Stealing to Survive: Crime and Income Shocks in 19th Century France

Vincent Bignon*
Banque de France, Paris

Eve Caroli◊
Paris Dauphine University, LEDa-LEGOS, Paris School of Economics and IZA

Roberto Galbiati∇
CNRS-Economix and Sciences Po Paris

September 2011

Keywords: crime, income shock, phylloxera, 19th century France.

JEL code: K42, N33, R11

Acknowledgements: We wish to thank Andrea Bassanini, Cecilia Garcia-Peñalosa, Tommy Murphy, Tommaso Nannicini and seminar participants at University Bocconi for useful comments and discussions. Charlotte Coutand and Clement Malgouyres provided excellent research assistance. We also thank Pierre-Emmanuel Couralet and Fabien Gaveau who proved crucial in helping us with some of the data. We are grateful to Gilles Postel-Vinay for sharing with us his data on wine and phylloxera and for insightful comments and suggestions. The views expressed in the paper are those of the authors and do not necessarily reflect those of Banque de France or the Eurosystem. The usual disclaimer applies.

* Banque de France. Pomone- DGEI – DEMFI (041-1422) ; 39, rue des Petits Champs. 75001 PARIS 01 France. Email : vincent.bignon@banque-france.fr
◊ Paris School of Economics, 48 Boulevard Jourdan, 75014 Paris. France. Email: caroli@pse.ens.fr
∇ Department of Economics Sciences Po. 28 Rue des Saints-Pères 75007 Paris. France. Email: galbiatir@gmail.com

Abstract

Using department level administrative data from 1826 to 1936 we document the evolution of crime rates in 19th century France and we estimate the impact of a negative income shock on crime. Our identification strategy exploits the phylloxera crisis. Between 1863 and 1890, phylloxera destroyed about 40% of French vineyards. Using the departmental variation in the timing of this shock we instrument wine production and we identify the effects of the shock on property and violent crime rates. Our estimates suggest that the phylloxera crisis did not significantly impact on violent crimes but caused a strong increase in property crimes. A back-of-the-envelope calculation suggests that the phylloxera crisis caused an increase in property crime rates of about ten percent.

Résumé

Sur la base de données départementales portant sur la période 1826-1936, nous estimons l'impact d'un choc de revenu sur les taux de criminalité en France au 19ème siècle. Notre stratégie d'identification repose sur la crise du phylloxéra. Cette maladie de la vigne détruisit environ 40% du vignoble français entre 1863 et 1890. Nous utilisons la variabilité dans la date à laquelle les différents départements français furent atteints pout d'instrumenter la production de vin et nous identifions ainsi les effets du choc de revenu induit par le phylloxéra sur les taux de crimes contre les propriétés et contre les personnes. Nos résultats suggèrent que le phylloxéra n'affecta pas de façon sensible les crimes contre les personnes. En revanche, il fut à l'origine d'une forte augmentation des crimes contre les propriétés: environ +10%.

1. Introduction

Economic theory and casual observation both suggest that bad economic conditions, economic crises and poverty favour criminal activity as they alter the opportunity costs to engage into crime. At the same time, higher crime rates are likely to have a negative impact on economic growth as the prevalence of crime in an area discourages business. Thus, crime and poverty may co-evolve and countries may be stuck in a high crime - low growth equilibrium.

Despite the fact that understanding the impact of economic conditions on crime is of great importance both for understanding economic development and to design optimal crime control policies, there is still scarce evidence documenting the causal impact of negative economic conditions on crime rates. This is not surprising since such an analysis requires reliable data on crime records, matched with information on economic conditions. Moreover, the identification of the causal link between negative income shocks and criminal activity requires a credible research design and some source of exogenous variation in the independent variable.

In this paper we resort to uniquely rich data on criminal records collected by the French Ministry of Justice at the departmental level (a French department is roughly equal in size to a US county) between 1826 and 1936. To identify the impact of a negative economic shock on crime, we take advantage of the phylloxera crisis that burst in France in the second half of the 19th century. The phylloxera (an aphid which attacks vines' roots) destroyed about 40 percent of vines in France, thus inducing a large negative income shock in an economy still largely dependent on agricultural production. The phylloxera crisis started in 1863 when the aphid appeared in Southern France and ended in the 1890s when vineyards were replanted with hybrid American vines which were resistant to the insect. As phylloxera affected the different departments in different years, we exploit departmental variation in the timing of the shock to identify its effect on crime rates. The massive negative shock to the French economy induced by the phylloxera attack is indeed an extraordinary event that helps solving the major identification problems related to reverse causality and confounding factors. To the best of our knowledge, the only paper exploiting the source of exogenous variation in income induced by phylloxera is Banerjee et al. (2010) who estimate the effect of negative income shocks in utero and during early childhood on future health conditions.

We use a similar research design to identify how negative income shocks affected crime rates in 19th century France. The very rich data collected by the French administration starting 1826 allow us to identify the impact of the crisis on violent and property crime, as well as minor offences. This exercise is unique from a historical perspective since comparable datasets are collected only starting in the 20th century in other countries (e.g. the Uniform crime report in the USA starts being compiled in the 1930s) or for a shorter period of time in some German states like Bavaria and Prussia (see Mehlum et al., 2006 and Traxler and Burhop, 2010).

Our results show that the phylloxera crisis did not significatively impact violent crimes but caused a strong increase in property crimes. In particular the fall in wine production and hence in agricultural income induced by the phylloxera attack causes a strong increase in thefts.

This paper contributes to the literature on the effects of negative economic conditions on crime in a historical perspective by covering all 89 French departments over 1826-1936. Beside being informative for the economics of crime and being one of the very first exercises of this kind in economic history, this paper also contributes to the literature in development economics to the extent that the economy and demographic structure of 19th century France were very similar to those of a developing country.

