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From internal taxes to national regulation: Evidence from a French wine tax reform at the turn of the twentieth century

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Abstract

The growth of the modern regulatory state is often explained in terms of an unambiguous increase in regulation driven by the actions of central governments. Contrary to this traditional narrative, we argue that as governments increased state capacity, they often strove to weaken the autarkic tendencies of regional laws, thereby promoting greater trade and a more integrated market. To show this, we exploit a quasi-natural experiment generated in the French wine industry by a law implemented on 1 January 1901 which lowered and harmonized various local tax rates.

We demonstrate that high internal taxes on wine, set by regional governments, discouraged trade and protected small producers of expensive and low quality wines. We then trace how the political response to this tax decrease led to increases in wine regulation.

Keywords: Regulation; State and local taxation; Market integration

1. Introduction

A growing literature stresses the importance of state capacity for economic development.[3] These studies argue that the historical legacy of the ancestor states and noble holdings that were consolidated by modern centralized governments during the early-modern period left a legacy of inefficient institutions (Rosenthal, 1992; Grafe, 2012; Johnson and Koyama, 2012; Drechlichman and Voth, 2013). Furthermore, through the process of state-building, centralized governments gradually undermined these inefficient institutions (Epstein, 2000; Dincecco, 2009; Fukuyama, 2011; Johnson and Koyama, 2011; Gennaioli and Voth, 2011). Most of these studies, however, rely on theory or on cross-country evidence to support their claims. In this paper we study how this process unfolded in a single industry inside a single country, thereby providing a more nuanced version of how increases in state capacity undermined autarchic vestiges of the past. Our analysis shows the role played by centralized states in suppressing locally set taxes, of deep historical origins, that impeded market development.

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[3] A state with greater "capacity" is usually defined as being able to enforce consistent laws (legal capacity) and being able to collect taxes (fiscal capacity). For example, see Besley and Persson (2010), Besley and Persson (2009), Acemoglu (2005), Acemoglu and Robinson (2012).

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The existing literature on the growth of government portrays the rise of regulation as a straightforward conflict between a predatory state and a mostly unfettered private market.[4] But the rise of the modern state was as much about the conflict between different levels of government as control of the private sector. Reform was beneficial where growing state capacity allowed the central government to weaken the autarkic tendencies of local government and thereby promote trade and market integration. We present an important case study from French economic history that illustrates how central regulation could replace diverse, and often obstructive, local regulations. In the Third French Republic, local regional taxes on wine obstructed domestic trade and promoted inefficiencies in production. By unifying regulations and lowering regional taxes, the French state promoted the modernization of the French wine industry.

Our primary contribution is to show that internal taxes on wine in France (set by regional governments) during the late nineteenth century favored local producers and local consumption. To this end, 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 between1896 and 1905.[5]

We identify the effect of internal taxes on market structure by taking advantage of a quasi-natural experiment created by the decrease in local tax rates due to a national law adopted on 29 December 1897 by the French parliament which came into effect on 1 January 1901. This law was the result of lobbying from "progressives" who wanted to improve citizens' health by encouraging the consumption of wine as opposed to hard liquor. Since there was significant variation in wine tax rates across regions before 1901, the exogenously timed decrease in rates generated by the binding tax rate ceiling varied across regions as well. Our main results show that the decrease in internal taxes in 1901 increased the amount of wine traded on formal markets and led to exit by small local producers of wine that was expensive and of low quality. These results are economically significant. A one standard deviation decrease in the tax rate resulted in an increase in formal market use and a decrease in the number of wine producers of over a quarter of a standard deviation of those variables. More generally, our finding that the number of wine producers decreased after taxes were lowered, when combined with the fact that wine production was increasing throughout this period, suggests an increase in the scale of production.

We complement our identification strategy which builds on the exogeneity of the 1901 tax change by undertaking falsification tests that assess the (lack of) significance of placebo tax reforms. The results from these tests reinforce our contention that the 1901 tax change was exogenous to the pre-1901 situation of wine production in each department. They therefore support our conclusion that internal taxes set by regional governments protected local producers and favored local consumption.

The locally set internal taxes that we study were unit taxes (collected on quantity consumed) and thus theoretically equivalent to transportation costs. They were also excise taxes as opposed to import taxes since they did not discriminate on point of origin. Our empirical findings are therefore also relevant to the modern literature on tax efficiency (Mankiw et al., 2009; Hines, 2008). Whereas the traditional cost of excises is taken as being the welfare losses to consumers and producers generated by the tax wedge, our analysis implies that excises on wine in nineteenth century France also discouraged the penetration of large-scale producers of cheap wine into certain markets.

We suggest that Alchian–Allen effects may explain this phenomenon (Hummels and Skiba, 2004; Alchian et al., 1972). The intuitive premise of the Alchian–Allen effect 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. We provide evidence that regions producing cheap table wine using factory methods in the South of France were disproportionately benefited by the lowering of internal taxes in 1901. Thus, our paper also makes a contribution to the literature on local public finance by showing that excise taxes, even when they do not discriminate on point of origin, can still deter specialization and trade.[6]

We conclude by describing the political response by local interest groups to the increased market competition resulting from the elimination of local taxes. These popular movements ultimately resulted in the creation

[4] An obvious explanation for this over-sight is selection bias in our data sets. Easily accessible, centralized, records only became available as national governments increased their activities and, as a consequence, also started collecting more data. This creates an automatic, though potentially spurious, positive correlation between "size of government" and "size of national government". See Novak (1996) for an important exception to this observation.

