Do Higher Fines Reduce Recidivism?

Evidence from a Twenty Percent Increase in (Dutch) Traffic Fines

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Abstract

This paper investigates the effect of the height of speed fines on recidivism by exploiting variation from a governmental increase of speed fines with twenty percent. We estimate local difference-in-differences models using population data of all offenders from the months before and after the introduction of the higher speed fines. Our estimates do provide evidence for a reducing effect of higher speed fines on recidivism for the group of light offenders. In addition, light offenders did reduce their speed. These reducing effects are not observed for the heavy group of offenders. Our estimates do not provide evidence for a reducing effect on the total number of fines, due to the higher fines. Moreover, we find no effect on the sum of fines in the year after the offense. Higher speed fines do also not extend the time till the next offense.

1 Introduction

The speed fines in the Netherlands have been increased on January the 1st of 2012. The new tariffs are on average 15% higher than before. An interesting and very relevant question is whether or not this leads to significant reducing effects on recidivism. It therefore raises the following question which is examined in this paper: "Do higher fines reduce recidivism?"

There are two parties concerned in this debate whether or not the increase results into desired positive effects of less recidivism which may result into a better road safety. The first one, the government, argues that the fines are this heigh because it is in favour of the road safety and influences the behavior of the road users the best. The website of the Public Prosecutor states: "Fortunately, road users abide by the traffic rules more and more. The road safety benefits of this, because speed plays a role in each accident." Other stakeholders however, suppose that the raise in speed fines is only for raising additional funds for the Ministry of Justice and Safety. This view is supported by two papers that state that speed fines are often used as a tool to generate revenues for the government.[1][2] The height of speed fines in the Netherlands can also be compared to these in surrounding countries. In February a research department published results of a comparison between the height of speed fines in the Netherlands and countries such as France, Belgium, Germany, Spain and Luxembourg. Their conclusion was that Dutch road users are paying a higher price for the same traffic offenses than road users in the other five countries.[3] This observation also raises the question whether or not the raise in speed fines in the Netherlands can be justified.

This paper presents a framework to deal with the question whether or not speed fines fulfill their intended purpose of less recidivism and thus improving road safety. The paper examines the effects of increasing speed fines on recidivism. It discusses the effects by five indicators of the behavior of road users. We are able to do this by analyzing the effects of a comparable increase in speed fines in the Netherlands in 2008. The traffic fines increased with

[1] Makowsky, Michael and Thomas Stratmann, 2008, "Political Economy at Any Speed", *The American Economic Review,* pp. 509 – 526.

[2] Garrett, Thomas A., Gary A. Wagner, 2009, "Red Ink in the Rearview Mirror: Local Fiscal Conditions and the Issuance of Traffic Tickets", *Journal of Law and Economics,* pp. 71 – 90.

[3] RTL news research department, "Nederland heeft hoogste boetes van West-Europa", 11-02-2012.

20% at April the 1st. We obtained a unique dataset from the Central Fine Collection Agency (CFCA), which includes the whole population of offenders before and after the increase in fines. The dataset includes 1.976.063 offenses of 1.337.014 individuals. This provides the opportunity to investigate the traffic behavior of very similar traffic users that received different fines because of the increase of speed fines of the 1st of April 2008.

The aim of traffic regulation is to protect the society and to influence the behavior of offenders and all other road users. Traffic offenders can be penalized in different ways. The most common penalty in traffic regulation is the speed fine. The offender is punished and the speed fine should influence the future behavior of this road user in a positive way. A distinction can be made between a deterrent and a penalty effect. The deterrent effect is when someone notices the increase of a fine, for instance by reading a newspaper. The deterrence effect is often used as a justification for increased punishment for criminal offenses. Nevertheless, recent studies, for instance Pratt et al (2006), show that the deterrence effect of higher penalties is small to negligible. This suggests that road users are often not aware of the height of fines. This paper however, focuses on the penalty effect of actually receiving a fine. In that case a road user is certainly aware of the height of the fine he received by mail. The experience of receiving a speed fine captures the total negative feeling of such a penalty.

This paper is organized as follows. In Section 2 an overview is presented of previous studies concerning penalties and behavior. In Section 3 the data used in this research are described and descriptive statistics are presented. The methodology used in this paper is described in Section 4. Section 5 presents the results of the main analyses. Before I start with the main part of this paper I will formulate the five sub-questions treated in this section. The sub-questions are:

1) Do higher fines reduce *recidivism*?
2) Do higher fines reduce *the number of fines* of an offender in the year after his first offense?
3) Do higher fines reduce *the sum of fines in euros* of an offender in the year after his first offense?

4) Do higher fines increase *the time it takes till the first reoffense*?
5) Do higher fines lead to a *lower exceeding of the maximum speed at the first reoffense*?

