FROM INTERNAL TAXES TO NATIONAL REGULATION: EVIDENCE FROM A FRENCH WINE TAX REFORM AT THE TURN OF THE TWENTIETH CENTURY

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This Version: 13 June, 2012

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 governments often strove to weaken the autarkic tendencies of regional laws, thereby promoting greater trade and a more integrated market. For this purpose, we focus on the wine industry in France at the turn of the twentieth century and take advantage of a quasi-natural experiment generated by a law implemented on 1 January 1901 which lowered and harmonized various local tax rates. We show that high internal taxes on wine, set by regional governments, discouraged trade and protected small producers. We then trace how the political response to this tax decrease led to increases in wine regulation.

Key words: Regulation, State and Local Taxation, Market Integration

JEL classification: H71, L51, K23, N43, R12

∗This paper previously circulated under the title “Trade, Taxes, and Terroir”. We would like to thank seminar participants at George Mason University, the State University of New York at Buffalo, and the Mercatus Center, as well as conference participants at the 2011 Southern Economics Association Meetings, 2011 Cliometric Society Meetings, ISNIE 2011, the 2011 ASSA Meetings, the 2010 AAWE Meetings and the 2010 Israeli Economic Association Meeting for reading and commenting on earlier versions of the paper. We also benefited from helpful conversations with Greg Clark, Samia Costa, Price Fishback, Robin Hanson, Garett Jones, Esteban Klor, Joel Mokyr, Gilles Postel-Vinay, James Simpson, Alex Tabbarok, Jean-Laurent Rosenthal, Claudia Rei, Alexandra Mislin, and John Wallis. We received able research assistance from Collin Fausnaugh. All remaining mistakes are the fault of the authors.

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1 Introduction

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. Whether framed as government acting in the public interest (Stiglitz, 1996; Pigou, 1954) or in the interest of private business (McChesney, 1987; Stigler, 1971) the common theme is that central governments introduced additional rules where none had existed before. An important implicit assumption of these arguments is that when national governments legislate, they face a “blank slate” in the sense that existing taxes and regulations set by local authorities are rarely discussed.¹ Contrary to this traditional narrative, we present evidence in this paper that governments around the turn of the twentieth century often strove to weaken the autarkic tendencies of regional laws, thereby promoting greater trade and a more integrated market. However, the response by local interest groups to increased market competition resulted in increases in protectionist regulations. Thus, protectionist regulations gradually emerged as substitutes for protectionist internal taxes and tariffs.²

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 (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).³

¹An obvious explanation for this oversight 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.

²As such, this study is related to the literatures on the development of the modern state capacity (Aghion et al., 2012; Besley and Persson, 2010, 2009; Tilly, 1986; Weber, 1976), the historical development of modern fiscality (Aidt and Jensen, 2009b; Lindert, 2004, 1994) and the historical sources of increases in public spending (Pickering and Rockey, 2011; Aidt and Jensen, 2009a; Aidt et al., 2006; Husted and Kenny, 1997; Hettich and Winer, 1988).

³These wine regulations in France ultimately resulted in the well known appellation d’origine contrôlée system. See Colman (2008) and Steinberger (2009) for recent treatments of the extensive system of French food and beverage regulation.
The timing of the adoption of these regulations in France can be understood as part of a political backlash by wine producers who felt threatened by increasing market integration resulting from the national government’s lowering of internal French tariffs. As such, the main contribution of this study 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 (called récoltants in French), 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 1905.4

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. We complement this strategy by using the geographic variation in soil quality as an instrument for a region’s initial tax rate on wine. Our instrumental variables regressions reinforce 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 and Allen, 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

4Departments are administrative divisions of the French territory which were created in 1790.
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 was 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.\footnote{See Baldwin and Krugman (2004); Baldwin et al. (2003); Kind et al. (2000) on changes in industry location under increased economic integration when different groups influence political decisions, notably in matters of tax competition.}