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

[6] See Baldwin et al. (2003) on changes in industry location under increased economic integration and changes in tax competition.

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of national regulations which impeded internal trade. Thus, national regulations which protected local producers gradually emerged as substitutes for locally enforced internal taxes and tariffs at the end of the nineteenth century. This 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 (1890–1920) (Masten, 2011; Law and Kim, 2005; Glaeser and Shleifer, 2003). Much like the U.S., France was imposing new regulations on food and beverages at the turn of the century. Where the U.S. adopted the Pure Food and Drug Act in 1906 (Coppin and High, 1999; Wood, 1986; Temin, 1980), the French government introduced between August 1905 and June 1907 a series of regulations outlawing the production of "adulterated" wine (Stanziani, 2004; Warner, 1975) that also sought to protect local producers from competition. These wine regulations ultimately resulted in the well known *appellation d'origine contrôlée* system. [7] As such, our paper contributes the understanding of the origins of the modern regulatory state as well.

The rest of this article is organized as follows. Section 2 provides the institutional background on wine production and taxation in nineteenth century France. Section 3 presents theoretical support for our hypothesis. Section 4 presents the data and Section 5 explains the identification strategy. Section 6 analyzes the results. Section 7 concludes.

2. Wine production and taxation in nineteenth century France

2.1. Wine production

Present-day France still remains a country of relatively small wine producers. In the United States, approximately seventy percent of wine is produced by the five largest estates. In France, the comparable number is only ten percent (Simpson, 2011). Despite some advances in scale and specialization, the overall picture has not changed greatly since the late nineteenth century. As Fig. 1 shows, between 1896 and 1900 most of the departments in France were producing wine. [8]

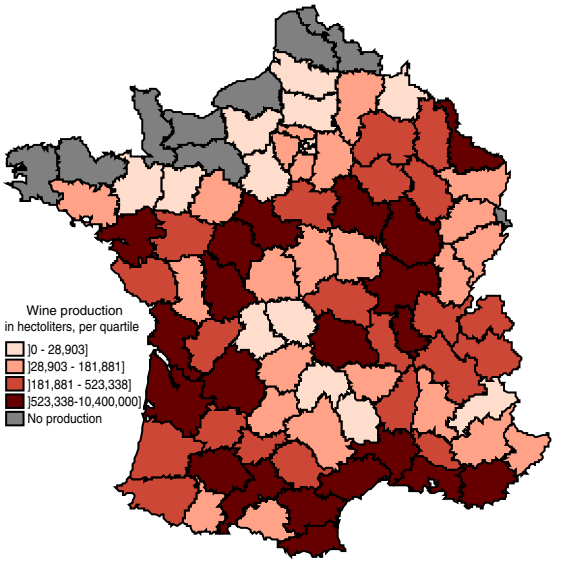

Fig. 1. Departmental wine production, 1896–1900. *See text for sources.*

During that period, the amount of wine produced by an average *vigneron* was about 21 hl. [9] This compares to the average annual (taxed) consumption of wine of about 0.9 hl per person during the same period and implies that each farm produced enough for about twenty-three people.

The large number of small wine producers meant that there was an over-reliance on locally produced wine to satisfy consumption needs. Wine was often not traded in distant markets, but rather was produced for consumption "on the farm" and was exempt from taxation (*en franchise*). According to official government data, between 1896 and 1900 fully twenty percent of the wine consumed in the average wine producing department 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 fifty percent.

One question we address is whether this situation reflected the optimal amount of specialization and trade in the French wine sector. Imperfect competition due to high transactions costs is consistent with the highly variable production costs observed across regions. Fig. 2 shows the market value per hectoliter of wine across departments between 1896 and 1900. The range goes from seventeen francs per hectoliter in the South

[7] See Colman (2008) and Steinberger (2009) for recent treatments of the extensive system of French food and beverage regulation.

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

[9] *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*.

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(the Midi) where cheap wine was produced using industrial technologies, all the way to eighty-six francs per hectoliter in northern regions producing champagne. Of course, some of the variation in cost was due to differences in quality, but not all. As we 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.

These observations suggest that a lack of market integration and the persistence of inefficiencies allowed too many French peasants to be involved in the wine business. If markets became more integrated as a result of a decrease in the costs of internal trade, we would expect the number of wine producers in high cost regions to fall while wine production would increase in low cost regions.

Measuring the lack of market integration, however, is difficult because most of the factors that determine the costs of trade co-evolve relatively slowly. As Simpson (2011) argues, before the full development of the European railway network, the wine trade was marked by high transport costs and high taxes. As a result, most wine was produced for domestic consumption. Furthermore, urban growth and income *per capita* were increasing throughout the nineteenth century. 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.[10]

During the second half of the nineteenth century, new sources of scale economies were introduced in both viticulture (grape growing) and viniculture (wine making) (Simpson, 2011). Many of these innovations substituted capital for labor at a time when wages were increasing and the price of wine was decreasing (Bayet, 1997; Annuaire Statistique De La France, 1933). 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 twenty-one percent of French production. In the 1870s it was about thirty percent, and during the first decade of the twentieth century, it was forty percent (Lachiver, 1988; Annuaire Statistique De La France, 1934). Economies of scale cannot be exploited, however, 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.