There are few papers tackling the impact of a negative income shock on criminal activity in developing countries. Miguel (2005) resorts to survey data on contemporary rural Tanzania to show that the killing of "witches" (i.e. old women) increases in times of extreme weather events leading to floods and droughts. Fafchamps and Minten (2006) exploit an exogenous cut in fuel supply in rural Madagascar following a disputed presidential election to identify the effects of a massive increase in poverty and transport costs. Using original survey data collected in 2002 they find that crop theft increases with transitory poverty. Theft thus appears to be used by some of the rural poor as a risk coping strategy. Only a couple of papers resort to historical data to perform a similar exercise. Mehlum et al. (2006) estimate the impact of poverty on crime in 19th century Bavaria (one of the German states). The authors use rainfall as an instrumental variable for rye prices and show that an increase in rye prices following bad weather conditions induces and increase in property crime and leads to significantly less violent crime. Traxler and Burhop (2010) replicate the exercise by Mehlum et al. for Prussia and find similar results. With respect to Mehlum et al. (2006), it is worth noting that despite we cover a similar historical period, our research design has a number of advantages. We have observations for both our independent and dependent variables for each of the 89 French

departments over the whole period of the analysis. In contrast, Mehlum et al. (2006) use data on crime rates in seven Bavarian regions while they only have one single series of rainfall and rye price data for the whole of Bavaria. Moreover, while rainfall potentially affects both economic conditions and the probability of apprehension of criminals, the phylloxera crisis affects incomes while leaving unaltered the probability of apprehension.

This paper also relates to the recent literature on unemployment and crime in contemporary developed countries. These studies using panel data at the state or regional level (Raphael and Winter-Ebmer, 2001; Gould et al., 2002; Oster and Agell, 2007; Lin, 2008; Fougère et al., 2009; Mocan and Bali, 2010) reach a consensus that increasing unemployment contributes to raise property crimes (although the magnitude is not large) and does not significantly affect violent crimes. Our paper also investigates the impact of a drop in income on crimes rates, but in a much longer historical perspective. It also relates, to some extent, to the literature on the effects of business cycle on crime since the phylloxera crisis constitutes a strong negative shock to the French economy. Consistently with our findings, this literature (Cook and Zarkin, 1985) finds that property crimes' trends in the USA are countercyclical.

While these papers focus on the effects of poverty and income shocks, other papers investigate the effect of structural poverty and inequality on crime. Resorting to cross-country comparisons, Fajnzylber et al. (2002) show that differences in crime rates are related to growth and poverty. In a cross-country study, Soares (2004) shows that income inequality is related to crime. Finally, Bourguignon et al. (2003) develop a structural model of the link between crime and inequality in Colombia.

The paper develops as follows. Section 2 presents the data sources and describes the main facts regarding the evolution of crime rates in 19th century France. Section 3 describes the identification strategy. Section 4 presents the results of the study and Section 5 provides some conclusion.

2. Data and Facts

2.1. Historical Background

At the beginning of the 19th century, France was still a developing country. GDP per capita amounted to 1,218 USD in 1820. The country experienced modest but constant economic

growth over the century so that GDP per capita reached 3,452 USD in 1913.[1] While income per capita thus increased by about 200%, crime rates decreased quite sharply. Violent crimes declined from 6 per 100,000 inhabitants in 1826 to 4.3 in 1913, while property crimes precipitated from about 15.9 to 3.4 per 100,000 over the same period.

This large decrease in crime rates – in particular for property crimes – does not result from major changes in penal law over the period. During the whole century, the Napoleonic codes indeed remained the basis of criminal law – see Carbasse (2000). Trials used to take place in front of civilian juries drawn from the voting population. Guilt and mitigating circumstances were assessed by the jury while sentences were pronounced by the professional judges who lead the trials. One candidate explanation for the correlation evidenced by Figures 1a-b between declining crime rates and increasing GDP per capita is, of course, the existence of a negative relationship between income and crime – Becker (1965).

In 19th century France, agriculture still represented a major source of income for many households. The share of agricultural production and extractive industry in GDP amounted to 38.5% in 1830, decrease to 33% in 1850 and was still as high as 28% in 1890 (Craft, 1984, 54). This made France much more dependent on agriculture than the United-Kingdom, for example, where the corresponding shares were respectively 24.9% in 1840 and 13.4% in 1890 (Craft, 1984, 53). Within the agriculture sector, wine production represented an important activity. In 1862, the year before phylloxera first reached France, wine production represented about one-sixth of the value of agricultural production, which made it the second most important product after wheat (Banerjee et al 2010). Any disease affecting French vineyards was therefore likely to represent a big shock to a mostly rural economy. Phylloxera turned out to be such a shock.

The insect was first spotted in France in the Gard department in 1863. It is an aphid that attacks the roots of grape vines reducing the yield of fruit and causing the eventual death of the plant (Pouget, 1990). By the end of the 1860s, the aphid affected most departments in the Southeast of the country (Bouches du Rhône) and in the Bordeaux region. From the Southeast, it moved northward and from the Bordeaux region it moved northwest. The insect progressively expanded across departments and by the end of the 1870s it had affected all wine producing departments in Southern France. As reported by Pouget (1990) it took a long time to scientists to understand that phylloxera was the cause of vines' death. From 1868, the year in which phylloxera was identified as the cause of the vines' disease, experts

[1] For both years, Maddison (1995) expressed in 1990 Geary-Khamis dollars.

experimented various treatments to fight against the pest from vineyard flooding to the use of chemical products. None of the treatments introduced proved to be effective until the 1890s. The solution, i.e. grafting European vines onto phylloxera-resistant American roots, was only implemented in the early 1890s.

So, over almost thirty years, phylloxera has been a threat to French vines. However, its real impact varied a lot across departments because some of them did not grow any vines while, in others, wine production could reach up to 80% of the whole agricultural production (Galet, 1957). As a consequence, the phylloxera pest could be expected to have had a strong impact on real income, at least in a number of departments. This is why we use it in order to uncover the causal relation between income shocks and crime.

2.2. Data and measurement

Crime and police forces

The crime data that we use come from the *Compte Général de la Justice Criminelle* published by the French Ministry of Justice since 1826 and based on reporting by local court public prosecutors and clerks. During the 19th century, the *Compte Général* was one of the most continuous and reliable administrative sources in France and it has been used as a model to set up criminal statistical records in several countries (see Perrot and Robert, 1989). Since its creation, the *Compte* was assigned a double role. It was first a management tool that was designed to help the State assess the working of the law and the effects of legal reforms. But, beyond policy makers,, it was also supposed to provide information to moralists and thinkers. As such it contributed to the first developments of criminology. As such it contributed to the first developments of criminology. Despite the *Compte* was published yearly until 1982, we only collected data for the period from 1826 to 1936. As underlined by Perrot and Robert (1989) the quality of the data indeed declined after the 1930s, in particular due to the decrease in the funding awarded to the judiciary system to collect data.

