

The deterrent effect of an increase in sentence time : evidence from French peines planchers.*

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Abstract

Abstract: In August 2007, the French parliament passed the first mandatory sentencing act against repeat offenders. The law was largely unanticipated, strongly promoted by the government and broadly enforced. Therefore, it gives an opportunity to measure the deterrent effect of a medium increase in the severity of sentences in a country where population under judicial control is small. The impact on sentences were lower than that observed in other countries: 46 prison days and 64 probation days for targeted infractions. In order to assess the deterrent effect of the law, I use the detailed individual database of all French sentences from the French Ministry of Justice. I avoid confusion with incapacitation effects and cohort evolution by focusing on re-offense dynamics of people sentenced *before the law was passed*. The identification strategy is based on the fact that offenders only differ by the time between the first sentence and the date of entry into force of the law. Offenders thus spent various amounts of time under the risk of mandatory sentencing. The number of crimes committed by primo-offenders, who are not targeted by the law, offers an important control for simultaneous criminal context evolution. The analysis shows a significant deterrent effect of the law on targeted offenders, around 5%. This result is robust to many specifications and controls. Nevertheless, the effect seems to be a short term one. After five months, there is no longer evidences of any deterrence.

Introduction

Over the last decades, the public opinion in industrialized countries has become increasingly preoccupied with questions of crime and insecurity. Politicians have been reacting to this concern and gradually adopting a "tough on crime" discourse largely independent on their political party (Wacquant 2009). This new approach induced sentences of higher severity and, to a lesser extent, attempts to increase crime detection probability. Following this evolution, the American criminal population has started increasing in the late 1970's and has now

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reached more than 2 million persons. Western Europe started a similar, but softer, transition in the late 1990's.

This paper focuses on a large-scale increase in sentence time in France in August 2007. The law introduced the first mandatory sentencing for recidivists. This new disposition was largely enforced and punishment for targeted infractions increased by 46 prison days (a roughly 30% increase) and 64 days for probation (a roughly 150% increase).

Previous studies have pointed out the different channels through which an increase in sentence time can have a beneficial effect on crime (Kessler Levitt 1998). Three major mechanisms can be isolated: the deterrent effect, the incapacitation effect and the specific deterrent effect¹. Even if joint evaluation can give useful information, it's important to distinguish between these three effects. Depending on the relative importance of these three effects, social cost combined to politics can largely differ. According to its promoters, the law should lead to a "gold equilibrium" where there are fewer crimes and fewer sanctions. Conversely, its detractors have stressed that the law would probably induce strong social costs, due to the need to build more prisons, and the effects on prisoners' well-being.

Although the importance of distinguishing between different channels has long been recognized, only recent studies have dealt with this problem. Most papers on deterrence have focused on extreme changes in expected sentences. For example, the much investigated "three strikes and you are out" policies in US implied life without the possibility of parole upon the third strike. The identification strategy is often based on the difference between short term impact, due to a deterrent effect, and long term evolution coming from a mix of deterrent and incapacitation effects (Kessler and Levitt 1999, Marvell and Moody 2001, Shepherd 2002, Abrams 2007 for "add-on gun laws"). This strategy requires some assumption on what short term is. Other states are used as control group². Helland and Tabarrock (Helland and Tabarrock 2007) avoid this issue by using individual data and comparing re-offence rate of a treatment and a control group. Nevertheless, those studies based on three strikes laws focus on a massive increase in sentence which could be extremely costly and give rise to major negative side effects (Iyengar 2008).

However, less studies have looked at the effect of more modest increases in expected sentences on offending. Drago, Galbiati and Vertova (Drago, Galbiati and Vertova 2009) assess the impact of an increase in sentence time in the context of the large Italian amnesty of 2006. Their identification strategy is based on the comparison of offenders whose sentences were differently converted into suspended prison. Equally condemned people spent varying lengths of time in jail because of the amnesty. Then, they faced different risks in case of re-offence because of varying suspended prison time. The authors estimate the joint effect of shorter incarceration and longer suspended sentences. They claim that the specific deterrent effect is negligible and that they only measure the general de-

¹I refer here to the classical definitions in economics of crime. General deterrence is the "incentive" effect of sanctioning. While I refer to specific deterrence as the effect of the penalty on those that experience it. So the effect of an expected one month increase in incarceration is general deterrence while the effect of spending one month more for those already incarcerated is specific. Incapacitation is the impossibility of doing any crime when incarcerated.

²This control groupe rises an important problem for the definition of the relevant explanatory variable: the vote or the enforcement of a law.

terrent effect. This assumption is documented in this context. This setup is the closest from the one presented here except the Italian decrease in incarceration rates.

Based on rich data computing all French trials and uniquely identifying each offender, I'm using a different method to assess the general deterrent effect of the law. I get rid of incapacitation and specific deterrent effects of the law by focusing on offenders condemned before the law was passed. Those offenders have at least one "strike" before the vote of the law. The determining factors of this infraction as well as the choice of the sanction are orthogonal to the law. The increase in sentence time only affects the re-offending rates of this group. Depending on the date of their trial, those offenders will spend different amounts of time under the force of the law. The identification strategy is based on the shift in the instantaneous probability of re-offense when offenders are threatened with higher sentences. The time before the law allows to identify cohort fix effects depending on the date of the trial.

This method clearly identifies a shift in the probability of re-offense. This could be interpreted as a causal effect of the law if there is no simultaneous shock. I control for this drawback using the "natural" control group of the law, first-time offenders, who are not targeted by the law. Even if instantaneous probability of offense cannot be computed for people who have never broken the law before, I can compute the number of first offenders per month and place. I use this variable as time-varying covariate. It controls for exogenous shocks affecting all criminals (criminal or legal opportunities, police activity, etc). I find a small but significant and robust deterrent effect of the law. The instantaneous probability of re-offense diminishes by 5%. This result is almost identical to the 1.25% diminution for each additional month in expected sentence found by Drago, Galbiati and Vertova.

This deterrent effect is stronger for offenders who have a short "criminal career". It is absent for offenses linked to addiction or sexual deviance. The institutional context is described in the first section. Section 2 measures the effect of the law on sentence time. Section 3 presents the empirical strategy. Section 4 gives descriptive statistics for the relevant variables. Sections 5 and 6 present the central results. Section 7 discusses the duration of the effect. Section 8 disaggregates the results in two dimensions: criminal career and type of crime.

1 French context

1.1 Criminal system before the law

The French criminal system is divided in three parts. We distinguish "contraventions", minor offenses for which prison could not be pronounced (small violence, driving beyond speed limits...), "délits", for which the maximal prison terms are shorter than ten years (burglary, drug related offences...), and "crimes" the gravest offenses for which maximal prison terms go from ten years to life (murder, rape...). Criminal procedures differ: "contraventions" are judged by one professional magistrate, "délits" are judged by three professional magistrates, "crimes" court are made up of three professional magistrates and nine jury members (six since 2011).

Maximum sentence duration (and minimum) defined in the penal code brought together probation ("sursis avec mise à l'épreuve", obligations are defined and if not filled convicted person goes to jail), suspended prison ("prison avec sursis" with no obligation nor prison but enhanced prison sentence in case of new conviction) and actual prison ("prison ferme"). For the purpose of clarity we will use the English notion of probation, suspended prison and prison in this paper. Specific dispositions are applied to recidivists. Mainly, maximum prison terms are doubled. However, recidivism, "récidive légale", is a restrictive notion in the French penal code. It applies to all people who are convicted for identical or "related" infraction in a five years period after a trial³. "Related" infraction includes all robbery, all road infractions, all violence and all drug infractions⁴. As it did not induce important change for trial and sentences before mandatory sentencing (maximum prison terms are almost never bounded) recidivism were not fully picked up by prosecutor and evolved depending on ministry's instructions.