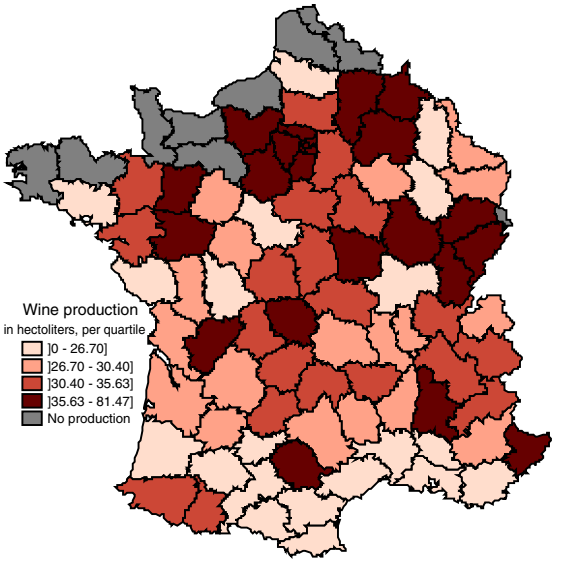

Fig. 2. Departmental average value of wine production, 1896–1900. *See text for sources*.

2.2. Wine taxation

In order to show the effects of locally set taxes on the French wine trade, 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. B (available online) discusses how we construct these measures.

Fig. 3 shows the sum of the octrois and other indirect tax rates for every department in France between 1896 and 1900.[11] These combined tax rates on wine, which were assessed per volume and not ad valorem, were very high, with a national average tax rate around seven francs per hectoliter of wine. However there was a great deal of variation in the wine tax rate across departments.

[10] The 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 forty percent of vineyards in France (Galet, 1988).

[11] Data for Figs. 3 and 4 collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906. We exclude Corsica and the overseas departments from the analysis since some data are missing.

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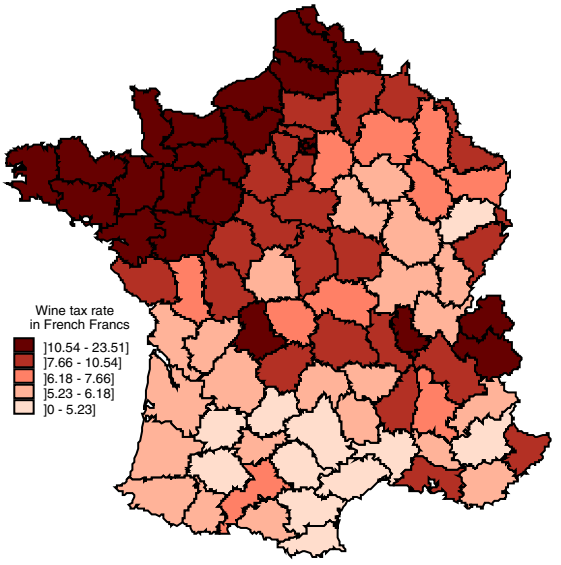

Fig. 3. Average departmental wine tax rate, 1896–1900. *See text for sources*.

[12] Fig. 3 suggests 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 ten and twenty francs per hectoliter. In Paris, by far the greatest consumer center, the tax rate was nineteen francs per hectoliter. Taking the average price for a hectoliter of wine at seventeen francs after taxes were lowered during the 1901–1905 period following (Pech, 1975), this implies a tax rate of over fifty percent in the capital. By contrast, in the South, tax rates ranged between two and five francs per hectoliter, thereby implying a tax rate of between ten and twenty percent. This local variation in tax rates is a vital component of our strategy to identify the effect of internal taxes on wine market integration because it allows us to compare the features of the wine market before and after the implementation of the 29 December 1897 law.

2.3. The 29 December 1897 law and its implementation on 1 January 1901

The law of 29 December 1897 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; Veber and Millerand, 1899). Given the national nature of the progressive movement, it is likely that the timing of the lowering of the octrois taxes across regions was exogenous to local factors. This makes the 1901 reform a valid quasi-natural experiment to identify the effect of local taxes on market structure.

This policy reform 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 5.00 francs (Marion, 1927, 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.[13]

As written into the original legislation, none of the tax rate ceilings were binding on municipalities for two years. However, 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 the issues preventing implementation of the law were resolved (Marion, 1927, vol. 6, 235) and on 1 January 1901 the law was finally implemented.

The effect on wine tax rates of the binding ceiling across French departments is clear from Figs. 3, 4, and 5. But why should this reduction have had any effect on internal trade? These taxes were all consumption taxes which did not discriminate on the point of origin of wine, and thus, did not directly add to the costs of internal trade. In what follows, 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

[12] The combined tax rate equals the sum of the rates on the (*octrois* + *droit de circulation* + *droit d'entrée* + *droit en détail*). See Section 3.2 for details. For our analysis below we will simply call this number the "tax rate".

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

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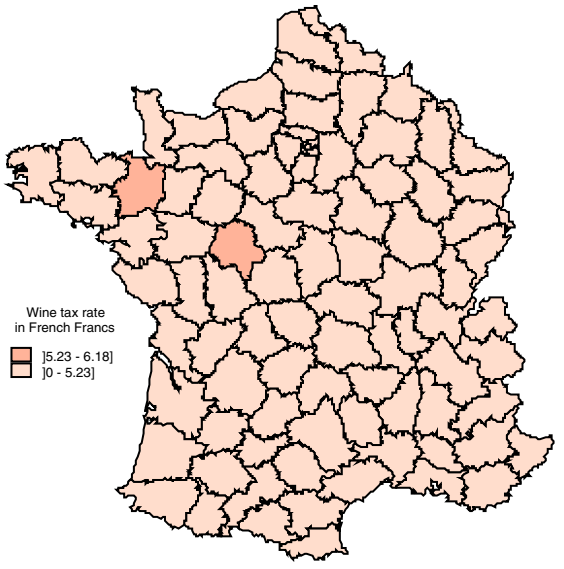

Fig. 4. Average departmental wine tax rate, 1901–1905. *See text for sources*.

fixed charge applied to both products will lower the relative price of the more expensive good (Alchian et al., 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).

