax Decrease (francs)	69	3.146632	.2990006	2.326357	4.146908
InitialValueProd	Log of Initial Value of Production per Hectare (francs), 1896-1900	69	3.419886	.3157897	2.808686	4.400236
Interact	(DiffWineTaxRate) x (InitialValueProd)	69	-3.083918	1.35028	-7.432475	-1.053794

Notes: Panel A: Full sample (76 departments). Panel B: Excludes the lowest ten percent of wine producers (69 departments). Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906. All variables are logged.

Table 2: Did High Internal Taxes Impede Market Development?

Dependent Variable = Difference in Proportion of Wine Consumed Off Market (DiffPropEnFranchise)

	(1) OLS	(2) OLS	(3) OLS	(4) LIML	(5) LIML	(6) OLS
DiffWineTaxRate	0.4231*** (0.1299)	0.3497** (0.1372)	0.3534*** (0.1142)	0.9012*** (0.2854)	0.6744*** (0.2567)	
Dichotomous Tax Rate Treatment (=1 if change < mean)						-0.3238*** (0.1169)
Controls		x	x		x	x
Restricted Sample			x	x	x	x
Observations	76	76	69	69	69	69
R-Sq	0.104	0.135	0.251			0.253
First Stage F-stat				8.09	7.29	
Shea Partial R-sq				0.2858	0.277	
Hansen-J (p-value)				0.4003	0.633	
Hausman test (p-value)				0.1106	0.165	

Notes: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée*. All variables are logged. Controls include the difference in railway mileage and difference in production of wheat at the department level. The "Restricted Sample" excludes the lowest ten percent of wine producing departments. Significance levels are denoted by: *** p<0.01, ** p<0.05, * p<0.1. Huber-White robust standard errors are reported for all specifications.

Table 3: Did High Internal Taxes Protect Local Producers?

Dependent Variable = Difference in Number of Wine Producers (DiffRecoltants)

	(1) OLS	(2) OLS	(3) OLS	(4) LIML	(5) LIML	(6) OLS
DiffWineTaxRate	0.2181*** (0.0616)	0.1804*** (0.0595)	0.1428** (0.0564)	0.2883** (0.1200)	0.2668** (0.1261)	
Dichotomous Tax Rate Treatment (=1 if change < median)						-0.1255** (0.0587)
Controls		x	x		x	x
Restricted Sample			x	x	x	x
Observations	76	76	69	69	69	69
R-Sq	0.131	0.181	0.136			0.132
First Stage F-stat				8.09	7.29	
Shea Partial R-sq				0.2858	0.2772	
Hansen-J (p-value)				0.7771	0.7409	
Hausman test (p-value)				0.1621	0.1892	

Notes: Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906. All variables are logged. Controls include the difference in railway mileage and difference in production of wheat at the department level. The "Restricted Sample" excludes the lowest ten percent of wine producing departments. Significance levels are denoted by: *** p<0.01, ** p<0.05, * p<0.1. Huber-White robust standard errors are reported for all specifications.

Table 4. Falsification test

Panel A. Falsification test for the regressions in Columns (1)-(3) of Table 2.

(1)	(2)	(3)
0.023	0.019	0.021
[0.0047]	[0.0043]	[0.0045]

Panel B. Falsification test for the regressions in Columns (1)-(3) of Table 3.

(1)	(2)	(3)
0.002	0.103	0.018
[0.0014]	[0.0096]	[0.0042]

Note: This Table presents the results of a falsification test on the OLS regressions in Columns (1), (2) and (3) of Tables 2 and 3. We report the percentage of times our randomly-generated reforms were significant at the 5% level, and its standard error in brackets.

Table 5: Were Departments with Higher Initial Values of Wine Affected More By Tax Reform?

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	DiffPropEnFranchise	DiffPropEnFranchise	DiffRecoltants	DiffRecoltants	DiffTotalProduction	DiffTotalProduction
DiffWineTaxRate	-2.5195**	-2.6452**	-1.4688***	-1.5753***	-1.7241**	-1.8436***
	(1.1091)	(1.2093)	(0.5505)	(0.5727)	(0.6635)	(0.6287)
InitialValueProd	0.4956**	0.4723*	0.1886	0.1769	0.6306***	0.6124***
	(0.2089)	(0.2492)	(0.1149)	(0.1187)	(0.1365)	(0.1316)
Interact	0.8658**	0.8690**	0.4717***	0.4914***	0.5586***	0.5702***
	(0.3268)	(0.3528)	(0.1630)	(0.1692)	(0.1960)	(0.1847)
Controls		x		x		x
Restricted Sample	x	x	x	x	x	x
Observations	69	69	69	69	69	69
R-squared	0.209	0.296	0.191	0.235	0.133	0.204

Notes: Specifications (2), (4), and (6) are plotted in Figures 6 (a) – (c). Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906. All variables are logged. Controls include the difference in railway mileage and difference in production of wheat at the department level. The "Restricted Sample" excludes the lowest ten percent of wine producing departments. Significance levels are denoted by: *** p<0.01, ** p<0.05, * p<0.1. Huber-White robust standard errors are reported for all specifications.