1.2 Law on "peines plancher"

Mentioned and moved aside in the mid 2000 when N. Sarkozy was J. Chirac's home secretary, mandatory sentencing came back as one of the major penal proposition during the 2007 electoral campaign. Shortly after the presidential election in which N. Sarkozy was elected, French ministry of Justice R. Dati, brought a bill to the senate. The emergency procedure, chosen by the government led to a very quick parliamentary adoption and the law has been enforced since August 12th⁵.

Because of this rapid adoption we can consider the law as largely unanticipated. Figure 1 presents the standardized occurrence of the research of words "peine plancher" in Google. Four months before the adoption, there was no research at all.

The most important part of this law imposes minimum sentencing for re-offenders depending on the new crime's maximum term. The minimums introduced are: one year for a new crime punished by a term of 3 years, two years if the term is 5 years, three years if the term is 7 years, four years if the term is 10 years. The law allows judges to rule out minimum sentencing for extraordinary reason but they have to specially motivate their choice⁶.

Minimum sentencing targets only recidivists - defined earlier - and could be filled with probation, suspended prison or prison.

The jurisdiction's president is supposed to inform offenders of the risk they take if they commit a new crime in the following five years. This is non mandatory information and the warning should only be given "if it's justified by circumstances or by the offender's personality".

The second part of the law is a technical modification of mandatory care which

³For the most severe offenses ("crimes") there is no limited time period.

⁴Art 132-8 and following, qualification rules evolved slightly through time.

⁵The senate voted the law on July 5th and the national assembly on July 18th. The law was definitively adopted on July 26th, promulgated on August the 10th, and applied from August 12th

⁶Minimum sentences are also defined for most severe offenses but they still fall under the same sanction rules as before the law and, as those cases are judged slowly, exclusion rule is easy to use by the court.

was already possible before the law and does not concern an important number of sentences.

2 Effect of the law on sentences

It is first necessary to measure how the law was applied by courts. Recidivists, defined as re-offenders on the same crime, are targeted and, in theory, their sentence should increase.

I use criminal record compilations from the statistics service of the French ministry of Justice (Sous Direction de la Statistique et des Etudes)⁷ and calculate sentences evolution from 2004 to 2008 for primo-offenders, recidivists and re-offenders non recidivist. Results for facts judged in less than 15 days⁸ are presented in figure 3. Results perfectly fit the predictions: there is a sharp increase in sentences for recidivists, a small increase for re-offenders non recidivist and almost no evolution for primo offender.

Differences between prison, probation and suspended prison are presented in figure 4, 5 and 6. Sentence increasing is due to a large increase in probation duration and a moderate one in prison duration. Suspended prison remains unaffected.

Those results are confirmed and quantified by simple difference in difference regressions. The outcome variable is sentence duration, and the explanatory variable is a dummy equal to one after August 2007 (*law*), two groups dummies for re-offenders (*reoffender*) and recidivists (*recidivist*), and interaction terms which capture the effects of being a re-offender and after August 2007 or a recidivist and after August 2007.

$$\begin{aligned}
 \text{Sentence}_i = & \beta_0 + \beta_1 * \text{law}_i + \beta_2 * \text{law}_i * \text{Reoffender}_i + \beta_3 * \text{law}_i * \text{Recidivist}_i \\
 & + \beta_4 * \text{Reoffender}_i + \beta_5 * \text{Recidivist}_i + \beta_4 * X_i
 \end{aligned}
 \tag{1}$$

Results are presented in table 2. They are consistent with previous graph. There is an overall increase in sentences of 110 days for recidivist. This evolution is based on prison and probation (resp +46 and +64 days). Suspended prison remains broadly constant for all categories over the period.

Impacts diverge among crimes. Robbery and drug related crimes are more impacted than violence (see annex table 11). Road related crimes sentences are almost constant.

Impacts also diverge among procedural way. Alternative procedure⁹ which does

⁷More information are given in section 4 when the data base used for assessing the deterrent effect of the law is presented

⁸Infractions committed at the end of the 2004-2008 period are not judged in this period. Therefor there is more information on facts happened in 2004 than those of 2008. It's necessary to keep only infractions judged in certain time in order to homogenize the data set. A short lag between facts and judgment allow to keep a longer observation period.

⁹The alternative procedure used here is called "Composition pénale". In this case sentences are decided by the prosecutor after bargaining with the offender. This procedural way is possible only for offenses punished by a maximum term of five years. More important for our purpose, "composition pénale" could not constitute recidivism first term and then the law cannot be applied in case of new offenses.

not induce a classification as recidivist in case of new offense is not impacted by the law (see annex table 12).

3 Expected effect and identification strategy

3.1 Potential effect

The French Ministry of Justice presented the text as an important way to decrease recidivism through deterrent effect. The law is supposed to introduce clear and high sentences for repeat offenders. Primo offenders are not targeted. Their sentences should remain stable and their incitations unaffected, unless their returns to crime diminish because they their expected sentence increased for future offenses (anticipation effect).

As the law is applied, if offenders have this information we should find that re-offense rate decreases after August 2007. The number of primo offender per period should remain unaffected.

The magnitude of any deterrent effect depends on the information available. Two points are important: information on sentence evolution, information on targeted crime or profile.

Figure 2 presents the standardized occurrence of the Google search of words "peine plancher" compare to other important campaign propositions: migration quotas ("immigration choisie"), university self governance ("indépendance université") or minimum guaranteed service ("grève service minimum"). It shows that levels are close and it confirms that minimum sentencing was one important discussed topic¹⁰.

3.2 Stylized facts

The goal is to see if the law has the deterrent effect stressed by its promoters. Therefore I first try to see if there is a break in criminal activity for offender targeted by the law.

As it was stressed by previous studies (Kessler Levitt 1999) it's important to distinguish general deterrent effect, incapacitation effect and specific deterrent effect. Recidivism rate after the law could decrease because potential re-offenders are beyond bars or because criminal behavior becomes too costly. If there is strongly negative peer effects it's also possible that general deterrence and specific deterrence canceled each other.

The first idea is to compare the number of repeat offenders (the treatment group) to the number of primo offenders (the control group) before and after the law. This strategy captures a lower bound if there is an anticipation effect so that non yet targeted people decrease their infraction rate. Figure 7 present this comparison for the whole country. It's hard to see a clear reduction in crime for the group of repeat offenders.

However this approach suffers from several important drawbacks. Firstly, as

¹⁰According to lawyers, precise application of the law is hard to foresee for an offender. It depends on the maximal sentence term which depends on the precise qualification of the fact which could be one important point discussed during a trial.

France is characterized by short incarceration time¹¹ there is immediate confusion between general deterrence and incapacitation. Moreover, as the law only increases sentences by an average of two months, confusion with specific deterrence also arrives quickly. The empirical strategy based on the difference between a short term impact due to general deterrence and a long term impact where general deterrence and incapacitation effects are join together can't be used directly¹².