The rest of this article is organized as follows. Section 2 provides 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 with 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 Figure 1 shows, between 1896 and 1900 most of the departments in France were producing wine.\footnote{Wine production in hectoliters, broken down by quartiles. Source: Data collected from various volumes of the \textit{Annuaire Statistique de la France} and \textit{Bulletins de Statistique et de Législation Comparée} between 1894 and 1906. Farm gate value of wine production in French francs, broken down by quartiles.}

During that period, the amount of wine produced by an average vigneron was about twenty-one hectoliters.\footnote{In French, the word \textit{vigneron} is used to describe a farmer who cultivates grapes for the purpose of wine production. \textit{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 \textit{vigneron} and a \textit{viticulteur} (indeed, this is a significant part of our argument about “on the farm production”, i.e., which was exempt from taxes.).} This compares to the average annual (taxed) consumption of wine of about .9 hectoliters per person during the same period. This means that each farm was producing enough wine 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 in French). According to official government data from the *Annuaire Statistique De La France* (1894-1907), 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 this paper addresses is whether this situation was consistent with 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. Figure 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 (known in France as the Midi) where cheap wine was produced using industrial technologies, all the way to eighty-six francs per hectoliter in northern regions producing champagne (e.g. Marne). 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 ineffi-
ciencies 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 \textit{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.\footnote{The phylloxera, which was first noticed in 1863, was caused by an aphid which attacked the roots of the common wine root stock \textit{vinis vinifera}. Between 1863 and 1890 the disease accounted for the destruction of close to forty percent of vineyards in France. Between 1868 and 1900 it cost close to thirty-five billion Francs to uproot damaged vines and replant with resistant strains (Galet, 1988).}

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). 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.\footnote{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. Algeria is hot, however, and fermentation there occurs too fast. This problem was addressed by Paul Brames 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. In this respect, Simpson (2011) claims that in 1903 the cost of building a two hundred hectoliter wine cellar was about six francs per square meter. By contrast, the cost of a twenty thousand hectoliter cellar was about four francs per square meter.} All of these substituted labor for capital at a time when wages were increasing and the price of wine was decreasing (Bayet, 1997; \textit{Annuaire Statistique De La France}, 1933, 62-3; Simpson, 2011).
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, 606-9; Annuaire Statistique De La France, 1934, 179-80). 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.

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. 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. Individual cities were given broad authority to set rates according to their needs, provided the taxes were collected on the

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10 (Toutain, 1992, Table 1.19, p. 105) documents that the quantity of wine production had declined in all but two French regions between 1840 and 1892: Auvergne (where the increase in production was minimal) and Languedoc. However, his 1929 and 1986 data on wine production show that little has changed since the late nineteenth century. In fact the only puzzle is why wine production around the Paris region has not picked up ever since all the other wine producing regions in the North of France were roughly producing the same amount of wine in 1840 and in 1986. For instance, Champagne produced 1761 and 1882 hectoliters of wine in 1840 and 1986 respectively while Alsace produced 914 and 1235 hectoliters in those years.

11 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 taille 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).

12 The other four categories were “food”, “fuel”, “building materials”, and “miscellaneous”.
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.

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).13 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 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 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).

Figure 3 shows the sum of the octrois and other indirect tax rates for every department in

13If 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.
France between 1896 and 1900.\footnote{Data for Figures 3 and 4 collected from various volumes of the \textit{Annuaire Statistique de la France} and \textit{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.} 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.\footnote{The combined tax rate equals the sum of the rates on the (octrois + droit de circulation + droit d’entrée + droit en détail). The actual way this number is calculated is explained in Section 3.2. For our analysis below we will simply call this number the “tax rate”.} Figure 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.\footnote{These examples are meant 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) depended on the price of local wine, not on the national average.} 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 on 1 January 1901.

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, vol. 6, 209; 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 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.\textsuperscript{17}

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

\textsuperscript{17}The full text of the 29 December 1897 law is reproduced in Veber and Millerand (1899).
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 central 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, 235). The exemption of the bouilleurs de cru was maintained (for production of hard alcohol less than 20 liters). The 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, 236). As for the indirect taxes, the droit d’entrée and the droit en détail 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, 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 Figures 3, 4, and 5. 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 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 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
Law of Dec. 1897 allows voluntary tax rate decrease
Jan. 1901: Wine Tax Ceiling Binding

Average Wine Tax Rate (francs per hectoliter)

Figure 4: Departmental Wine Tax Rate and Wine Consumption, 1896-1905.