The *Compte* provides detailed information on the number of people accused and convicted of violent crimes, property crimes and minor offences in each department every year (see Figure 2 for crimes – a similar table is available for minor offences). We also have data on the number of people accused of a selection of more precise crimes and offences: homicides, robberies, thefts in churches, on country roads, thefts by house servants, other thefts and

forest related offences. Using the departmental population provided by the Census[2], we compute yearly crime rates defined as the ratio of the number of people accused to the departmental population, broken down by type of crimes and offences, in each department over 1826-1936. As illustrated on Figures 3 and 4, violent and property crimes decreased sharply over the century whereas minor offences remained roughly constant. These general trends are taken into account by including year fixed effects in our regressions.

We also compute conviction rates for each type of crime or offence by dividing the number of people convicted by the number of people accused in each department every year. This allows us to control that phylloxera did not affect the severity of judges, which would bias our estimates.

The *Compte Général* also provides information on police forces. More precisely, we know the yearly number of urban and rural policemen, superintendents, forest wardens and guardsmen in each court-of-appeal[3] jurisdiction between 1843 and 1932. We compute an indicator of police force presence defined as the ratio of the total number of police forces divided by the population in each court-of-appeal jurisdiction. We use it as a control in some specifications in order to check that our results on the impact of an income shock on crime rates are not due to changes in the local presence of police forces.

Wine production and phylloxera

Data on wine production and phylloxera come from Galet (1957).[4] In our dataset, the number of hectolitres of wine produced is available for all departments between 1850 and 1905. Wine was produced in 79 out of the 89 French departments in 1862 – i.e. the year before phylloxera was first spotted in France. We also have information on the share of wine in agricultural production as of 1962: it is larger than 15% in 40 departments. Finally, we also have data on the surface planted in vines per inhabitant in 1962: the French average is as high as 0.7 ha. We use these variables in reduced-form equations in which we allow the impact of phylloxera on crime rates to vary according to the importance of wine-related activities in each department as of 1862.

[2] Census data are available every five years only. In order to get yearly departmental population, we interpolate Census data using growth rates of population between Census years.

[3] The data are actually available at the court (i.e. infra-departmental) level for 1843-1862, at the departmental level for 1879-1885 and at the court-of-appeal level for 1863-1878 and 1886-1932. We aggregate them at the court-of-appeal level for all years between 1843 and 1932. There were 27 courts of appeal in France in 1826.

[4] They have been used for the first time by Banerjee et al (2010). We are grateful to Gilles Postel-Vinay for sharing these data with us.

As regards phylloxera, the information provided by Galet (1957) is used to identify the first year in which the aphid was first spotted in the department. Following Banerjee et al (2010) we consider that the crisis ended in 1890 when phylloxera-resistant American vines were re-planted in all departments.

Age structure of the population

Eventually, using the data from the *Statistique Générale de la France*, we compute the ratio of young men (aged 15-29 or 15-39) to the departmental population. These data are available every five years since 1851. We use them as dependent variables in some specifications in order to check that the phylloxera crisis did not generate large migrations that could have modified the age structure of the population in favour of age groups more likely to commit crime.

3. Identification Strategy

The basic idea underlying our empirical analysis is to exploit the exogeneity of the phylloxera pest with respect to crime rates to grasp the impact of an exogenous change in wine production. In order to do this, we rely on a 2SLS strategy.

3.1. Phylloxera and wine production

We first show that phylloxera significantly affected wine production between 1850 and 1905 (the period over which we have data on wine production – see Section 2.2). We build an indicator of the presence of phylloxera in a department as follows. We define the pre-phylloxera year as the year before the insect was first spotted in the department. We then set our phylloxera indicator p_{ij} equal to 1 between the first year (after pre-phylloxera year) when the production is below its pre-phylloxera level and 1890 (the year in which the solution to the disease was introduced). We set it to zero otherwise. We do this because we want to capture the fall in wine production due to the aphid, and because the time span it took the insect to spread out strongly varies across departments, so that it cannot be captured by a single lag structure (Banerjee et al. 2010).

Then we run the following regression of the log of wine production in department *i* at year *j* on the phylloxera indicator for the years 1850 to 1905:

$$\log Wine\_prod_{ij} = ap_{ij} + t_j + d_i + s_{ij} + \varepsilon_{ij} \quad (1)$$

The terms t_j and d_i represent year and department fixed effects respectively, while s_{ij} is a department-specific trend and ε_{ij} is an error term. In all specifications - with and without department specific trends - standard errors are clustered at the department level.

Results are reported in Table 1. During the phylloxera crisis, wine production is dramatically affected and it falls by about 35%. This result shows that the phylloxera pest provides an ideally strong exogenous shock on wine production. It is worth noting here that with respect to using meteorological variables, phylloxera not only has the advantage of not having an impact on deterrence costs but plausibly provides a stronger shock on wine production than variations in meteorological variables (Chevet, Lecocq and Visser, 2011).

3.2 Wine production and crime rates

Figures 5a-b report trends in differences in crime rates between wine-producing and non wine-producing departments[5] along with wine production. The figures provide some preliminary graphical evidence suggesting that property crimes in wine-producing departments tend to rise more than in non wine-producing departments when wine production declines. This is particularly true during the phylloxera period.

Our baseline empirical strategy consists in running IV regressions of the impact of wine production on crime rates. We instrument wine production in department *i* at year *j* by our phylloxera indicator p_{ij} for years 1850 to 1905.

Our baseline specification is the following:

$$Cr_{ij} = \beta \log Wine\_prod_{ij} + t_j + d_i + s_{ij} + \varepsilon_{ij} \quad (2)$$

Where *Crij* represents the crime rates (by type) in department *i* and year *j* and where we instrument wine production with the phylloxera indicator. The exclusion restriction underlying this empirical strategy is that phylloxera affects crime rates only through its impact on wine production. We maintain that the negative shock on wine production induced by the aphid's attack corresponds to a strong income shock for people engaged in wine production related activities. In fact, the negative shock in wine production following the phylloxera attack was not compensated by a strong increase in wine prices. To make up for the shortage

[5] Wine-producing departments are defined as departments in which wine production represented at least 15% of agricultural production in 1862. All other departments are defined as non wine-producing.

of French wine, the rules for wine imports into France were relaxed. Moreover, given the size of the crisis in the most affected regions, farmers could not systematically rely on credit to weather the crisis (Postel-Vinay 1989 and Banerjee et al. 2010). As a consequence, the phylloxera attack caused a large shock to the income of people in the vine-growing regions.