Secondly, with aggregate data and high natural variance per month, there is only limited detection power¹³.

Lastly, groups are not independent. The number of repeat offenders at date t depends on the number of primo-offenders at date $t - 1, t - 2...$. The common trend assumption of diff and diff strategy does not hold and corrections (lag coefficients) are hard to set with limited time series.

3.3 Identification strategy

In order to isolate the deterrent effect of the law, my identification strategy is based on the evolution of the reiteration rate for people condemned *before the law*. All the group I focused on has a first term offense independent of the law. The law will then affect those people differently. Let's compare what happens to two individuals, condemned to minor sentences at different dates. An offender A condemned just before the law will have the minimum sentence in case of reiteration. A similar person B condemned one year earlier will be, in case of reiteration, under former rule during one year, and then under mandatory sentencing. If the law has a deterrent effect, A should be more affected than B . This situation is presented in figure ???. If there is deterrence, for each offenders cohort, depending on trial's date, the law should induce a break in the instantaneous re-offense probability (i.e. hazard rate) at a different moment. The different times of the breaks is the source of our identification. The panel structure (different observation time for different cohorts) allow to calculate cohorte fixed effects as well as "time since trial" fixed effects. This strategy is presented in figure 9.

As we focus on trial before the law and as it was largely unanticipated, there is no composition effect. Offenders face different conditions in case of reiteration but their first infraction, the one which bring them in the database, and the judgment are not affected by the distance between the trial and the law.

3.4 Separate the effect of the law from potential simultaneous evolution

The identification strategy allows to isolate a break in offenders' hazard rate of re-offense. This break could be interpreted as the causal effect of the law if

¹¹Over the period from 2004 to 2008, less than 20% were condemned to jail. The average prison length for those sentenced to it, is around 200 days and the median is 120 (four months).

¹²However, it's possible to overcome this drawback by compering primo-offenders and "primo re-offenders". Incapacitation and specific deterrent effects should only affect the third infraction and following ones. This strategy does not change anything to the other drawbacks.

¹³It's possible to decrease this variance by aggregating data at the year level but this induces a sharp decrease in the number of observations.

there is no simultaneous change affecting criminality. A problem arises if the law itself induces changes in different dimension. The law should affect criminals' incentives but it could also change institutions' ones. Two groups could be affected: policeman and prosecutors. Police and public prosecutor's department efforts could change if they view their work as more effective when offenders get higher sentences¹⁴.

The direct targeting of repeat offenders by the police is unlikely as it is difficult to know an individual's criminal status during an arrest. Targeting is possible for long and complex cases where the background is checked before. This is generally not the case for road related offences, drug consumption or violent crime. Moreover, police databases are not equivalent to the justice data set used here and do not contain judicial outcomes¹⁵. However, it is possible that the police increase its general effort or target specific kinds of infractions where re-offenders are more numerous.

I use the number of primo-offenders arrest per month and place as a control for police activity. The offence probability for somebody without a criminal history should be orthogonal to the law as sentences will not be affected. Then primo offender is a natural control group. If the police increase its efforts after the law, primo-offenders will be impacted. This control also captures general characteristics as for example criminal and legal opportunities.

For an offender condemned before the law, the instantaneous probability of committing a new offence at time t depends on sentences, impacted by the law, and environmental characteristics, captured by the number of primo-offender arrested during this period. If the primo-offenders are more numerous it is orthogonal to the law but due to the fact that there is more criminal opportunities, less legal opportunities or a higher arrest probability. In this situation, the instantaneous probability of committing a new offence at time t should be higher.

This control introduces a bias if there is some anticipation effect so that primo-offenders are deterred by the law (see Shepherd 2002 on that effect). This will lead to a downward bias in the evaluation of the deterrent effect. I'll always present model with and without it.

The evolution of the number of primo offenders per month in 2006 and 2007 is presented in figure 10. We can see a decrease in 2007 after the vote of the law. This is in line with an increase in police activity following the law or a deterrent effect on primo-offenders.

Prosecutor's activity could also evolves and specifically target recidivists. In order to control for this potential procedural evolution, I use data on the percentage of treated cases (treated cases over treated cases plus closed file) and

¹⁴It's also possible that political power put higher pression on their activity not necessarily because of the law but simultaneously as a global tough on crime politics. We did not find such evidence in memoranda or decree. This probably come from the fact that Political pression on those agents were already high since 2002.

¹⁵Police databases record all "contact with the police" which include, for example, people who where only witnesses in a case. Conversely, for an arrest, the police database does not contain judicial outcomes. Anecdotal evidences stress that an important part of "primo offenders" are only "primo" for justice but were already present in Police data base. This induces that it's probably hard for policemen to know if previous arrestation lead to one or no judgment.

the percentage of proceedings (proceedings over proceedings plus alternatives) per trimester and location (most disaggregate data available).

4 Data description

4.1 Origins of data set

I use criminal record compilations from the statistics service of the French ministry of Justice (Sous Direction de la Statistique et des Etudes). It contains the results and details of almost all criminal cases judged each year. Only the smallest infractions which are not included in individual criminal records are not registered. It contains all "délits" and "crimes" (defined in part 1.1). Each individual is identified by a single id, constant through the panel. This allows to reconstruct the penal history of an individual. Precise facts and sentence descriptions are available. Date of both infraction and trial are included but, unfortunately, it does not contain any information on sanction enforcement, in particular prison stays could be delayed or fully converted into probation. Socio-demographic variables are included such as age, sex, nationality. The years from the mid 90's to 2010 are available. The unit of observations is the penal case, thus the data set contains trials of the year and not infractions (an infraction commit on year x , is recorded in data set $x + 1$ if it is judged one year after the facts).

4.2 Aggregate construction

We keep offences from 2004 to July 2007 (last month before the law). We drop minor offences ("contraventions") and the most severe ones ("crime") as they are not targeted by the law (or poorly enforced in the case of the most severe offences). These core infractions are called the first term offence.

For each observation we reconstruct individual criminal records in the five years preceding the offense. People are qualified as re-offender if they had at least one previous case.

We then compute new cases occurring in the next period. We keep all offenses committed in the following year and judged in the following three years. We calculate the number of days between the first offence's trial and new date of offence. As the vast majority of offences are judged in less than 2 years, this methodology avoids an important and artificial drop in re-offence speed when we go further from the trial.

Descriptive statistics are presented in table 1. There were 871,240 trial between January 2006 and July 2007, divided in 5 important infractions: road related offenses, the most numerous (43% of trial); robberies (19%); violences and sexual assaults (12%); drug related infractions (6%) and verbal assaults (mainly against police, 4%). Roughly 91% of offenders are male. Average age is 31 (median 28) and 88% are French. Numerous offenders have several contacts with justice: 42% are re-offenders (defined as those who were already condemned in the 5 years before their offense) and 19% will be re-arrest in the following year. Average sentence is low according to US one: 39 days prison sentence, 22 days suspended prison sentence and 23 days probation sentence.

5 General deterrent effect using linear regression

5.1 Model

The trend break is first identified using linear regression on aggregated observations. I divide the data set of all judgment occurred between January 2006 and July 2007 in 19 cohorts, one per month, and compute, for each cohort and each department, the reiteration hazard rate (percentage of people who re-offends during the month, knowing that they did not reiterate before) for each of the 12 months of the spell. The new database contains 21660 observations (95 departments times 19 cohorts times 12 months in the spell). Average hazard rate is slightly decreasing, going from 0.0218 the first month of the spell, to 0.0146 the 12th month.