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.

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, 2011).

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

18 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)
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 labelling) 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.\textsuperscript{19} 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.

The potential importance of Alchian-Allen effects during our period can be seen in Figures 3 and 4. Between 1896-1900, 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 in 1901, 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.\textsuperscript{20}

Figure 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

\textsuperscript{19}More expensive wine would have been less affected by this tendency since its relative price actually decreased with higher taxes.

\textsuperscript{20}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.
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 Figure 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. 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.

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 $i$,

$$q_{ig} = h(p^*_i, p_{ic}), g = H, L$$

where $q$ is the quantity demanded and $g$ indexes the type of good ($H =$high quality, $P =$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 $\tau_i$. We further assume that this charge is assessed on quantity rather than quality; as such, we can suppress the quality subscripts and write $p^*_i = p_i + \tau_i$. In the absence of transportation costs, $\tau_i$ may be interpreted 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 $\tau_i$ on the relative compensated demands for the high and low quality goods.\textsuperscript{21}

$$\frac{\partial (q_{iH}/q_{iL})}{\partial \tau_i} = \frac{q_{iH}}{q_{iL}} \left[ (\eta_{HH} - \eta_{HL}) \left( \frac{1}{p^*_{iH}} - \frac{1}{p^*_{iL}} \right) + (\eta_{LC} - \eta_{HC}) \frac{1}{p^*_{iL}} \right]$$

where $\eta_{HH}$ is the own price elasticity of the high quality good, $\eta_{HL}$ is the cross price elasticity of the low quality good for the high quality good, $\eta_{LC}$ is the cross price elasticity of the low quality good with respect to the composite good, and $\eta_{HC}$ is the cross price elasticity of the high quality good for the composite good.

Equation 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 equation 2, $(\eta_{HH} - \eta_{HL}) \left( \frac{1}{p^*_{iH}} - \frac{1}{p^*_{iL}} \right)$, 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 $\eta_{HL} < 0$ and the

\textsuperscript{21}We follow the derivation of Hummels and Skiba (2004).
high quality good has a higher price than the low quality good. The remaining term of equation 2 \((\eta_{LC} - \eta_{HC}) \frac{1}{P_{iL}}\) 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 equation 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 \(\frac{1}{\frac{p_{iH}^*}{p_{iL}^*}}\) 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.

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).\(^{22}\) We create a department level panel spanning 1896 to 1905 that allows 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 (seventy-six out of eighty-seven 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 restricted sample covers sixty-nine departments. Descriptive statistics for the variables used in both the full and restricted samples are given in Appendix A.

\(^{22}\)The Bulletins were published by the Treasury and contain many of the series upon which the Annuaires are based.
4.1 The French Wine Market

Our empirical analysis focuses on three dependent variables which capture the main features of the French wine market and as such which should have been affected by the reduction in internal taxes. 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.\(^\text{23}\) We generate the *propenfranchise* variable which is the proportion of wine consumed *en franchise* to measure non-market transactions as

\[
(propenfranchise = \frac{\text{wine consumed “on farm”}}{\text{total wine consumption}}).
\]

Our second dependent variable, called *Recoltants*, is an estimate from the *Bulletins* of the number of wine farmers, or *r´ecoltants* in French, 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. Exit from a given department’s wine sector would imply that the wine taxes were protecting those farmers from competition.

Our third dependent variable, called Production, is simply a measure of the total annual production of wine, in hectoliters, for each department from the *Annuaires*. Since internal taxes were collected on the quantity of wine consumed, then we would expect any distortions to affect consumption of cheap wine more than expensive wine (Alchian and Allen, 1972). Thus, when the taxes are lowered, we would expect output to increase in departments that produce cheap wine and decrease in departments producing expensive wine. In other words, after the costs of trade declined in 1901, departments should specialize more according to their comparative advantages.