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. We suggest two channels through which this effect likely operated in nineteenth century France to discourage specialization and trade. 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, 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. More expensive wine would have been less affected by this tendency since its relative price actually decreased with higher taxes. 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.

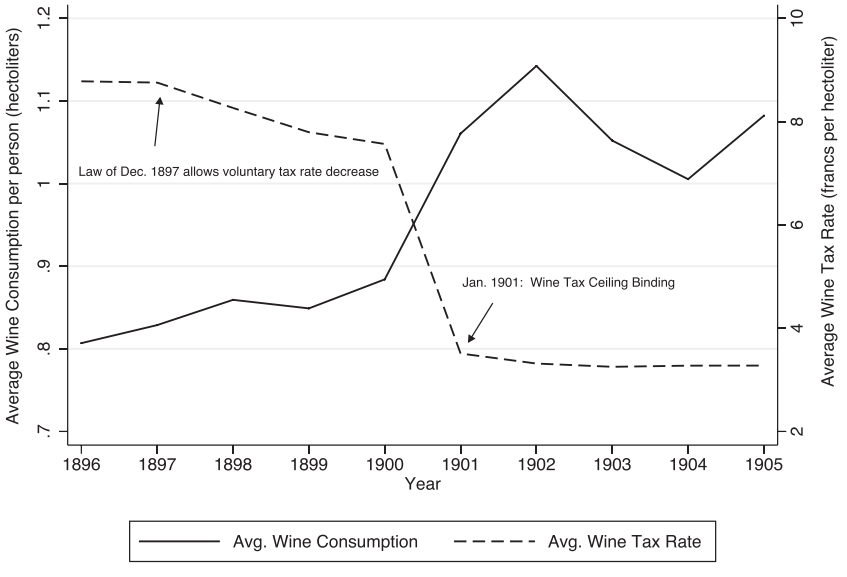

Fig. 5. Departmental wine tax rate and wine consumption, 1896–1905. Data collected from various volumes of the *Annuaire Statistique de la France* and *Bulletins de Statistique et de Législation Comparée* between 1894 and 1906.

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The potential importance of Alchian–Allen effects during our period can be seen in Figs. 3 and 4. Between 1896 and 1900, the average price of a hectoliter of wine across all of France was about twenty-four 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 eighteen francs. This implies a relative price of cheap imported to expensive locally produced wine of about 0.74. After the tax rate decrease in1901, the average price of wine in France was about eighteen francs and Southern wine was about twelve francs, which implies a decline in the relative price of cheap imported wine of eight percent. This decline increases to about twenty percent if we exclude 1902 and 1903 from our calculations which were bad production years.[14]

Fig. 6 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 twenty-five percent 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 Fig. 6 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.

In Appendix C (available online) we formally derive the distortionary effect of tax rates on consumption in the presence of Alchian–Allen effects. One of the main insights of the derivation is that the distortionary effect of the tax rates increases as the difference in price between the high and low quality goods increases. In our empirical analysis in Section 5, we will rely on this theoretical insight to investigate the interaction between the change in a department's tax rate and the post-tax price of wine in that department. We will thus compute the price difference between the high quality good, which is the locally produced, expensive wine and the low quality good, which is the imported, cheap wine. The more expensive the wine produced by a given department (after taxes), the larger the Alchian–Allen effect should be on the margin.

4. Data

Our data are collected from various issues of the *Annuaire* and, where necessary, from the Bulletins de Statistique et de Législation Comparée (1894–1907) (henceforth, *Bulletin*). We create a department level panel spanning from 1896 to 1905. We will use two samples. The first includes all wine producers (seventy-six out of eighty-seven departments). The second is a restricted sample in which the lowest ten percent of wine producers (as measured by departmental production between 1896 and 1900) are dropped. This restricted sample covers sixty-nine departments. Descriptive statistics for the variables used in both the full and restricted samples are given in Appendix A.

4.1. The French wine market

Our empirical analysis focuses on three dependent variables. The first 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*", which was untaxed.[15] We generate the *propenfranchise* variable as the ratio of wine consumed "on the farm" to total wine consumption. Our second dependent variable, called *Recoltants*, is an estimate of the number of wine farmers (*récoltants*), in a given department each year. We use this to measure whether there was entry or exit from the wine sector after the tax rate was lowered. Our third dependent variable, *Production*, is simply a measure of the total annual production of wine, in hectoliters, for each department.

[14] 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.

[15] According to the *Annuaire Statistique* before 1852 information on wine value, production, and how much was traded on markets (as opposed to consumed "on the farm") was collected by town mayors (*maires*). In 1852 cantonal committees were created to collect these data. By 1902 these data were also being verified (*secondées*) by professors of agriculture from the local universities.