I regress the hazard rate (hr) on fixed cohort effects ($Cohort_i$ are dummies equal to one if the observation is in cohort i), fixed effects for each month of the spell ($Spell_j$), geographical fixed effects (Geo_k) and a dummy equal to one after the August 2007 (law):

$$hr_{i,j,k} = \beta_0 + \beta_1 * law + \sum_{i=2}^{19} \alpha_i * Cohort_i + \sum_{j=2}^{12} \gamma_j * Spell_j + \sum_{k=2}^{95} \delta_k * Geo_k \quad (2)$$

Following observations made in part 3.4, I control for the number of primo-offenders arrests in the department (normalized per department).

5.2 Results

Results are presented in table 3.

According to simple linear regression strategy, hazard rates present a small but significant trend break after the law. The hazard rate falls by -0.00066 per month after the law. Over a year, using average hazard rate for each month of the spell, this result represent a reduction of 0.4 percentage point (with a reiteration rate of 19% this represent a diminution of 2%).

If I include primo-offender arrest in the control variable, results are even smaller but still significant. This control variable goes in the intuitive direction: if there is more primo offenders there is higher hazard rate. It could be explained by more numerous criminal opportunities, higher police efforts...

Sample restrictions confirm previous results. Columns 3 and 4 in table 3 present the effect of the law on hazard rate for people condemned during a trial. Results are similar. Conversely hazard rate for people judged using an alternative procedural way (and not targeted by the law) is not affected by the law. These results are presented in columns 5 and 6.

6 General deterrent effect using duration model

6.1 Why using duration model?

Linear regressions give evidence of a small but significant deterrent effect of the law. However, with the previous methodology it is impossible to use the individual dimension of the data. It also impose a fix transition under the force of the law for each cohort.

Duration models give the opportunity to use the individual dimension of the data set. An important set of control variables could be added. This class of model also permits to define, for each observation, the precise part of the spell affected by the law. Cohort and geographical fixed effects can still be used. Using duration model, I modelize the hazard rate for all offense judged between January 2006 and July 2007, as follow:

$$h_i(t) = h_0 * \exp^{\alpha * law + \sum_{k=2}^{19} \beta_k * Cohort_k + \gamma * X_i + \delta * Z_i(t)} \quad (3)$$

where h_0 is the baseline hazard rate which could be specified (parametrically) or not (semi-parametric model: Cox model), law a dummy equal to 1 if t is after the law, $Cohort_k$ are dummies equal to one if observation i belongs to cohort k , X_i are states (socio-demographic characteristics, cohort dummy, geographical dummies, etc) and $Z_i(t)$ are time varying covariates (number of primo offender arrest in the department, prosecutors' activity, etc). α is the parameter of interest.

The number of primo-offender arrest is still a key control variable. As duration models use individual data it is now possible to control for the number of primo offender arrest in a specific type of offense. The idea is that offenders are specialized and could be more sensible to criminal opportunities or police efforts in their "field". For example if the police targets drug dealing or if there is more and more drug in one department, the offenders condemned for drug will probably have an higher hazard rate than those condemned for violence.

Duration models also give the opportunity to control for unobserved heterogeneity which, otherwise, could bias estimates. This comes from the fact that those who shared some characteristics will leave faster (or slower) than the rest and some unobserved variable will be more and more frequent as time from trial increases. Time dependence will present a decreasing hazard rate where there is only dynamic selection¹⁶.

Different methods allow to deal with unobserved heterogeneity. The standard one, used here, consists in adding a multiplicative parametric function following a Gamma distribution to the hazard rate.

Standard modelization will be done using piecewise-constant baseline hazard rate. This functional form is much more flexible than fully parametric form (like Weibull) and allow to control for unobserved heterogeneity (contrarily to Cox). In order to avoid convergence problems I limit the number of constant to 4, one per each 3 month period of the spell. This means that the baseline hazard rate will be constant for day 1 to 90 after the trial, 91 to 180, 181 to 270 and 271 to 360.

¹⁶For a complete overview of duration model see Van den Berg (2001).

6.2 Results

Results are presented in table (4).¹⁷

The column 1 presents the effect of the law, without control variable. In column 2, fixed cohort effects and fixed geographic effects are added. In column 3 a large set of state controls are added: socio demographic variable (age, sex, French nationality dummy), fixed crime effects (8 categories: robbery, road related offenses, economic offenses, violence, drug, foreigner legislation, verbal assault, divers), 3 sentence variables in day (prison, probation, suspended prison), and criminal case control (a dummy for those who are already repeat offenders).

The key time varying covariates are added in the following columns: number of primo offender arrests in the offender's geographical area per month of the spell (column 4), number of primo offender arrest in the offender's geographical area and crime category per month of the spell (column 5), percent of cases classified by procurator per calendar trimester of the spell and percent of case brought to court by procurator per calendar trimester of the spell (column 6).

Column 7 and 8 present the results for different time varying covariates mix. Coefficients are all significant. They go from -0.065 to -0.045. This represent, everything held constant, a multiplication of the baseline hazard rate between 0.956 and 0.936 and so a decrease in the hazard rate between 6.5% and 4.4%. Those results are comparable to those obtain with linear regression: they are still significant but small.

As expected, controls for primo-offenders' arrest rate are positive and decrease the effect.

6.3 Robustness check

The first set of robustness checks consists in running duration models on groups not targeted by the law. The results for minor offenses (the infraction which could not be sentenced by prison) are presented in columns (1) and (2) of table ???. The results for an alternative procedural way are presented in columns (3) and (4). Even in case of recidivism the law cannot be applied to persons in this two groups and there is no deterrent effect for them. However point estimates for the alternative procedural way are not so far from the previous one. It could come from a small deterrent effect due to the fact that the rule were not directly clear in all court ¹⁸.

This hypothesis is confirmed by the results. In the third part of table (??) (columns (5) and (6)) I run the same models with a data base composed of trial between January 2005 and July 2006 and a placebo law in August 2006. Coefficients are not significant, point estimates do not always go in the right direction. There is no deterrent effect of this placebo law.

The second set of robustness checks consists in running duration models with different parametric forms of the baseline hazard rate. Results are presented in table 6. Columns 1 and 2 present results for duration models with unobserved heterogeneity, columns 3 and 4 present Cox models, columns 5 and 6 present models with baseline hazard rate split in 6 pieces (instead of 4). Results are very

¹⁷The proportional hazard assumption was tested using Schoenfeld residual. The hypothesis is not rejected for the variable of interest and for the vast majority of the control variables (not shown).

¹⁸Minimum sentencing were sometimes applied until a jurisprudence of the high court

similar to those obtain in section 6.2. Deterrent effect per year goes from 2.3% (Cox model) to 5.8% (piecewise-constant with unobserved heterogeneity)¹⁹.

The last set of robustness checks consists in using a bigger database and different following periods. The database is extended to two years. Results for different following periods are presented in table 7. Columns 1 and 2 present results of duration models with following period of two years, columns 3 and 4 results with following period of 1.5 years. Results are closes to those obtain in section 6.2, around 4.5%.

7 Short term and long term effects

The question of the duration of the effect is a key political question. A political shock, as the one studied here, could only change the equilibrium for transitory period if it does not affect the important day to day variable affecting behavior.