In the descriptive statistics reported in Table 1, we note that the average number of wine producers decreased by 3.6% and the amount of wine transacted on informal markets decreased by seven percent (mean Diff *Recoltants* = -0.036 and mean Diff*PropEnFranchise*  

\(^\text{23}\)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.
= -0.07) in the full sample. Thus the implementation of the 29 December 1897 law on 1 January 1901 had potentially large effects.

4.2 Wine Tax Rates

In our study, the most important explanatory variable is the department level wine tax rate (called WineTaxRate). It 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

\[
\text{octrois tax rate} = \frac{\text{octrois tax revenues}}{\text{quantity of wine taxed}}.
\]

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.\textsuperscript{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

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

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). We use the sum of the octrois and indirect tax rates as our primary independent variable (WineTaxRate). In the descriptive statistics reported in Table 1, we note that on average, tax rates decreased across the departments by about ninety-two percent as a result of the government’s reform (the DiffWineTaxRate variable has a mean of -0.92).

\textsuperscript{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”.
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.

### 4.3 Soil Quality

To control for potential endogeneity in our regressions and 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 create an instrumental variable for the tax rate based on geography. This choice is motivated by the intuition that departments with higher initial tax rates in the early period, will also experience larger decreases after the policy change. We sought to find 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.

One way geography could play a significant role in forming a preference for local wine production is by determining comparative advantage. We expect that places with a comparative advantage in wine production would impose lower taxes on wine since this is more politically feasible for local governments. Likewise, places mainly producing wheat will be more likely to tax wine at a higher rate, which will in turn, make it less likely that cheap non-local wine is shipped in. This reinforces a preference for local production of wine. In other words, the octrois system, by making cheap wine less competitive in high tax regions, biased consumption towards local wine beyond what would have emerged due to variances in preference or historical conditions.

To measure the comparative advantage of a region for wine production as opposed to wheat production we collect data on soil quality from the FAO’s Global Agro-Ecological Zones...
Figure 7: Soil Types Across France (FAO, two-letter codes). See text for sources.

(GAEZ) 2002 database (Fischer and IIASA, 2002). The database reports on soil types across France at the scale of five arc minute by five arc minute cells (about 1.86 kilometers by 1.86 kilometers at the equator). Figure 7 shows the different soil types with the borders of the Departments superimposed over them.\footnote{The two letter codes for soil types as well as all sources are explained in Fischer and IIASA (2002).} In particular, Fischer et al. (2002) constructed a ranking from one to five of the suitability of each of the soil types for growing wheat. Next we use the GIS software to determine the proportion of each soil type found in each department based on the ranking by Fischer and IIASA (2002). We thus create a weighted average of the suitability of the soil in each department for growing wheat using the proportion of each soil type as the weights. Our measure ranges between one and five for each region, where one is most suitable for wheat and five is least suitable.

The resulting data, organized by quartiles, are shown in Figure 8. Given that we want to focus on regions with a comparative advantage in wine production, we create our instrument (Soil Quality Wheat) for the initial wine tax rate as a dummy variable equal to one if a department has soil quality for wheat in quartiles one, two, or three from Figure 6 and zero otherwise. In other words, our instrument indicates which regions are more likely to have a comparative advantage in wine production since their soil is unsuitable for wheat. The...
instrument is positively correlated with wine production (rho = 0.20 at the 10% level) which is consistent with our hypothesis that places where wheat is costly to produce, will instead focus on producing wine.

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).

It has been shown that difference-in-differences models using data with more than two time periods run a substantial risk of generating biased standard errors (Bertrand and Mullainathan, 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.

Thus we choose to follow the advice of Bertrand and Mullainathan (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

\[ y_{it} = \alpha + \beta t + \delta \tau_{it} + X_{it}' \Lambda + \phi_i + \epsilon_{it}, t = 1, 2 \]  

where \( y_{it} \) is one of our three dependent variables, \( t \) is a time indicator, \( \phi \) is a vector of department fixed effects, \( X' \) is a vector of control variables, and \( \epsilon \) 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 variant department level changes in the urban demand for wine 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, \( \tau \), and the coefficient, \( \delta \), is the difference-in-differences estimate.