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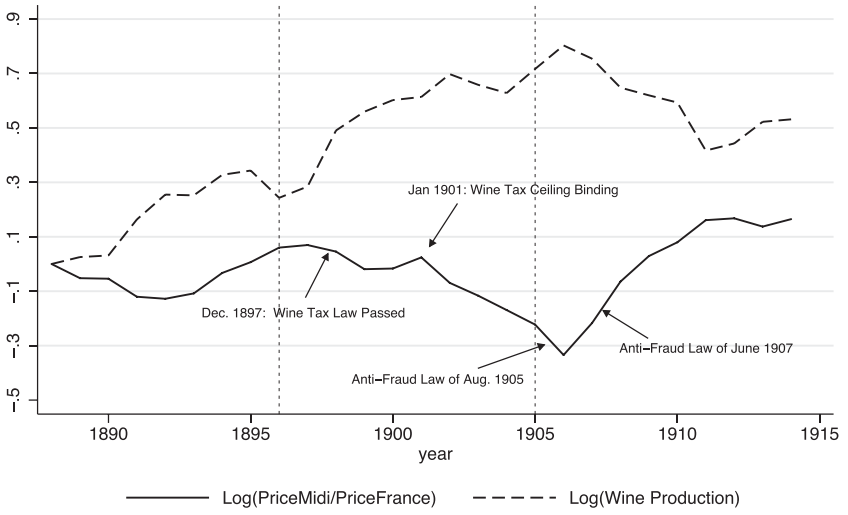

Fig. 6. Production and the relative price of Midi wine, 1888–1914. Data from various years of the *Annuaire Statistique*. Five year moving averages. Scale of wine production is log(hectoliters). Midi Departments are Hérault, Pyrénées Orientales, Gard, and Aude.

4.2. Wine tax rates

Our most important explanatory variable is the department level wine tax rate (*WineTaxRate*). Its creation required the construction of two separate rates, one for the wine octrois and another for the other indirect taxes (*droit de circulation*, *droit d'entrée*, and the *droit en détail*). We use the sum of the octrois and indirect tax rates as our primary independent variable (*WineTaxRate*). Details of their construction can be found in Appendix B (online).

We proxy the value of wine in each department using annual data in the *Annuaires* on the value of wine output per hectare. We thus build the *CostWine* variable which is the estimated average sale price (after taxes) of the wine produced in the department.

In addition, we generate two control variables. From the *Annuaires* we collect yearly data on the size of the urban population subject to the Octrois tax. This allows us to control for the possibility that the increase in wine traded on markets (decrease in on the farm consumption) stemmed from migration from rural to urban areas. We also collect yearly data on wheat production (the *ProdWheat* variable) from the same source in order to control for department level agricultural shocks that affect wine production and consumption.

5. Empirical methodology

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 have difficulty in pinning down causality. We avoid this problem by investigating whether departments which experienced a decrease in wine tax rates (the treatment group) also experienced an increase in market participation or a decrease in the number of wine producers compared to the departments whose taxes were not lowered (the control group). Since the lowering of local wine taxes on 1 January 1901 was initiated at the national level, we can exploit it as a quasi-natural experiment since its timing was exogenous to local conditions determining market participation, entry and exit, and production.

This reformulation 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 difference-in-differences approach is immune to bias 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).

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

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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

$$\Delta y_i = \beta + \delta \Delta \tau_i + \Delta X'_i \Lambda + \Delta \epsilon_i \quad (1)$$

where y_{it} is one of our three dependent variables, t is a time indicator, ϕ is a vector of department fixed effects, X' is a vector of control variables, and ϵ is an i.i.d. error term. The control variables we include are the size of the urban population and output of wheat in each department. The first controls for time-varying department level changes in the urban demand for wine and the second for time-varying 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, and the coefficient, δ, is the difference-in-differences estimate.

Since these were unit taxes, 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. In line with the theory of Alchian–Allen effects we explored in Section 3, we expect that 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

$$\Delta y_i = \beta + \pi \nu_{i1} + \delta \Delta \tau_i + \gamma(\nu_{i1} \Delta \tau_i) + \Delta X'_i \Lambda + \Delta u_i \quad (2)$$

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 in addition to its indirect influence through the tax treatment.

6. Results

6.1. The effect of internal taxes on market integration and small-scale producers

In Table 1 we report the results of estimating Eq. (1) 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 Eq. (1) 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 one percent 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 one percent level.

In Table 2 we estimate specification (2) using the difference in the number of wine farmers (*récoltants*) as our dependent variable. It might be hypothesized that if *récoltants* were protected from market forces by high local tax rates, then marginal producers should exit once tax rates were lowered (the coefficient on the difference in the tax rate should be positive). This is precisely what we observe in columns (1), (2), and (3) of Table 2 where all estimates have a positive sign and are significant at the one percent 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 run specifications in Tables 1 and 2 in which we transform the continuous difference in tax

Table 1
Did high internal taxes impede market development? 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 urban population 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.

Dependent variable = Difference in proportion of wine consumed off market (DiffPropEnFranchise)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS
DiffWineTaxRate	0.4231***	0.3817***	0.3802***	
	(0.1299)	(0.1312)	(0.1190)	
Dichotomous tax rate treatment (=1 if change < mean)				−0.3238***
				(0.1169)
Controls		x	x	x
Restricted sample			x	x
Observations	76	76	69	69
R-Sq	0.104	0.123	0.229	0.253

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Table 2
Did high internal taxes protect local producers? Notes: *See notes to Table 1.*

Dependent variable = Difference in number of wine producers (DiffRecoltants)				
	(1) OLS	(2) OLS	(3) OLS	(4)OLS
DiffWineTaxRate	0.2181***	0.1729***	0.1415**	
	(0.0616)	(0.0571)	(0.0568)	
Dichotomous tax rate treatment (=1 if change < mean)				−0.1255**
				(0.0587)
Controls		x	x	x
Restricted sample			x	x
Observations	76	76	69	69
R-Sq	0.131	0.196	0.148	0.132

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 (the *Dichotomous Tax Rate Treatmen*t variable). This should minimize any potential endogeneity arising from departments with extremely high initial tax rates driving the results. We report these results in column (4) 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 1 and 2, 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 (Bertrand et al., 2004). The procedure assigns placebo reforms to random departments in random years and then re-estimates Eq. (1). We repeat these steps a thousand times. If we find that the coefficient associated with these randomly-generated reforms is significant at the five percent level in roughly no more than fifty out of the thousand 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 reform implemented on 1 January 1901.