Section 6 examines whether or not the main results are robust for several checks and some additional analyses are performed. Finally, Section 7 presents the conclusion and a discussion of the results found in this paper.

2 Previous studies

Our focus is on previous studies that analyze the impact of the height of fines on recidivism and papers that deal with the discussion whether or not speed fines are an effective way to improve the road safety. Furthermore we spend some time to discuss other more general literature about punishing, rewarding and influencing, which is relevant for our research.

2.1 Higher penalties and reoffending

Previous studies have equivocal findings when analyzing the relation between higher penalties and reoffending. Three main views can be distinguished. Two studies (Redelmeier et al, 2003; Bureau significant, 2008) conclude that higher fines do have a reducing effect on reoffending. Three other studies (Moffat and Poynton, 2007; Elvik and Christensen, 2007; SWOV, 2007) have a different conclusion: Higher fines have limited or negligible effect on reoffending. The studies of Lawpoolsri et al (2007) conclude conflicting results.

Redelmeier et al (2003) suggests that receiving a driving conviction reduced the risk of a fatal crash in the next month with approximately 35%. They identified drivers in Ontario (Canada), who had been involved in fatal crashes during a period of 11 years. A case-crossover designed was created to determine the protective effect of recent convictions on individual drivers. The benefits of a conviction reduced fast in the second month and were not significant by 3-4 months. The benefit was higher for speeding violations with penalty points than for speeding violations without points. The most recent study in the Netherlands is performed by an independent research institute, Bureau Significant. They conclude that because road users will get used to the higher fines the effects will be small and only temporary. They expected that

the higher fines would lead to fewer fines in 2008. These expectations are based on a qualitative analysis and are the result of sessions with an advisory group consisting of fifteen Dutch persons working for the CFCA, Ministry, the police and universities.

Moffat and Poynton (2007) examined the history and subsequent reoffending of 70.000 road users who received a fine for a driving offense, including drink-driving, speeding, driving while disqualified and some other offenses, between 1998 and 2000. Offenders were divided into two groups, a high penalty group and a low penalty group and a Heckman 2-step model was estimated to determine the effects of receiving a higher fine by comparing the offender groups with high and low fines. They suggest that substantial increases in fines do not have a significant impact in deterring recidivist offenders. The only significant effect which is very remarkable is that longer license disqualifications appear to increase the risk of reoffending, which is contrary with the hypothesis of deterrence effects. Elvik and Christensen (2007) finds that increased fixed penalties, for the most common traffic violations, are not effective in increasing compliance. To analyze the effects multiple regression analysis was performed. For not wearing seat belts however they find a significant increase in compliance. Unless this finding of effectiveness for not wearing seatbelts the increase in fixed penalties is not found for speeding. They even found a very slight tendency for the violation rate to increase, but this tendency was far from significant. Their findings seem to be inconsistent because the fixed penalties for speeding increased much more than penalties for not wearing seat belts. They suggest that compliance is not just determined by penalties but also by the risk of detection. There could have been changes in the amount of enforcement at the same time that could have influenced the results.

Jingyi et al. (2006) found different results for different ways of punishing. They identified and followed a group of 3.739.951 road users in Maryland for one year. Traffic tickets and speeding citation are distinguished; a speeding citation not only leads to a fine but also costs license points. Drivers were categorized in two groups by whether or not they received a fine in May 2002. They conclude that drivers who received a speeding citation are at an increased risk of receiving another speeding citation, which implies that speeding citations would have limited effects on deterrence. However, they find that the lowest penalty, a fine, is associated with a

reduced rate of recidivism. A Dutch survey study found that the effect of the most common type of traffic penalty, a fine, is small. The effects are negligible in both recidivism and when expressed in time.

2.2 Penalties; increasing road safety or just raising funds

Road safety is an important social-economic issue. The costs of road accidents are enormous. These costs consist of direct material costs, direct medical costs, police costs but also production losses and traffic jams (SER, 1999). Traffic laws, including traffic fines, are created to improve public safety. The issuance of speed fines is one of the major traffic law enforcement tools (Garret and Wagner, 2008). High speed, defined as exceeding the maximum speed limit, can be related to a risky driving behavior. Risky means that the probability on an accident increases regarding the normal speed (French et al, 1993). The paper of Lee (2012) supports the view of that fines improve road safety. Other studies (Makowsky & Stratman, 2009; Garret and Wagner, 2008; French D., 1993) however conclude that fines do not improve road safety and/or are just an easy way for the government to raise funds.