We choose to estimate (1) as a cross section in differences specified as

\[ \Delta y_i = \beta + \delta \Delta \tau_i + \Delta X_i' \Lambda + \Delta \epsilon_i \]  

If \( E(\Delta \tau_i, \Delta \epsilon_i) = 0 \), then our OLS estimates of Equation (2) will be consistent. However, our estimates 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 Equation (2) using Limited Information Maximum Likelihood (LIML) methods and soil quality as the instrument.

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 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

\[ y_{it} = \alpha + \beta t + \pi \nu_{i1} t + \delta \tau_{it} + \gamma (\nu_{i1} t \tau_{it}) + X'_{it} \Lambda + \phi_i + u_{it}, \ t = 1, 2 \]  

(5)

where \( \nu_{i1} \) 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. Again, we choose to estimate Equation (3) as a cross section in differences

\[ \Delta y_i = \beta + \pi \nu_{i1} + \delta \Delta \tau_i + \gamma (\nu_{i1} \Delta \tau_i) + \Delta X'_{i} \Lambda + \Delta u_i \]  

(6)

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 equation 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 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.

Furthermore, the LIML estimates of equation 4 are presented in columns (4) and (5) of Table
Table 2: Did High Internal Taxes Impede Market Development?

<table>
<thead>
<tr>
<th>Dependent Variable = Difference in Proportion of Wine Consumed Off Market (DiffPropEnFranchise)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>LIML</td>
<td>LIML</td>
<td>OLS</td>
<td></td>
</tr>
<tr>
<td>DiffWineTaxRate</td>
<td>0.4231***</td>
<td>0.3817***</td>
<td>0.3802***</td>
<td>1.1409**</td>
<td>1.073**</td>
<td>-0.3238***</td>
</tr>
<tr>
<td>(0.1299)</td>
<td>(0.1312)</td>
<td>(0.1190)</td>
<td>(0.4917)</td>
<td>(0.5383)</td>
<td>(0.1169)</td>
<td></td>
</tr>
<tr>
<td>Dichotomous Tax Rate Treatment (=1 if change &lt; mean)</td>
<td></td>
<td></td>
<td></td>
<td>-0.255***</td>
<td>-0.226***</td>
<td></td>
</tr>
<tr>
<td>First Stage Coefficient on Soil Quality (Wheat)</td>
<td></td>
<td></td>
<td></td>
<td>(0.078)</td>
<td>(0.077)</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Restricted Sample</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>76</td>
<td>76</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>R-Sq</td>
<td>0.104</td>
<td>0.123</td>
<td>0.229</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>First Stage F-stat</td>
<td>10.64</td>
<td>8.59</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

1. In the preferred specification reported in Column 5 where 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 one percent level. Furthermore, in the first stage regression the coefficient on our instrumental variable, “Soil Quality Wheat”), enters with the correct sign (negative) and is 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 of 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.
### Table 3: Did High Internal Taxes Protect Local Producers?

<table>
<thead>
<tr>
<th>Dependent Variable = Difference in Number of Wine Producers (DiffRecoltants)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>LIML</td>
<td>LIML</td>
<td>LIML</td>
<td>OLS</td>
</tr>
<tr>
<td>DiffWineTaxRate</td>
<td>0.2181***</td>
<td>0.1729***</td>
<td>0.1415**</td>
<td>0.5032**</td>
<td>0.4923**</td>
<td>0.1255***</td>
</tr>
<tr>
<td>(0.0616)</td>
<td>(0.0571)</td>
<td>(0.0568)</td>
<td>(0.2403)</td>
<td>(0.2619)</td>
<td></td>
<td>(0.0587)</td>
</tr>
<tr>
<td>Dichotomous Tax Rate Treatment (=1 if change &lt; mean)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.255***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.078)</td>
<td></td>
</tr>
<tr>
<td>First Stage Coefficient on Soil Quality (Wheat)</td>
<td></td>
<td></td>
<td>-0.226***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.077)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Restricted Sample</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>76</td>
<td>76</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>R-Sq</td>
<td>0.131</td>
<td>0.196</td>
<td>0.148</td>
<td>-</td>
<td>-</td>
<td>0.132</td>
</tr>
<tr>
<td>First Stage F-stat</td>
<td>10.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.59</td>
</tr>
</tbody>
</table>

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.