The results of the falsification test on the specifications from columns (1) to (3) in Tables 1 and 2 are shown in Table 3 where we report the percentage of times our randomly-generated reforms were significant at the five percent level, as well as its standard error in parentheses. The tests of the OLS regressions in columns (1) to (3) in Table 1 show that the randomly-generated reforms are respectively significant 1.9%, 4.1% and 10% of the time (with standard errors of 0.0043, 0.0063 and 0.0095). Moreover, the randomly-generated reforms in the falsification test for the OLS regressions in columns (1) to (3) in Table 2 are significant 0.2%, 0.3% and 0.6% of the times (with standard errors of 0.0014, 0.0017 and 0.0024). Hence, five out of six results in this falsification test suggest that there is less than a five percent 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.

One possible objection to the findings we present in Tables 1 and 2 is our abstraction away from the foreign sector. Indeed Simpson (2011, 124) argues that in the aftermath of the phylloxera, rising foreign tariffs along with the declining reputation of French producers of high quality wines generated a "long and deep" recession. Changes in the quantities of wine produced and consumed over our sample period were unlikely, however, to have been significantly affected by external policies relating to international imports and exports of wine. The overall levels of trade in wine were small relative to total domestic production and only the very highest quality wines were exported. The slight decline in the volume of exports after the 1880's probably did reflect the hardships faced by the few producers of high quality wines, notably from Médoc, noted by Simpson (2011). All in all however, both the absolute levels of internationally traded wines and the even smaller changes from year to year for this period were sufficiently small that they are unlikely to noticeably influence the shifts in production observed due to the falling domestic taxes. Foreign imports of wine into France decreased about 7% and exports changed hardly at all between our pre and post-treatment periods (Annuaire Statistique De La France, 1894–1907). We conclude that these small shifts are unlikely to change the general direction of the effects we observe regarding the differential benefits of the tax cuts on the regions producing the cheaper domestic wines.

6.2. The effects of internal trade liberalization on production and consumption

In Table 4, we report results from estimating Eq. (2) 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 column (1) of Table 4, we present the interaction results using the decrease in off-market consumption as the dependent variable. The results are consistent with the prediction that departments which produced more expensive wine experienced a larger marginal effect on market use

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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 (the Midi) produced cheap wine worth about eighteen francs per hectare. In the middle is Gironde, located on the west coast and where many *haut cru* (high quality) wines come from today. This department had an average value of production of about twenty-eight francs per hectare. Finally, Marne in the North of France is where Champagne is made. Its average value of production was a whopping eighty-two 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 three standard deviations.

Furthermore, column (2) of Table 4 presents the interaction results using the change in number of wine producers as the dependent variable. As we hypothesized in the theory presented in Section 3, 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 columns of Table 4 we estimate Eq. (2) using the total production of wine as the dependent variable. 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 lower 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.

6.3. How lobbying shapes production and consumption patterns

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 Fig. 5 makes clear, consumption skyrocketed after the lowering of the octrois and other internal wine taxes. Opposition came from producers rather than consumers.

It is likely that the various departmental wine taxes had served to delay the integration of the French wine market, thus insulating the small *vigneron* from both domestic and international market forces. For example, Saint-Amour and Chevet (1991) suggest that the market for grain had been well integrated by the third quarter of the nineteenth century. However, wine is a less homogenous good whose integration was hampered by these taxes. Thus, the change in tax laws, as well as the impact of internal and external market integration due to lower transports costs and the vicissitudes caused by phylloxera, all combined into unusually severe shocks to the wine-growers who were until then used to a relatively stable existence.

But the response of the wine-makers' lobbies was not directly targeted at market integration.[16] The rhetoric of this opposition was framed 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, 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 (Smith, 1978).

There were two institutional innovations which emerged as a response to producer pressures after

[16] The response was also not targeted at foreign competitors. This was probably because the tariff policy initiated by Prime Minister Méline in 1892 had substantially shielded French farmers from foreign producers. On the Méline tariff, and more generally, on the consequences of the rise in world average tariffs from the 1870's onwards, see among others Clemens and Williamson (2004), Jacks et al. (2010), O'Rourke and Williamson (1999).