7.1 Data

Based on stylized facts (see for example figure 9) I define the short term effect as the following 5 months after the enforcement.

Using the same database as before (all trial from January 2006 to July 2007) will biased the result as the Long term effects will be measured on people who do not offend during the "short term period". I modified the data base and use in this section all trial from January 2006 to December 2007. Because of the deterrent effect of the law, the offender who committed crime after the law should differ from the others. I remove them from the database by focusing on trial which occurs at least 5 months after the crimes. Then even for the cohort of people judged in December 2007, all facts were done *before the law*. This database contain, for each period after the trial, some offenders who do not face the law, and some who faced it more than 5 years after the enforcement.

Adding unobserved heterogeneity is an additional way to address the selection problem.

7.2 Results

Results are presented in table 8, with ((4) to (6)) or without unobserved heterogeneity. The short term effect goes from 5% to 10%. These results are higher than the global deterrent effect found in the previous section. The long term effect is never significant and the points estimates often go in the wrong direction. This gives strong evidence of a short but not durable effect of the law.

8 Deterrent effect per sub-group

Up to this point there is numerous and coherent evidences of significant deterrent effect of the law. As the law induces an important social cost through prison, it is useful to identify which sub-groups are the most sensible to deterrent effect. Two dimensions seem particularly relevant in this case: type of crime and age.

¹⁹Results are similar with baseline hazard rate following Weibull, Gompertz, Lognormal, Loglogistic or Gamma distribution. Akaike information criteria indicate that piecewise-constant models are the most accurate (not shown).

8.1 Deterrent effect per crime

It is important to look if there is important disparities in deterrent effect between crimes. Offenses do not induce similar costs or trauma for victims and then political efforts should be different. They also probably proceed from different mechanisms (impulsiveness, addiction...).

I run duration models on subgroup constituted of different kind of crime. Results are presented in table 9. If there is some deterrent effect on the most common infraction (robbery in column (1) and (2) and violence in column (3) and (4)) it's less obvious for crime linked to addiction (column (5) and (6)) or negligence (column (7) and (8)). Results for drug related offence are not robust to specification change. Distinction between drug dealing and drug consumption gives higher point estimates for the former (not shown).

8.2 Deterrent effect per age

The link between crime and age is also a regular question in research or political debate. Table 10 present the results for different age group. Minor offenders do not present evidence of deterrent effect. That could come from the fact that they are more impulsive criminal or that minimum sentencing are only rarely implemented for this subgroup.

9 conclusion

This paper presents robust evidence of a 2% significant deterrent effect of the increase in sentence time. Results are consistent in three ways. Firstly, they are consistent across different empirical strategy and robust to many specifications. Secondly, disaggregated results are consistent amongst themselves. "Negligence" crimes and crime linked to addiction are less deterred; minor offenders are not deterred. Thirdly, those results are consistent with previous literature. However, the impact of the increase in sentence time is smaller than the effect measured in papers on "three strikes law": Kessler and Levitt (Kessler and Levitt 1998) find a diminution of 4% in all targeted crimes, Helland and Tabarrok (Helland and Tabarrok 2007) find a decrease of 48% among the class of criminals with one strike and 12.5% among criminals with two strikes. This difference could come from the fact that "three strikes law" increases sentences by a larger amount than French law. At least two other parameters could explain this pattern. First, it would be interesting to wonder how far people are familiar with the law. Higher deterrent effects could come from a larger knowledge of the law. Secondly, differences in the effects could come from differences in offenders' "deterability" (Jacob 2010). The US present an incarceration rate which is 10 times higher than Europe one and French prisons are characterized by important social marginality²⁰. Those people are probably harder to dissuade from offending.

A complete cost benefit analysis of the law should take into account all the three major channels through which the law could induce a shift in criminality: general deterrence, incapacitation and specific deterrence. At this stage I can only

²⁰Some descriptions of prisoners educational background, pre-incarceration employment status or marital status are presented in Combessie (2010) for France and Western (2006) for the US.

say that the increase in sentence time does not lead to the "Gold equilibrium" hoped by its promoters. According to the French ministry of justice, one year in prison costs 32,000 euros and the law induces an increase of 4000 prisoners per year (Leturcq 2012) for a cost of 128 millions euros (164 millions US dollars).

PRELIMINARY VERSION please do not quote

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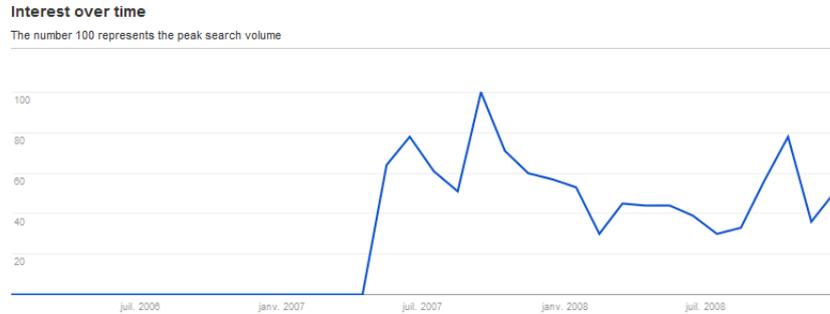


Figure 1: Evolution of the research of the words "peines plancher" in Google.

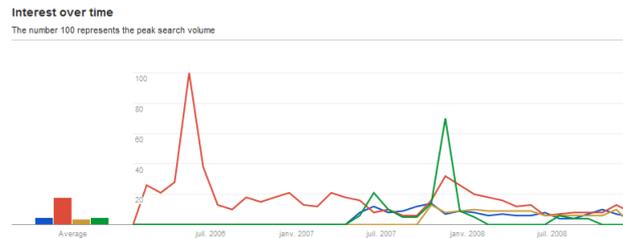


Figure 2: Evolution of the research of the words "peines plancher" (blue), "immigration choisie" (red), "grève service minimum" (brown), "autonomie université" (green) in Google between January 2006 and December 2008.

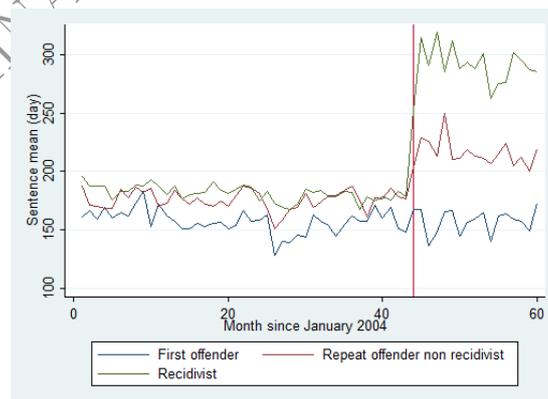


Figure 3: Sentence evolution between 2004 and 2008. Sentences are the sum of prison, suspended prison and probation condemnation. Red line represent the vote of the law.