4. Results

4.1. Baseline Results

In Table II we report the results obtained when estimating the model represented in equation (2). Panel a) reports results of OLS estimates for violent, property crimes and misdemeanor offences respectively. The first three columns do not include department-specific trends. All specifications include time and department-level fixed effects and standard errors are clustered at the departmental level. Results from the most complete specification – col. (4) to (6) - reveal a positive and significant relationship between wine production and violent crimes, and a negative, despite non significant relationship between wine production and property crimes. The positive relationship between wine production and violent crime is consistent with the hypothesis that the consumption of criminogenic commodities increases with income and with the fact that wine prices plausibly decrease when wine production increases. However this relationship cannot be interpreted as causal as it may be driven by the presence of unobserved heterogeneity. The importance of unobserved confounding factors in the interpretation of the wine production-crime link is apparent when looking at the coefficient on wine production in the property crime regressions. In the most simple specification reported in Panel a) comlumn (2), the coefficient on wine production is positive. The sign of the coefficient however changes when we instrument wine production with phylloxera (Panel b). A number of factors like higher investment or the greater availability of goods that can be easily stolen may drive the results when we do not instrument wine production. Thus, under the hypothesis that the phylloxera indicator is a valid instrument, results in Panel b) show that violent crimes are not affected by wine production, while the negative income shock induced by the impact of phylloxera on wine production causes an increase in property crimes. These results are consistent with the hypothesis that negative economic shocks may encourage crime by reducing the quality of non-criminal opportunities. Moreover, despite we do not have data on unemployment for 19th century France, these results are consistent with papers showing that the quality and quantity of legitimate employment opportunities are pro-cyclical and negatively related to crime rates. All in all,

these baseline results imply that a ten percent increase in wine production causes a decrease of .0186 percentage points in property crime rates. In the period we analyze, this means that a ten percent negative shock on wine production implies on average a 2.5% increase in property crime rates (0.186/7.405 = 0.025). A back-of-the-envelope calculation suggests that, following the 40% average drop in wine production brought about by the phylloxera crisis, property crime rates increased by about ten percent.

Table III reports results by type of crime. Wine production has no significant impact on the rate of homicides. In contrast, it has a strong negative impact on robberies and thefts. A negative income shock induced by a decrease in wine production increases both robberies and thefts and has a strong impact on thefts committed by house servants. Results in Table III also show a negative, despite imprecisely estimated, sign on the forest related offences, that is to say misdemeanor offences related to the appropriation of woods from forests. These results are consistent with the interpretation that a decrease in wine production corresponds to a negative income shock increasing people's poverty. Also, the sign on thefts in churches and on country roads is consistent with this interpretation although, in both cases, the estimates are imprecise.

Table IV reports results from difference-in-difference estimates. We interact the phylloxera indicator with the share of wine in agricultural production in 1862 on the one hand (columns 1-3) and with the agricultural surface cultivated in vine per inhabitant in 1862 on the other hand (columns 4—6). In both cases we consider the whole period between 1826 and 1936. So, in the diff-in-diff strategy we have a larger control group with respect to the IV-strategy[6]. Results reported in Table IV are in line with those we find when running IV estimates. The impact of the phylloxera crisis on crime rates increases with the importance of wine in agricultural production and it is significant for property crimes while it does not appear to be different from zero for violent crimes.

Taken together these results show that income fluctuations affect crime rates. A strong negative income shock in rural France during the 19th century caused a strong increase in property crimes while leaving unaltered violent crime rates.

[6] In the IV strategy we use data between 1850 and 1905, the only period for which we have data on wine production for all departments.

4.2. Robustness Checks

In the previous section, we showed that the negative shock in wine production caused by the phylloxera crisis is associated with an increase in property crime rates. We have maintained that the main channel driving our results is a negative shock on the income of people whose main source of revenue is related to wine production. According to this interpretation, the phylloxera crisis affected the quality and quantity of labor opportunities and induced a number of people to increase their amount of illegal activities with respect to legal ones. An alternative mechanism consistent with our results is related to the response of the criminal justice system to crime. Reduced State and local tax collection during bad times may result in reduced budgets for police forces and a subsequent reduction in the capacity of the criminal justice system to contain crime. In order to control for this potential alternative mechanism we have run IV-estimates similar to equation 2 but inlcuding police forces at the court-of-appeal level as a control variable. Results are reported in Table V. The coefficients on property crimes are essentially equal to those reported in Table 2 - Panel b). This test allows us to exclude that our results are driven by a radical change in the presence of police forces at the local level as a consequence of the phylloxera crisis.

A second potential alternative mechanism through which the phylloxera crisis could have affected crime rates is the behavior of judges. During bad times, judges and juries could be more lenient toward those committing property crimes as they might justify misbehavior as a consequence of the need to survive.[7] If this is the case, the overall deterrence of the criminal justice system would be reduced as a consequence of the phylloxera attack. In order to check for this alternative explanation, we have collected data on convictions and we have computed the conviction rates for each crime and department by year. If judges are more lenient as a consequence of the phylloxera attack, wine production (instrumented by the phylloxera indicator) should predict conviction rates. In Table VI we report the results of a model similar to the one in equation (2) where the dependent variable is the conviction rate per department per year. Results show that wine production does not significantly predict conviction rates. If anything, the negative (but non significant) coefficient on conviction rates for property crimes suggests that judges are less lenient in bad times.

[7] For example Ichino, Polo and Rettore (2003) show that labor judges in Italy are more favorable to workers in regions where unemployment rates are high.

Finally, the phylloxera crisis could influence migration flows to and from the affected departments. In particular, massive migrations from the affected departments could change the age structure of the department population. Given that age is a predictor of the probability to commit crime (Ganong, 2010), changes in the age structure of the departments induced by the phylloxera crisis are a potentially confounding factor that could affect our results. Resorting to data on population, we regress the share of young males – the gender/age group most likely to commit crime - on wine production instrumented by the phylloxera indicator. Results for this test are reported in Table VII. Wine production never significantly predicts the share of young males, whatever the precise definition of youth we adopt. This suggests that the income shock generated by the phylloxera pest did not give rise to large migrations across departments, at least in this age group.

Taken together, these results suggest that the strong effect of the phylloxera crisis on crime rates, and in particular on property crime rates, are plausibly driven by their impact on the economic conditions of those living in the affected departments.

5. Conclusions

This paper studies the effects of a large income shock on crime using a unique dataset based on 19th century French administrative data and records of wine production at the departmental level. By exploiting the large drop in wine production and the consequent fall in agricultural income caused by the phylloxera crisis we estimate the causal effect on violent and property crime rates. Our results show the phylloxera crisis had a strong impact on property crime rates, plausibly driven by the impact of the phylloxera on the economic conditions of those living in the affected departments. The results are robust to various alternative explanations including possible changes in the criminal justice system or in migration flows following the phylloxera crisis.