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1901. First, regulations were passed in August 1905 and June 1907 making it illegal to produce "adulterated" wine (Warner, 1975, 41–2).[17] Among the requirements imposed by these regulations were rules on the types of additives which could be used in wine production and requirements that wine producers report their production, the weight of harvested grapes as well as the quantity of musts (unfermented wine) which they shipped. There were also vague prohibitions against the production of wine that was "artificial" 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 desvignerons du Midi* (CGV), were largely responsible for actually enforcing the laws against adulteration and fraud being created by the National Government. A telling indication of the CGV's relentlessness in pursuing those it considered guilty of fraud is that in 1912 it spent 412,000 francs in the South of France alone on the identification and prosecution of "artificial" wine, whereas the entire government budget for enforcing anti-fraud legislation was 1,143,000 francs for the whole of France (Warner, 1975, 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.[18]

Of course, there were adulteration practices in the wine sector (Stanziani, 2003), just like there were adulteration practices in other sectors at the turn of the twentieth century (Dupré, 1999; Law, 2003; Wood, 1986). Our point is therefore not to discard adulteration practices as pure invention by politicians willing to protect wine lobbies. Still, our analysis suggests that artificial wine was an issue used by lobbies to pressure the government, thus leading to the adoption of laws preventing adulteration and protecting producers of cheap wine made from real grapes.[19] As the previously cited literature on adulteration in other foodstuffs shows, a substantial part of the concerns about quality or adulteration was driven by interest group considerations and we cannot determine to what extent this was also true for French wine.

The effect of these new regulations, largely enforced by syndicates of small "traditional" wine producers, coincided with a gradual increase in the price of wine across France that began after 1907. As a result, 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 as can be seen in Fig. 6. It would thus appear that one factor contributing to the emergence of the modern regulatory state was the competitive pressures due to increased market integration.

7. Conclusion

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.[20] This preference, in turn, is often invoked as an explanation for France's extensive system of food regulations and, more generally, the predilection exhibited by French citizens for large government.[21] In this paper we demonstrate that high internal taxes on wine discouraged trade and protected small producers at the end of the nineteenth century. We also offer an explanation for why wine regulations, like the *appellation d'origine contrôllée* system, tended to proliferate in the first decades of the twentieth century after these taxes were lowered and markets became more integrated.

Our results provide a different perspective on the role of local governments in the development of state capacity. Far from being tools of the national administration, local governments were actually quite active, even in a country like France with its tradition of administrative centralization. Thus, in the late nineteenth century, the taxes which local governments

[17] 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. See among others Stanziani (2003) on this issue.

[18] In 1909, there were the *Confédération des Vigneronsdu Sud-Est*, the *Confédération des Associations Viticoles de Bourgogne*, 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, 48).

[19] It does not seem that there were lobbies of consumers which fought against adulteration practices. It is moreover beyond the scope of this study to determine whether French consumers at the turn of the twentieth century really preferred wine made from real grape as opposed to artificial wine.

[20] By the end of the eighteenth century Young (1929) had already 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 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 and Parker (1975) and Sicsic (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 agriculture in the nineteenth century exist.

[21] On French preferences for large government see, e.g., Benabou (2008) and Saint-Paul (2010).

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Table 3
Falsification test. Notes: This table presents the results of a falsification test on the OLS regressions in columns (1), (2) and (3) of Tables 1 and 2. We report the percentage of times our randomly generated reforms were significant at the five percent level. Standard errors in brackets.

(1)	(2)	(3)
Panel A. Falsification test for the regressions in columns (l)–(3) of Table 2.		
0.023	0.041	0.1
[0.0047]	[0.0063]	[0.0095]
Panel B. Falsification test for the regressions in columns (l)–(3) of Table 3.		
0.002	0.003	0.006
[0.0014]	[0.0017]	[0.0024]

implemented had significant impacts on market structure and trade. These high internal taxes slowed down the integration of the French market, protected local producers and discouraged the use of formal markets. As such, this paper makes a direct contribution to the historical literature on internal market integration in Europe (Jacks, 2006; Shiue and Keller, 2007). Consistent with the work of Hsieh and Klenow (2009) on industry efficiency, we also find that when local barriers to entry were removed by the central state, there was increased exit by smaller wine producers.

After the removal of the protectionist taxes in 1901, French consumers abandoned local winemakers for other producers who offered cheaper wine. We suggest this played a role in the proliferation of wine regulations before and after World War I in France. They stemmed, at least in part, from the producers of expensive and low quality wines who had previously benefited from the protection of internal taxes and who lobbied for increased regulation to act as a barrier to entry against competitors who produced cheaper wine. It would thus seem that greater market integration played a role in triggering the political forces which shaped the system of food regulation that persists to this day via fiscal rules and regulations. More generally, the gradual introduction of national wine regulations during the first decades of the twentieth century in France should be seen, not so much as a step backwards in terms of market integration, but rather as a *return* to the status quo. The only difference was that, whereas previously protection was generated by local taxes, with the rise of the state, this was substituted for by national regulations. We leave as an open question the potentially important welfare implications of thinking about the increases in national regulation as substitutes for local rules rather than as unambiguous increases in state intervention in markets.

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Table 4
Were departments with higher initial values of wine affected more by tax reform? Notes: *See notes to Table 1.*

Dependent Variable	DiffPropEnFranchise (1)	DiffRecoltants (2)	DiffTotalProduction (3)
DiffWineTaxRate	−2.846**	−1.8954***	−2.2520***
	(1.3155)	(0.6295)	(0.7528)
InitialValueProd	0.4921*	0.2499**	0.6928***
	(0.2657)	(0.1198)	(0.1624)
Interact	0.9385**	0.5832***	0.6933***
	(0.3880)	(0.1836)	(0.2247)
Controls	x	x	x
Restricted sample	x	x	x
Observations	69	69	69
R-squared	0.249	0.272	0.195

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Appendix A. Descriptive statistics

Table A1
Descriptive Statistics.