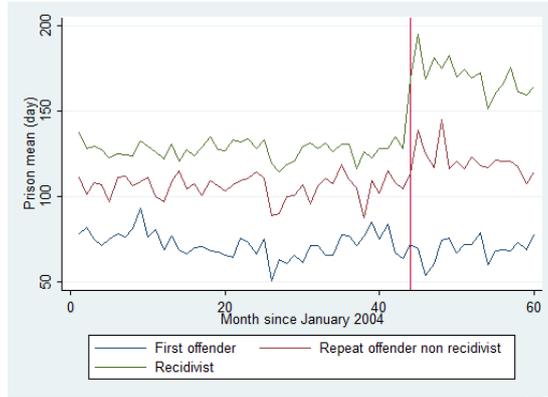


Figure 4: Prison evolution between 2004 and 2008. *Sentences are the sum of prison, suspended prison and probation condemnation. Red line represent the vote of the law.*

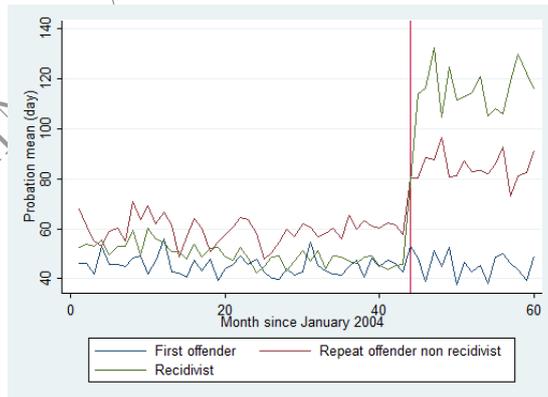


Figure 5: Probation evolution between 2004 and 2008. *Sentences are the sum of prison, suspended prison and probation condemnation. Red line represent the vote of the law.*

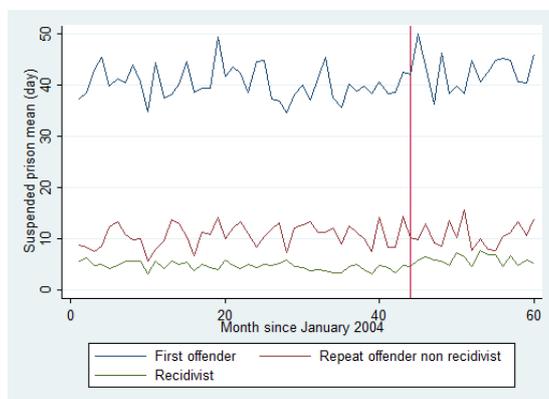


Figure 6: Suspended prison evolution between 2004 and 2008. *Sentences are the sum of prison, suspended prison and probation condemnation. Red line represent the vote of the law.*

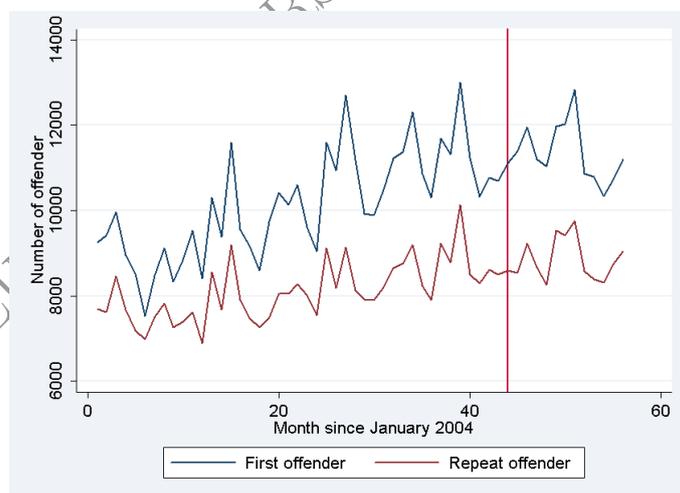


Figure 7: Number of offender per category between 2004 and 2008. *Blue line represent the number of offender who did their first criminal act during the month. Purple line represent the number of offender who did at least their second criminal act during the month. Red line represent the vote of the law.*

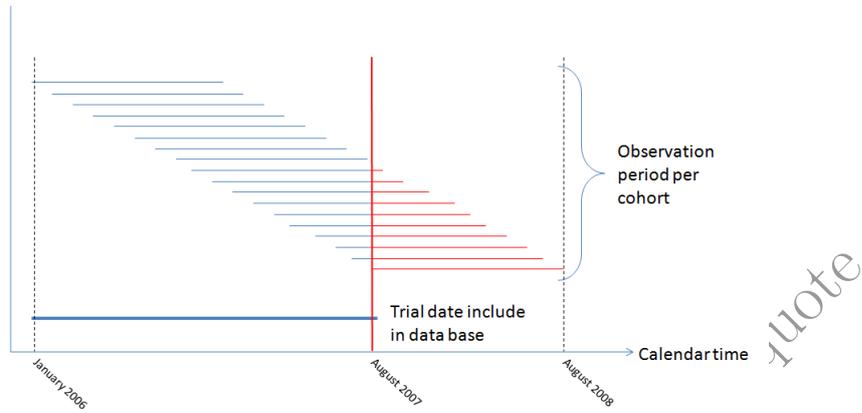


Figure 8: Time spent under the force of the law per cohorte. *The thick line represents the date of judgments included in the data base. Other lines represent cohorts. Their length correspond to 12 month because it's the observation period per cohort. The red part is the time under the force of the law. For e.g. people judged in February 2007 are represented by a line going from February 2007 to January 2007 (observation time), blue until August 2007 and red after.*

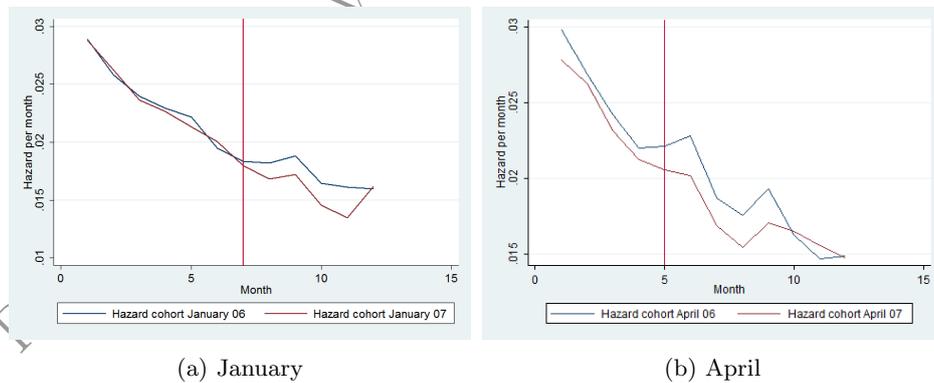


Figure 9: Hazard evolution for different cohorte in 06 and 07. *This graph represent the percentage of new offender (over those who do not re-offend yet) per month for cohort judged in January 2006 (blue) or January 2007 (red). The vertical red line represent the time at which cohort 2 faced the law. We can see that the Hazard rate decrease after the law for 2007 cohort.*