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 2. Again, focusing on specification (5) which includes controls and excludes marginal wine producing regions, we find that the coefficient of interest increases in size and is significant at the five percent level.

We also run specifications in Tables in 1 and 2 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 (the Dichotomous Tax Rate Treatment variable). 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 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 and Mullainathan, 2004). The procedure assigns placebo reforms to random departments in random years and then re-estimates Equation 4. 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.

| Panel A. Falsification test for the regressions in Columns (1)-(3) of Table 2. |
|----------------|----------------|----------------|
| (1)            | (2)            | (3)            |
| 0.023          | 0.041          | 0.1            |
| [0.0047]       | [0.0063]       | [0.0095]       |

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

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.002</td>
<td>0.003</td>
<td>0.006</td>
</tr>
<tr>
<td>[0.0014]</td>
<td>[0.0017]</td>
<td>[0.0024]</td>
</tr>
</tbody>
</table>

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.

Table 3: Falsification Test

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 times (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.

6.2 The effects of internal trade liberalization on production and consumption

In Table 4, 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 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 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 present 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 equation 6 using the total production of wine
Table 4: Were Departments with Higher Initial Values of Wine Affected More By Tax Reform?

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>DiffPropEnFranchise</th>
<th>DiffRecoltants</th>
<th>DiffTotalProduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiffWineTaxRate</td>
<td>-2.846**</td>
<td>-1.8954***</td>
<td>-2.2520***</td>
</tr>
<tr>
<td></td>
<td>(1.3155)</td>
<td>(0.6295)</td>
<td>(0.7528)</td>
</tr>
<tr>
<td>InitialValueProd</td>
<td>0.4921*</td>
<td>0.2499**</td>
<td>0.6928***</td>
</tr>
<tr>
<td></td>
<td>(0.2657)</td>
<td>(0.1198)</td>
<td>(0.1624)</td>
</tr>
<tr>
<td>Interact</td>
<td>0.9385**</td>
<td>0.5832***</td>
<td>0.6933***</td>
</tr>
<tr>
<td></td>
<td>(0.3880)</td>
<td>(0.1836)</td>
<td>(0.2247)</td>
</tr>
<tr>
<td>Estimator</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
</tr>
<tr>
<td>Controls</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Restricted Sample</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Observations</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.249</td>
<td>0.272</td>
<td>0.195</td>
</tr>
</tbody>
</table>

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.

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 Figure 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. 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 1901. First, regulations were passed in August 1905 and June 1907 making it illegal

\[26\] The response was also not targeted at foreign competitors. This was probably because the tariff policy initiated by Prime Minister Mélène in 1892 had substantially shielded French farmers from foreign producers. On the Mélène 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).
to produce “adulterated” wine (Warner, 1975, 41-2). 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 des vignerons 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.

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. 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”

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27The 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.

28In 1909, there were the Confédération des Vignerons du 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).

29It 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.
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 Figure 6. It would thus appear that the modern regulatory state did not emerge as an outcome of changing technology or preferences but as a result of the competitive pressures which were triggered by 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.\textsuperscript{30} 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.\textsuperscript{31} 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 \textit{appellation d’origine contrôlée} 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 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. But once these taxes were removed, French consumers abandoned local winemakers for other producers who offered cheaper wine.

\textsuperscript{30}By the end of the eighteenth century Young ((1792) 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 (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.