The results are consistent with the standard economic model of crime and suggest that property crimes and in particular theft may have been used by some of the French rural population in 19th century as a risk coping strategy. Other forms of crime such as violent crimes do not appear to respond to the phylloxera shock. Despite it is very difficult to draw policy conclusions from an exercise not designed to test the effect of a specific policy, our findings are consistent with the idea that an insurance safety net against negative income shocks may result in a reduction of property crime rates.

References

Banerjee, A, E. Duflo, G. Postel-Vinay and T. Watts. 2010. "Long Run Health Impacts of Income Shocks: Wine and Phylloxera in 19th Century France", *Review of Economics and Statistics*, 92(4), 714-728.

Becker G., 1965. "Crime and Punishment: an economic approach", *Journal of Political Economy*, 76, 169-217.

Bourguignon, F., J. Nunez and F. Sanchez. 2003."A Structural Model of Crime and Inequality in Columbia", *Journal of the European Economic Association*, 1(2-3), 440-9.

Carbasse J-M. 2000. *Histoire du Droit Pénal et de la Justice Criminelle*, Paris: Presses Universitaires de France, 2nd edition.

Chevet, J.-M., S. Lecocq and M. Visser. 2011. "Climate, grapevine phenology, wine production and prices: Pauillac (1800-2009)". *American Economic Review Papers and Proceedings*, 101, 142-146

Cook, P. and G. Zarkin. 1985. "Crime and the business cycle.", *Journal of Legal Studies*, 14, 115-128.

Craft N.F.R. 1984. Economic Growth in France and Britain, 1830-1910: A Review of the Evidence, *Journal of Economic History* 44(1), 49-67

Fajnzylber, P., D. Lederman and N. Loayza. 2002. "What Causes Violent Crimes?", *European Economic Review*, 46(7), 1323-57

Fefchamps, M. and B. Minten. 2006. "Crime, Transitory Poverty, and Isolation: Evidence from Madagascar". *Economic Development and Cultural Change*, 54(3), 579-603.

Fougère, D., F. Kramarz and J. Pouget. 2009. "Youth Unemployment and Crime in France." *Journal of the European Economic Association* 7(5), 909-938.

Galet, P. 1957. *Cépages et vignobles de France*, Montpellier, Imprimerie du Paysan du Midi.

Ganong, Peter. 2010. "Reviving Rehabilitation: The Effects of Prison on Released Offenders in Georgia", Mimeo, Harvard University.

Gould, E., B. Weinberg, and D. Mustard. 2002. "Crime Rates and Local Labor Market Opportunities in the United States: 1979-1997", *The Review of Economics and Statistics*, Vol. 84(1), 45-61

Ichino A., M. Polo and E. Rettore. 2003. "Are Judges Biased by Labor Market Conditions?", *European Economic Review*, 47 (5), 913-944 .

Lin, M. 2008. "Does Unemployment Increase Crime?: Evidence from U.S. Data 1974–2000". *Journal of Human Resources*, 43(2), 413-436.

Maddison A. 1995. *Monitoring the World Economy, 1820-1992*, Paris, OECD Development Center Studies.

Melhum, H., E. Miguel and R. Torvik. 2006. "Poverty and Crime in 19th Century Germany", *Journal of Urban Economics*, 59(3), 370-388.

Miguel, E. 2005. "Poverty and Witch Killing", *Review of Economic Studies*, 72(4), 1153-1172

Mocan, N . and T. Bali. 2011. "Asymmetric Crime Cycles", *Review of Economics and Statistics*, forthcoming.

Oster, A., and J. Agell. 2007. "Crime and unemployment in turbulent times." *Journal of the European Economic Association*, 5(4), 752-775.

Perrot M. and P. Robert. 1989. *Compte Général de l'Administration de la Justice Criminelle en France pendant l'année 1880 et Rapport relative aux années 1826 à 1880*, Genève: Slatkine Reprints.

Postel-Vinay G. 1989. “Debts and Agricultural Performance in the Languedocian Vineyard, 1870–1914” (pp. 161–186), in G. Grantham and C. S. Leonard (Eds.), *Agrarian Organization in the Century of Industrialization: Europe, Russia, and North America*; Greenwich, CT: JAI Press,

Pouget, R. 1990. *Histoire de la lutte contre le phylloxéra de la vigne en France : 1868-1895*, Paris, Institut national de la recherche agronomique.

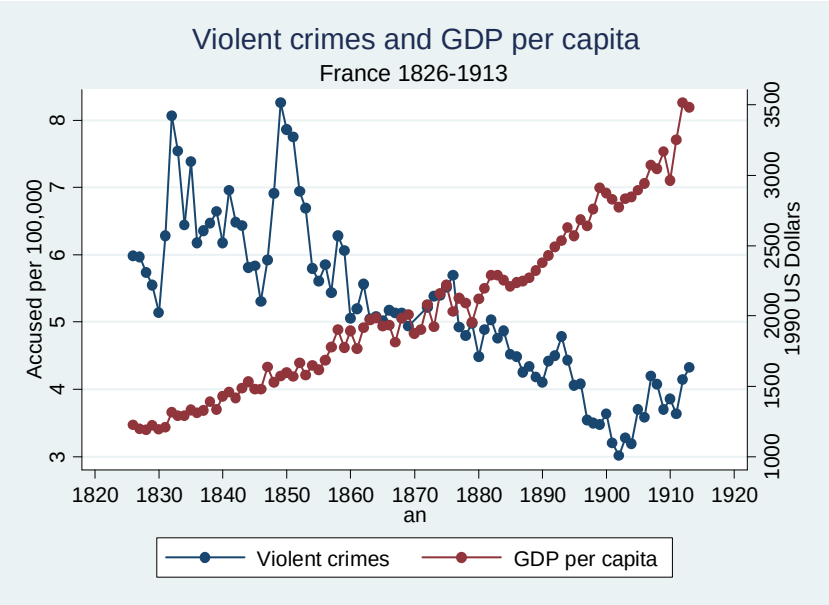
Raphael, S. and R. Winter-Ember. 2001. "Identifying the Effect of Unemployment on Crime", *Journal of Law & Economics*, 44(1), 259-83.