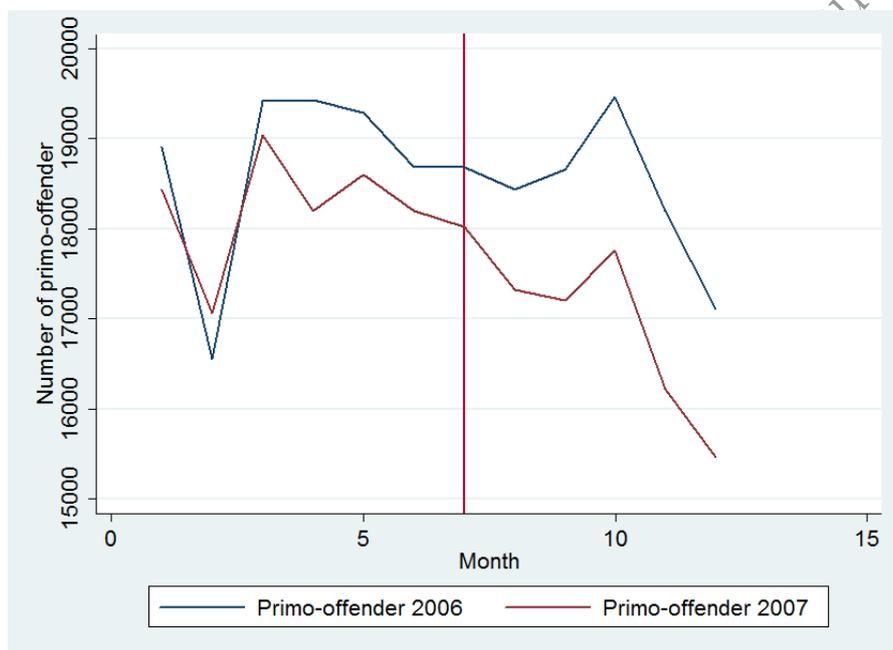


Figure 10: Primo-offender per month in 2006-2007. *This graph represent the number of primo offenders per month in 2006 (blue) and 2007 (red). The vertical red line represent the month of August, where the law was voted in 2007.*

	2006	2007	Total	sd
N	541 442	327 949	869 391	
Time between fact and trial	310.67	312.14	311.23	345.94
Sex	0.09	0.09	0.09	0.29
Age	31.72	31.85	31.77	12.35
French	0.87	0.87	0.87	0.33
Criminal record				
Reiteration	0.42	0.43	0.42	0.49
Recidivism (reconstructed)	0.24	0.25	0.24	0.43
Recidivism (legal)	0.08	0.10	0.09	0.28
Sentence (day)				
Prison	39.10	39.99	39.43	154.48
Suspended prison	22.90	22.16	22.62	63.68
Probation	22.19	22.79	22.42	75.52
Type of offense				
Theft	0.18	0.18	0.18	0.39
Road	0.43	0.43	0.43	0.49
Violence	0.09	0.10	0.10	0.30
Sexual	0.02	0.01	0.01	0.12
Drug	0.06	0.06	0.06	0.24
Verbal	0.04	0.04	0.04	0.20
Maximum sentence				
One year	0.25	0.24	0.24	0.43
Three years	0.45	0.45	0.45	0.50
Five years	0.18	0.18	0.18	0.39
Seven years	0.07	0.07	0.07	0.25
Ten years	0.06	0.06	0.06	0.23
Re-offence				
No re-offence	0.79	0.79	0.79	0.41
Theft	0.05	0.05	0.05	0.22
Road	0.08	0.08	0.08	0.27
Violence	0.02	0.02	0.02	0.14
Sexual	0.00	0.00	0.00	0.04
Drug	0.02	0.02	0.02	0.13
Verbal assault	0.01	0.01	0.01	0.11

Table 1: Descriptive statistics

	Total sentence	Prison	Probation	Suspended prison
Law	8.788***	0.116	5.918***	2.754***
Law*re-offender	38.852***	17.419***	23.245***	-1.812**
Law*recidivism	110.474***	46.569***	64.752***	-0.847
reiteration	10.517***	34.302***	6.006***	-29.791***
Recidivist	5.216***	21.711***	-10.822***	-5.673***
Age	0.171***	0.167***	0.265***	-0.262***
Sex	-37.983***	-37.386***	-3.450***	2.854***
French	32.889***	11.336***	44.934***	-0.710**
Time trend	-0.290***	-0.090***	-0.186***	-0.014
cons	142.067***	78.616***	14.732***	48.719***
N	178945	178945	178945	178945
R2	0.049	0.043	0.066	0.089

Table 2: Effect of the law on sentences for crime judged in less than 15 days. 2004-2008 "Law" is a dummy equal to 1 if the second term offense is posterior to the enforcement of "peines planchers".

PRELIMINARY VERSION Please do not quote

	(1)	(2)	(3)	(4)	(5)	(6)
	Hazard rate	Hazard rate	Hazard rate	Hazard rate	Hazard rate	Hazard rate
Data base	All judgment	All judgment	Only trials	Only trials	Alternative procedure	Alternative procedure
Law	-0.000660*** (0.000226)	-0.000429* (0.000227)	-0.000734*** (0.000259)	-0.000504* (0.000260)	0.000761 (0.000725)	0.000988 (0.000731)
Primo offender arrest		0.000626*** (7.32e-05)		0.000625*** (8.41e-05)		0.000586*** (0.000241)
Cohort fix effects	x	x	x	x	x	x
Spell fix effects	x	x	x	x	x	x
Geographical fix effects	x	x	x	x	x	x
N	21660	21660	21660	21660	21660	21660

Table 3: Deterrent effect of the law measured with linear regression. *law* is a dummy equal to one after August 1st, 2007

PRELIMINARY VERSION Please do not quote

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Time							
Law	-0.0625*** (0.00600)	-0.0652*** (0.00855)	-0.0627*** (0.00855)	-0.0445*** (0.00862)	-0.0509*** (0.00860)	-0.0612*** (0.00859)	-0.0446*** (0.00865)	-0.0502*** (0.00863)
Primo offender arrest				0.0560*** (0.00280)			0.0561*** (0.00282)	
Same type primo offender arrest					0.0418*** (0.00265)			0.0415*** (0.00265)
Percentage of treated case						0.115* (0.0610)	0.0207 (0.0611)	0.0765 (0.0610)
Percentage of proceedings						0.0206 (0.0544)	-0.0690 (0.0546)	-0.0162 (0.0544)
Geographic fix effects		x	x	x	x	x	x	x
Cohort fix effects	x			x	x	x	x	x
Socio-demographic controls			x	x	x	x	x	x
Crime fix effects			x	x	x	x	x	x
Sentence controls			x	x	x	x	x	x
Criminal case controls			x	x	x	x	x	x
N	869,360	869,360	869,360	869,360	869,360	869,360	869,360	869,360

Table 4: General effect

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Law	(1) Minor offenses	(2) Minor offenses	(3) Alternative procedure	(4) Alternative procedure	(5) Placebo	(6) Placebo
	-0.0462 (0.0413)	-0.0157 (0.0417)	-0.0363 (0.0423)	-0.0441 (0.0421)	0.00281 (0.00857)	-0.00264 (0.00907)
Geographic fix effects	x	x	x	x	x	x
Cohort fix effects	x	x	x	x	x	x
Socio-demographic control	x	x	x	x	x	x
Crime fix effects	x	x	x	x	x	x
Sentence control	x	x	x	x	x	x
Criminal case control	x	x	x	x	x	x
Number of primo offender arrest of the same type						
Prosecutor controls						
N	78,161	78,161	74,901	74,901	833,844	833,844

Table 5: Robustness check: deterrent effect on minor offenses (columns 1-2), alternative procedures not targeted by the law (columns 3-4) and placebo test of the effect of a similar law on August 12th 2006, with database composed of the offense judged between January 2005 and July 2006 (columns 5-6)