\textsuperscript{31}On French preferences for large government see Benabou (2008); Saint-Paul (2010).
This article thus suggests an explanation for the proliferation of wine regulations before and after World War I in France. They stemmed, at least in part, from the wine producers 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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Appendix A: Variable Descriptions and Descriptive Statistics

### Panel A: Full Sample

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
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<td><strong>Dependent Variables</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DiffProduction</td>
<td>Difference in Log of Wine Production (hectoliters)</td>
<td>76</td>
<td>0.247</td>
<td>0.398</td>
<td>-0.713</td>
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</tr>
<tr>
<td>DiffRecollants</td>
<td>Difference in Log Number of Wine Producers</td>
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<td>0.243</td>
<td>-1.131</td>
<td>0.435</td>
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<td>DiffPropEnFranchise</td>
<td>Difference in Log of Proportion of Consumption on Farm</td>
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<td>-0.072</td>
<td>0.527</td>
<td>-1.549</td>
<td>1.692</td>
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</tr>
<tr>
<td>DiffWineTaxRate</td>
<td>Difference in Log of Real Wine Tax Rate (real francs per hectoliter)</td>
<td>76</td>
<td>-0.924</td>
<td>0.368</td>
<td>-2.309</td>
<td>-0.355</td>
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<tr>
<td>DiffUrbanPop</td>
<td>Difference in Log of Population living in cities subject to Octrois taxes</td>
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<td>0.017</td>
<td>0.040</td>
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<td>Dichotomous Tax Rate Treatment</td>
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<td>0.457</td>
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<td>DiffProdWheat</td>
<td>Difference in Log of Wheat Production (hectoliters)</td>
<td>76</td>
<td>0.037</td>
<td>0.164</td>
<td>-0.410</td>
<td>0.399</td>
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<tr>
<td>InitialValueProd</td>
<td>Log of Initial Value of Production per Hectare (francs), 1896-1900</td>
<td>76</td>
<td>3.416</td>
<td>0.317</td>
<td>2.803</td>
<td>4.400</td>
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<tr>
<td>Interact</td>
<td>(DiffWineTaxRate) x (InitialValueProd)</td>
<td>76</td>
<td>-3.181</td>
<td>1.354</td>
<td>-7.432</td>
<td>-1.054</td>
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<tr>
<td><strong>Instrumental Variables</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SoilQualityWheat</td>
<td>= 1 if Department has soil highly suited for wheat cultivation</td>
<td>76</td>
<td>0.724</td>
<td>0.450</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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<td><strong>Dependent Variables</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>DiffProduction</td>
<td>Difference in Log of Wine Production (hectoliters)</td>
<td>69</td>
<td>0.219</td>
<td>0.341</td>
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<tr>
<td>DiffRecollants</td>
<td>Difference in Log Number of Wine Producers</td>
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<td>-0.018</td>
<td>0.210</td>
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<td>Difference in Log of Proportion of Consumption on Farm</td>
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<td>DiffWineTaxRate</td>
<td>Difference in Log of Real Wine Tax Rate (real francs per hectoliter)</td>
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<td>-2.189</td>
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<td>DiffUrbanPop</td>
<td>Difference in Log of Population living in cities subject to Octrois taxes</td>
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<td>0.016</td>
<td>0.042</td>
<td>-0.073</td>
<td>0.194</td>
</tr>
<tr>
<td>Dichotomous Tax Rate Treatment</td>
<td>= 1 if change in tax rate &lt; mean change</td>
<td>69</td>
<td>0.246</td>
<td>0.434</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>DiffProdWheat</td>
<td>Difference in Log of Wheat Production (hectoliters)</td>
<td>69</td>
<td>0.027</td>
<td>0.165</td>
<td>-0.410</td>
<td>0.399</td>
</tr>
<tr>
<td>InitialValueProd</td>
<td>Log of Initial Value of Production per Hectare (francs), 1896-1900</td>
<td>69</td>
<td>3.420</td>
<td>0.316</td>
<td>2.809</td>
<td>4.400</td>
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<tr>
<td>Interact</td>
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<td>-3.084</td>
<td>1.350</td>
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<td><strong>Instrumental Variables</strong></td>
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<tr>
<td>SoilQualityWheat</td>
<td>= 1 if Department has soil highly suited for wheat cultivation</td>
<td>69</td>
<td>0.739</td>
<td>0.442</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table A1: Variable Descriptions and Descriptive Statistics