Soares, R. 2004. "Development, Crime and Punishment: Accounting for the International Difference in Crime Rates", *Journal of Development Economics*, 73(1), 155-184

Traxler, C. and C. Burhop. 2010. "Poverty and crime in 19th century Germany: A reassessment. Max Planck Institute for Research on Collective Goods", Working Paper 2010-35

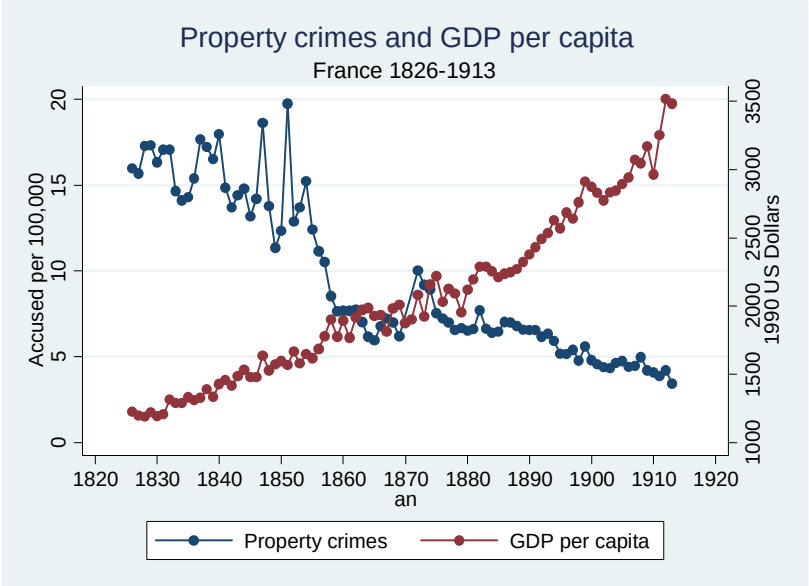
Figure 1 – Violent crimes, property crimes and GDP per capita

1-a Violent Crimes



Source: authors' computations from *Compte Général de la Justice Criminelle*, *Annuaire Statistique de la France* and Maddison (1995).

1-b Property Crimes



Source: authors' computations from *Compte Général de la Justice Criminelle*, *Annuaire Statistique de la France* and Maddison (1995).

Figure 2 - Compte Général de la Justice Criminelle, 1869

COURS D'APPEL.	DÉPARTEMENTS.	CRIMES — CONTRE LES PERSONNES. — NOMBRE — des accusations.	des accusés.	des acquittés.	des condamnés à des peines afflictives et infamantes.	des condamnés à des peines correctionnelles.	CRIMES — CONTRE LES PROPRIÉTÉS. — NOMBRE — des accusations.	des accusés.	des acquittés.	des condamnés à des peines afflictives et infamantes.	des condamnés à des peines correctionnelles.	NOMBRE TOTAL — des accusations.	des accusés.	des acquittés.	des condamnés à des peines afflictives et infamantes.	des condamnés à des peines correctionnelles.
Agen	Gers	21	30	12	10	8	12	12	3	3	6	33	42	15	13	14
	Lot	4	7	3	3	1	8	8	1	1	6	12	15	4	4	7
	Lot-et-Garonne	6	6	2	1	3	22	34	3	11	20	28	40	5	12	23
Aix	Alpes (Basses-)	10	12	#	5	7	6	6	1	2	3	16	18	1	7	10
	Alpes-Maritimes	21	27	11	6	10	13	25	6	7	12	34	52	17	13	22
	Bouches-du-Rhône	27	34	7	12	15	43	92	25	36	31	70	126	32	48	46
	Var	14	15	3	8	4	21	25	5	12	8	35	40	8	20	12
Amiens	Aisne	32	33	8	11	14	23	26	7	9	10	55	59	15	20	24
	Oise	33	38	8	20	10	33	39	8	17	14	66	77	16	37	24
	Somme	26	33	9	19	5	33	36	6	21	9	59	69	15	40	14
Angers	Maine-et-Loire	15	15	1	9	5	19	22	2	10	10	34	37	3	19	15
	Mayenne	5	6	4	#	2	12	14	1	7	6	17	20	5	7	8
	Sarthe	11	13	3	6	4	16	21	4	7	10	27	34	7	13	14