Variable name	Description	Obs	Mean	Std. dev.	Min	Max
Panel A: Full sample						
Dependent variables						
DiffProduction	Difference in log of wine production (hectoliters)	76	0.247	0.398	−0.713	1.646
DiffRecoltants	Difference in log number of wine producers	76	−0.036	0.243	−1.131	0.435
DiffPropEnFranchise	Difference in log of proportion of consumption on farm	76	−0.072	0.527	−1.549	1.692
Explanatory variables						
DiffWineTaxRate	Difference in log of real wine tax rate (real francs per hectoliter)	76	−0.924	0.368	−2.309	−0.355
DiffUrbanPop	Difference in log of population living in cities subject to octrois taxes	76	0.017	0.040	−0.073	0.194
Dichotomous tax rate treatment	= 1 if change in tax rate < mean change	76	0.289	0.457	0.00	1.00
DiffProdWheat	Difference in log of wheat production (hectoliters)	76	0.037	0.164	−0.410	0.399
InitialValueProd	Log of Initial value of production per hectare (francs),1896–1900	76	3.416	0.317	2.803	4.400
Interact	(DiffWineTaxRate) × (InitialValueProd)	76	−3.181	1.354	−7.432	−1.054
Panel B: Sample restricted to top ten percent of wine producers						
Dependent variables						
DiffProduction	Difference in log of wine production (hectoliters)	69	0.219	0.341	−0.612	1.036
DiffRecoltants	Difference in log number of wine producers	69	−0.018	0.210	−0.571	0.435
DiffPropEnFranchise	Difference in log of proportion of consumption on farm	69	−0.060	0.445	−1.358	0.814
Explanatory variables						
DiffWineTaxRate	Difference in log of real wine tax rate (real francs per hectoliter)	69	−0.893	0.365	−2.189	−0.355
DiffUrbanPop	Difference in log of population living in cities subject to octrois taxes	69	0.016	0.042	−0.073	0.194
Dichotomous tax rate treatment	= 1 if change in tax rate < mean change	69	0.246	0.434	0.00	1.00
DiffProdWheat	Difference in log of wheat production (hectoliters)	69	0.027	0.165	−0.410	0.399
InitialValueProd	Log of Initial value of production per hectare (francs), 1896–1900	69	3.420	0.316	2.809	4.400
Interact	(DiffWineTaxRate) × (InitialValueProd)	69	−3.084	1.350	−7.432	−1.054

Appendix B. Construction of the tax rate measures (for online publication)

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, 1972, 57–8). He also forced loans 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 before the Revolution and the National Assembly abolished them in 1791. 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, 44). In 1818 the octrois comprised sixty-eight percent of the revenues for Bordeaux, ninety-one percent for St. Etienne, eighty-five percent for Toulouse, and close to one hundred percent for Lyon (Cohen, 1998, 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", 1333–49). We focus on the most important category for most cities, alcoholic beverages.[22] 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", 1333–49). 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", 1333–49) this practice was forbidden and the octrois were technically consumption excises.

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

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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 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", 242).[23] 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", 243). Finally, the *droit en détail* (retail tax) was an ad valorem tax of fifteen percent on the price of wine sold which was collected from merchants at the point of sale (Block, 1898, "Boissons", 243).

Beside these three main indirect taxes, any town with a population between 4000 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 study, the *droit de taxe unique* had a per hectoliter rate (as opposed to an ad valorem rate) which 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", 243–44).

Our most important explanatory variable is the department level wine tax rate (*WineTaxRate*). It's creation required the construction of two separate rates, one for the wine octrois and another for 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 took place "on the farm" (*en franchise*) so that it 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.[24] Afterwards, the legislation which went effect into effect on 1 January 1901 eliminated all indirect taxes but the *droit de circulation*, which was lowered to 1.5 francs per hectoliter for all towns and cities. Hence we use this figure as the rate for indirect taxes after 1901. Thus, the indirect tax rate for the period 1896–1900 is calculated as

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

until 1901 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 Lévy-Leboyer and Bourguignon (1985).

Appendix C. Formalization of differential impact of Alchian–Allen effects on wine industry (for online publication)

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 to 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,

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

where q is the quantity demanded and g indexes the type of good (H = high quality, L = low quality) 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

[23] 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.

[24] 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*".

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

Alchian et al. (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.[25]

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

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.

Eq. (C.2) implies that relative demand for the higher quality (more expensive) good will increase, as the unit tax rate increases. The first two terms in brackets of Eq. (C.2), $\left(\eta_{HH}-\eta_{HL}\right)\left(\frac{1}{p_{iH}^*}-c1p_{iL}^*\right)$, 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 $\eta_{HL} < 0$ and the high quality good has a higher price than the low quality good. The remaining term of Eq. (C.2) $\left(\eta_{LC}-\eta_{HC}\right)\frac{1}{p_{iL}^*}$ is an indirect substitution effect with the composite good. The standard assumption in the literature is that $\eta_{LC} = \eta_{HC}$ and, thus, this effect can be ignored (or at least is of second order).

One of the main insights of Eq. (C.2) is that the distortionary effect of the tax rate increases as the difference in price between the high and low quality goods increases. In our empirical analysis, the high quality good is the locally produced, expensive, wine and the low quality good is the imported, cheap, wine. Under the assumption that our data on the market value of production per hectare in a department is equal to p_{iH}^*, we can then proxy for how much the price of department i's locally produced wine exceeds the price of the cheap imported wine (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 rate and the post-tax price of wine in that department. The more expensive the wine produced by a given department (after taxes), the larger the Alchian–Allen effect should be on the margin. Stated another way, departments with more expensive wine should be more affected by the 1901 decrease in taxes.

[25] We follow the derivation of Hummels and Skiba (2004).

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