PRELIMINARY VERSION please do not quote

	Piecewise-constant unobs heterogeneity	Piecewise-constant unobs heterogeneity	Cox	Cox	Piecewise-constant each 2 month	Piecewise-constant each 2 month
	-0.0600*** (0.00921)	-0.0474*** (0.00926)	-0.0367*** (0.00849)	-0.0232*** (0.00857)	-0.0479*** (0.00844)	-0.0348*** (0.00851)
Geographic fix effects	x	x	x	x	x	x
Cohort fix effects	x	x	x	x	x	x
Socio-demographic control	x	x	x	x	x	x
Crime fix effects	x	x	x	x	x	x
Sentence control	x	x	x	x	x	x
Criminal case control	x	x	x	x	x	x
Primo offender arrest (same type)	x	x	x	x	x	x
Prosecutor controls						
N	869,360	869,360	869,360	869,360	869,360	869,360

Table 6: Robustness check, deterrent effect depending on baseline hazard rate

PRELIMINARY VERSION Please do not quote

	(1)	(2)	(3)	(4)
Database period	2 years	2 years	2 years	2 years
Observation period	2 years	2 years	1,5 years	1,5 years
plancher	-0.0429*** (0.00446)	-0.0470*** (0.00610)	-0.0455*** (0.00471)	-0.0495*** (0.00671)
Geographic fix effects		x		x
Cohort fix effects		x		x
Socio-demographic control		x		x
Crime fix effects		x		x
Sentence control		x		x
Criminal case control		x		x
N	1,072,913	1,072,913	1,072,913	1,072,913

Table 7: Robustness check: deterrent effect with longer observation time or database

	(1) Time	(2) Time	(3) Time	(4) Time	(5) Time	(6) Time
Short term	-0.0848*** (0.00834)	-0.0536*** (0.0115)	-0.0533*** (0.0115)	-0.103*** (0.0104)	-0.0515*** (0.0123)	-0.0510*** (0.0123)
Long term	-0.00476 (0.00734)	0.00932 (0.0154)	0.00929 (0.0155)	0.0102 (0.00984)	0.0204 (0.0166)	0.0206 (0.0166)
Unobserved						
Heterogeneity				x	x	x
Geographic fix effects		x	x		x	x
Cohort fix effects		x	x		x	x
Socio-demographic control		x	x		x	x
Crime fix effects		x	x		x	x
Sentence control		x	x		x	x
Criminal case control		x	x		x	x
Primo offender arrest		x	x		x	x
Prosecutor controls			x		x	x
N	607,288	607,288	607,288	607,288	607,288	607,288

Table 8: Deterrent effect depending on the time after the law. Short term effect is defined as the effect in the 5 month following the law.

	(1) Robbery	(2) Robbery	(3) Violence	(4) Violence	(5) Drug	(6) Drug	(5) Involuntary injure	(6) Involuntary injure
Crime	-0.0584*** (0.0116)	-0.0407** (0.0167)	-0.0561*** (0.0187)	-0.0704*** (0.0272)	-0.0258 (0.0221)	-0.0637** (0.0321)	-0.0397 (0.0585)	-0.0213 (0.0846)
Law								
Geographic fix effects		x		x		x		x
Cohort fix effects		x		x		x		x
Socio-demographic control		x		x		x		x
Crime fix effects		x		x		x		x
Sentence control		x		x		x		x
Criminal case control		x		x		x		x
Primo offender arrest (same type)		x		x		x		x
Prosecutor controls		x		x		x		x
N	158 552	158 552	84 039	84 039	53 416	53 416	24 665	24 665

Table 9: Deterrent effect per crime

	(1) Under 18	(2) Under 18	(3) Between 18 and 30	(4) Between 18 and 30	(5) Between 31 and 40	(6) Between 31 and 40	(5) Above 41	(6) Above 41
Age group	Under 18	Under 18	Between 18 and 30	Between 18 and 30	Between 31 and 40	Between 31 and 40	Above 41	Above 41
Law	-0.0174 (0.0198)	-0.0116 (0.0278)	-0.0744*** (0.00847)	-0.0626*** (0.0122)	-0.0475*** (0.0143)	-0.0308 (0.0209)	-0.0416** (0.0171)	-0.0656*** (0.0249)
Geographic fix effects	x	x		x		x		x
Cohort fix effects	x	x		x		x		x
Socio-demographic control	x	x		x		x		x
Crime fix effects	x	x		x		x		x
Sentence control	x	x		x		x		x
Criminal case control	x	x		x		x		x
Primo offender arrest (same type)	x	x		x		x		x
Prosecutor controls								
N	49 256	49 256	368 709	368 709	171 616	171 616	206 705	206 705

Table 10: Deterrent effect per age group

	Robbery		Road offense		Violence		Drug	
	Prison	Probation	Prison	Probation	Prison	Probation	Prison	Probation
Law	3.634	11.216***	1.788	3.754	-4.310	5.481	-5.315	18.853***
plancherreit	16.143***	23.309***	18.858***	18.620***	18.593***	26.582***	4.288	17.174***
plancherrecidive	81.334***	104.305***	15.844***	9.487***	50.328***	72.372***	59.757***	148.017***
reiteration	40.596***	10.189***	64.437***	24.671***	49.724***	-8.898***	-53.198***	-4.489
Recidivist	31.427***	-24.206***	11.624***	12.262***	37.644***	-14.541***	20.207***	-8.111**
Age	1.406***	-0.829***	0.110***	0.801***	0.278***	1.310***	4.314***	-0.240
Sex	-58.414***	-8.477***	-33.743***	1.945	-48.343***	-2.136	15.532	17.265***
French	15.567***	44.984***	6.951***	12.582***	13.876***	38.726***	-132.066***	59.635***
moisfait2	-0.163***	-0.198***	-0.084*	-0.476***	0.095	-0.016	0.352*	-0.299***
cons	25.767***	45.015***	9.288***	-1.011	46.310***	27.574***	167.889***	26.819***
N	64139	64139	42228	42228	31705	31705	14133	14133
R2	0.101	0.116	0.107	0.044	0.084	0.053	0.109	0.118

Table 11: Effect of the law on sentences for different crimes judged in less than 15 days, 2004-2008 "Law" is a dummy equal to 1 if the second term offense is posterior to the enforcement of "peines planchers".

	Prison Re-offender	Probation Re-offender	Suspended prison Re-offender	Prison Recidivist	probation Recidivist	Suspended prison recidivist
Law	-8.077	-6.239	0.990	-2.775	-4.722	1.659
Pasttrial	50.455***	6.549*	-9.645***	61.305***	9.672*	-9.698***
law*pasttrial	14.777***	20.214***	0.439	16.003**	25.854***	-0.323
Age	-0.107***	-0.260***	-0.089***	-0.673***	-0.683***	-0.054***
Sex	-35.322***	-4.004**	3.051***	-42.048***	-7.640***	3.283***
French	-5.924***	15.737***	-2.971***	-1.819	19.417***	-2.567***
Time trend	1.085***	1.535***	-0.114***	1.138***	1.869***	-0.090***
cons	19.198***	6.556	23.831***	31.468***	11.695**	21.381***
N	141662	141662	141662	93249	93249	93249
R2	0.012	0.014	0.004	0.017	0.022	0.005

Table 12: Differences in sentence between re-offense after "composition pénale" or after normal trial, 2007-2008. "Pastrial" is a dummy equal to 1 if first term offense were not judged in a "Composition pénale", "Law" is a dummy equal to 1 if the second term offense is posterior to the enforcement of "peines planchers".