Figure 3 – Violent and Property Crimes in France 1826-1936

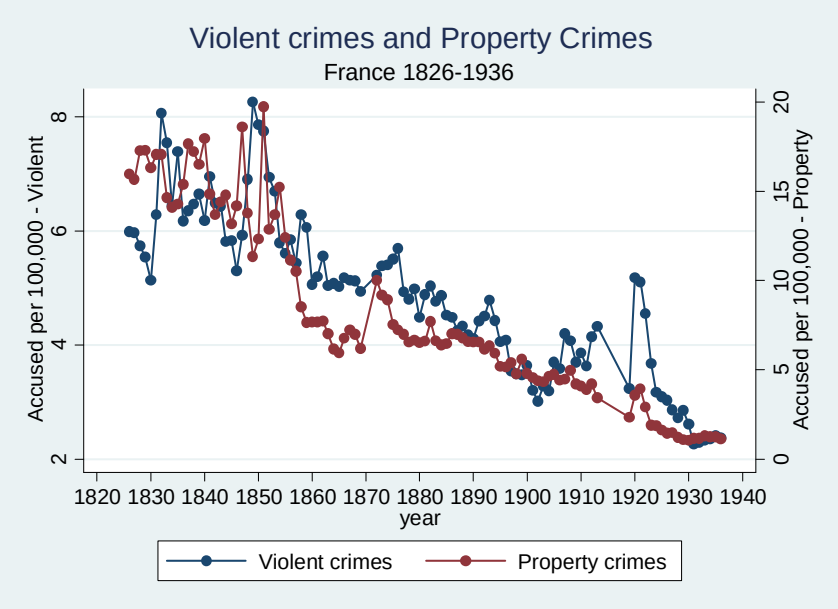


Figure 4 – Minor Offences in France 1826-1936

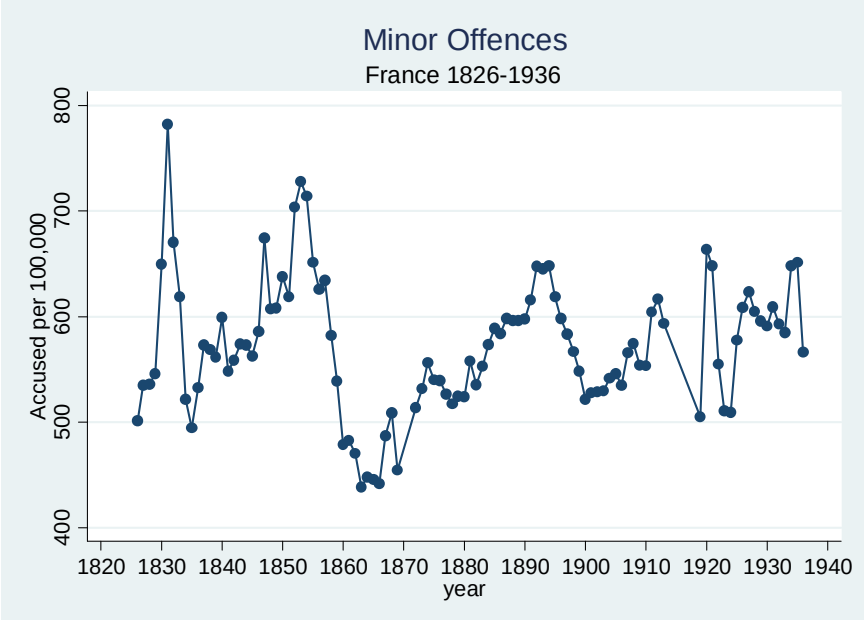
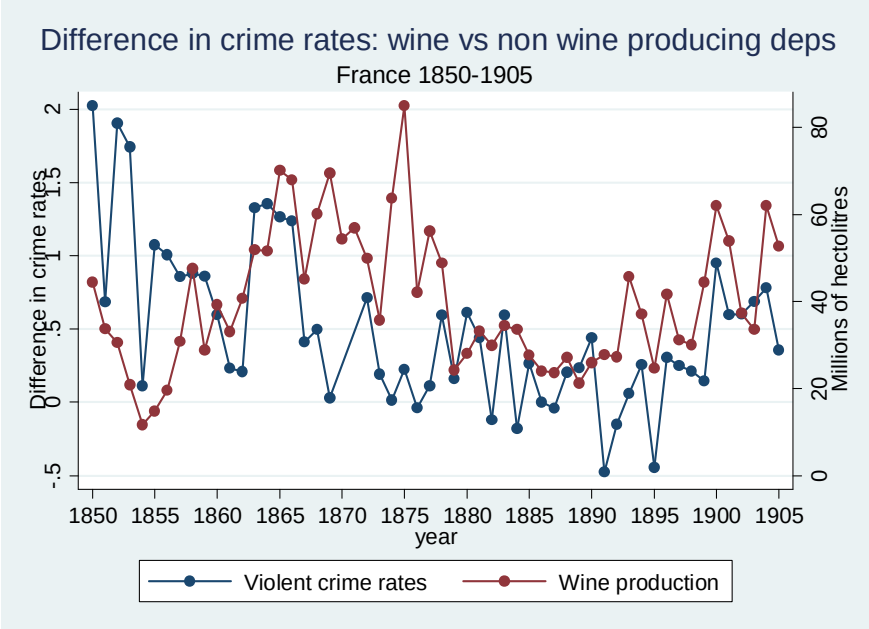
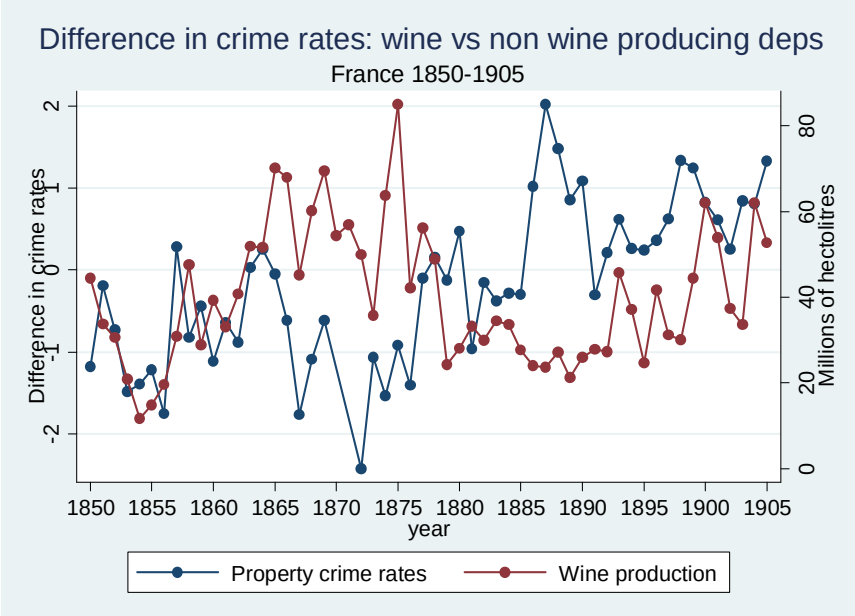


Figure 5: Differences in Crime Rates between Wine-Producing and Non Wine-Producing Departments

5-a. Violent Crimes



5-b. Property Crimes



Note: Wine-producing departments are defined as departments in which wine production represented at least 15% of agricultural production in 1862. All other departments are defined as non wine-producing

TABLE I

IMPACT OF PHYLLOXERA ON WINE PRODUCTION

	Log (Wine Production)	Log (Wine Production)
	(1)	(2)
Phylloxera	-0,325	-0,364
	(0.093)	(0.088)
Year Dummies	Yes	Yes
Department Dummies	Yes	Yes
Department Specific Trends	No	Yes
R-squared	0,876	0,919
Observations	4143	4143

Note: Robust standard error clustered at department level in parenthesis

TABLE II

IMPACT OF WINE PRODUCTION ON CRIME RATES

	Violent Crimes	Property Crimes	Minor Offences	Violent Crimes	Property Crimes	Minor Offences
a) OLS	(1)	(2)	(3)	(4)	(5)	(6)
Log Wine Production	0,047	0,271	-1,000	0,132**	-0,007	-5,769
	(0.065)	(0.207)	(8.787)	(0.061)	(0.080)	(6.129)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	No	No	No	Yes	Yes	Yes
R-squared	0,517	0,626	0,596	0,576	0,724	0,795
Observations	3995	3995	3995	3995	3995	3995
b) IV-regressions	(1)	(2)	3)	(4)	(5)	(6)
Log Wine Production	0,286	-3,102**	-8,151	0,243	-1,864**	-13,615
	(0.479)	(1.393)	(38.900)	(0.427)	(0.845)	(31.126)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	No	No	No	Yes	Yes	Yes
First Stage F-Stat	63,63	63,63	63,63	63,63	63,63	63,63
R-squared	0,529	0,435	0,608	0,575	0,682	0,795
Observations	3995	3995	3995	3995	3995	3995

NOTE: Robust standard errors clustered at department level in parenthesis. ** significant at the 5% level. In each crime category, dependent variables are defined as the number of charged individuals over the total departmental population in a given year.

TABLE III

IMPACT OF WINE PRODUCTION BY CRIME

	Homicides	Robberies	Theft in Churches	Theft on Streets	Theft by Houseservants	Other Thefts	Forest related Offences
IV-regressions	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log Wine Production	-0,069	-1.458**	-0,010	-0,032	-0.388*	-1.021**	-17.130
	(0.189)	(0.621)	(0.055)	(0.065)	(0.222)	(0.421)	(13.829)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F-Stat	63,63	63,63	63,63	63,63	63,63	63,63	63,63
R-squared	0,552	0,599	0,088	0,101	0,568	0,536	0,714
Observations	3995	3995	3995	3995	3995	3995	3919

NOTE: Robust standard errors clustered at department level in parenthesis. In each crime category, dependent variables are defined as the number of charged individuals over the total departmental population in a given year. ** siginficant at the 5% level, *significant at 10%

TABLE IV

IMPACT OF PHYLLOXERA ON CRIME RATES BY SHARE OF WINE IN AGRICULTURAL PRODUCTION AND HECTARES OF VINE PER INHABITANT

	Violent Crimes	Property Crimes	Minor Offences	Violent Crimes	Property Crimes	Minor Offences
	(1)	(2)	(3)	(4)	(5)	(6)
Phylloxera*Share of wine on agricultural production	-0,046	4.836**	-45,063			
	(0.718)	(2.343)	(38.584)			
Phylloxera*Hectares of vines per inhabitant				-0,608	5,584	344,381
				(1.557)	(3.808)	(163.983)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0,672	0,774	0,733	0,672	0,774	0,730
Observations	8929	8929	8928	8888	8888	8887

NOTE: Robust standard errors clustered at department level in parenthesis. In each crime category, dependent variables are defined as the number of charged individuals over the total departmental population in a given year.

TABLE V

IMPACT OF WINE PRODUCTION ON CRIME CONTROLLING FOR POLICE FORCES

	Violent Crimes	Property Crimes	Minor Offences	Violent Crimes	Property Crimes	Minor Offences
IV-regressions	(1)	(2)	(3)	(4)	(5)	(6)
Log Wine Production	0,281	-3.108**	-10,044	0,257	-1.824**	-16,624
	(0.482)	(1.408)	(38.584)	(0.428)	(0.835)	(30.804)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	No	No	No	Yes	Yes	Yes
Police Forces	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0,529	0,437	0,610	0,576	0,685	0,796
Observations	3986	3986	3986	3986	3986	3986

NOTE: Standard errors clustered at department level in parenthesis. In each crime category, dependent variables are defined as the number of charged individuals over the total departmental population in a given year.

TABLE VI

IMPACT OF WINE PRODUCTION ON CONVICTION RATES

	Violent Crimes	Property Crimes	Minor Offences	Violent Crimes	Property Crimes	Minor Offences
IV-regressions	(1)	(2)	(3)	(4)	(5)	(6)
Log Wine Production	1,817	-1,151	-1,033	0,961	-2.215	-0,718
	(2.927)	(3.087)	(0.667)	(2.761)	(2.898)	(0.480)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Department Specific Trends	No	No	No	Yes	Yes	Yes
R-squared	0,247	0,201	0,088	0,287	0,248	0,676
Observations	4140	4141	4145	4140	4141	4145

NOTE: Standard errors clustered at department level in parenthesis. In each crime category, dependent variables are defined as the number of convicted individuals over the number of charged individuals for that kind of offence in a given year.

TABLE VII

IMPACT OF WINE PRODUCTION ON THE SHARE OF YOUNG MALES

	Share of Males 15-19	Share of Males 15-29	Share of Males 15-39	Share of Males 15-49
IV-regressions	(1)	(2)	(3)	(4)
Log Wine Production	0,000	-0,004	-0,003	-0,002
	(0.016)	(0.006)	(0.006)	(0.006)
Year Dummies	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes
R-squared	0,388	0,508	0,636	0,705
Observations	805	805	805	805

NOTE: Robust standard errors clustered at department level in parentheses. Dependent variables are defined as the number of males in that age category over the total departmental population in a given year.

TABLE AI: DESCRIPTIVE STATISTICS

Variable	Number of Observations	Average	Standard Deviation
Total France			
Wine Production (in Hl)	4179	538713	1154565
Crime Rates (per 100,000 Habitants)			
Violent Crimes	9001	4,954	4,254
Property Crimes	9001	7,405	6,922
Minor offences	9000	546,599	363,323
Homicides	9001	1,371	2,736
Thefts	9001	5,206	5,534
Thefts in Churches	7331	0,108	0,270
Thefts on Streets	7847	0,235	0,463
Thefts by Houseservants	7847	1,239	1,797
Other Thefts	7847	4,109	3,933
Forest related offences	6643	151,227	375,059
Wine Producing Departments			
Wine Production (in Hl)	1967	964774	1565624
Crime Rates (per 100,000 Habitants)			
Violent Crimes	3881	5,509	5,532
Property Crimes	3881	7,606	6,170
Minor offences	3881	552,169	401,902
Homicides	3881	1,699	3,737
Thefts	3881	5,315	4,784
Thefts in Churches	3154	0,116	0,290
Thefts on Streets	3376	0,217	0,435
Thefts by Houseservants	3376	1,264	1,556
Other Thefts	3376	4,200	3,417
Forest related offences	2858	143,735	413,444
Non-Wine Producing Departments			
Wine Production (in Hl)	2212	159843	185115
Crime Rates (per 100,000 Habitants)			
Violent Crimes	5120	4,532	2,867
Property Crimes	5120	7,254	7,439
Minor offences	5119	542,375	331,070
Homicides	5120	1,122	1,559
Thefts	5120	5,124	6,039
Thefts in Churches	4177	0,103	0,254
Thefts on Streets	4471	0,249	0,482
Thefts by Houseservants	4471	1,220	1,960
Other Thefts	4471	4,041	4,280
Forest related offences	3785	156,884	343,191

Note: In each crime category, dependent variables are defined as the number of convicted individuals over the number of charged individuals for that kind of offence in a given year. Wine-producing departments are defined as departments in which wine production represented at least 15% of agricultural production in 1862. All other departments are defined as non wine-producing