Lee (2012) analyzed the effect of traffic tickets on motor vehicle accidents. The paper makes use of a large increase in number of traffic tickets during the so called Click-it-or-Ticket campaign in the state Massachusetts. This program consists of six periods of one or two weeks in one federal year, during which police officers specifically and forcefully focus on traffic law enforcement. By making use of IV regressions Lee finds that tickets significantly reduce accidents and non-fatal injuries. However, limited evidence is found that traffic tickets also reduce the number of fatal accidents.

Makowsky and Stratman (2008) do not support the view that fines are there to improve road safety. Their paper makes use of 68.357 observations from traffic stops and citations in Massachusetts. They show that police officers in towns which are more budget-strapped are more likely to issue a ticket than a warning. They find that traffic fines are more frequently imposed in the municipalities where revenues from property taxes are lower, so the budget condition of a municipality is a determinant for the height of traffic fines. Additionally, they also found that whether or not the driver is a resident of the municipality is a determinant of a

citation. If a driver resides out of town, the probability of receiving a fine becomes higher. Both these findings support the view that raising traffic fines is a way of fund-raising. The revenue motive is also tested in the study of Garret and Wagner (2008) by using annual data for North Carolina counties from 1990 to 2003. Their main finding is that after a year with a decline in revenues significantly more fines are issued, while controlling for demographic, economic and enforcement factors. At the same time they find no evidence that when local government revenues are increased, fewer tickets are issued in the year after. Combining these two observations they conclude that traffic fines, at least to some extent, can be seen as revenue tools for (local) government. Another point they mention while it may be an easy way for government to raise funds is that the amount of speed fines issued is unrestricted. French et al (1993) concluded that speed was the most important predictor of accident rates, beside planning and deviance. They performed principal component analysis by using the results of an exploratory survey about the driving style and decision-making style of 711 drivers. Their conclusion states that the preventative effect of fines is negligible when expressed in time. The effects are also negligible in terms of recidivism.

2.3 Obtaining and absorbing information

The practice of imposing penalties serves several goals. These are 1) retribution (→ somebody has to pay a price), 2) protection of the society, 3) stimulating better behavior of offenders in the future and 4) influencing the behavior of the whole society by the general normative effect of penalties. When considering (increasing) fines it is important to keep in mind why and when people behave like they do and when they would change their traffic behavior.

Simonsohn et al (2008) conclude that the way in which information is obtained matters. Information obtained from personal experience, and speed fines are in this category, are particularly influential. Their main conclusion is that people study information gained from experience more seriously than information gained in other ways. So information gained from experience is more powerful in influencing the behavior of people.

Haselhun en Pope (2011) examined the unique influence of personal experience on subsequent behavior. They conclude that an experience with a monetary fine has a large

influence on subsequent behavior. They show that larger fines are more influential than smaller fines by comparing road users with high and low fines.[4] This paper also mentions a number of studies in which important information did not have any effect on the behavior of people. Information about alcohol consumption and the dangers of it did not have any effect. (McKenna & Williams, 1993) and (Russo et al., 1986) also give examples of cases where new information has only modest effects on behavior.

A road user can receive the information of increased speed fines in different ways. The paper of Haselhuhn divides the learning of new information into description, observation and experience. A road user can receive factually the same information in these three ways. It can observe someone else receiving a speed fine, it can read or hear the information or it can receive a speed fine. Different for speeding fines between observation and description and experience on the other hand is the negative feeling of actually receiving the fine. By only the observation of others or just noticing the description people can make misinterpretations about how this feeling would be of receiving the (higher) fine.

2.4 What this paper adds

This paper is really quantitative of nature, instead of the earlier qualitative research of Bureau Significant which also tried to forecast the effects of the increase in speed fines at April the 1st of 2008. We analyze the penalty effect of the increased fines by making use of a unique sample, because it we are able to analyze the effect by making use of the whole population. The choice for focusing on the penalty effect of increased speed fines instead of the deterrence effect is twofold. First we assume that people are not often aware of the height of fines, second because other studies (for instance Pratt et al, 2006) state that deterrence effects are negligible. Monthly data, as used in the paper of Lee may obscure the sensitivity of the behavior of drivers to fines. We obtained day-to-day data of the whole population, which enables us to examine the effect of the increase in fines of April the 1st of 2008. This paper examines the penalty effect of increasing fines on recidivism by using all the speed fines issued in the period March and April of 2007 and 2008. We can do this with the unique opportunity of the exogenous shock at April

[4] "Experiences and behavior", Haselhuhn M., Pope G., 2011

the 1st in the height of speed fines. By exploiting this shock we can set up an experimental design, Section 3 explains our experimental design. In Section 2.1 we pointed out papers (Haselhuhn and one earlier) who also tried to examine the effect of higher fines on recidivism. These studies compare the behavior of offenders who received a high fine with the behavior of offenders who received a low fine. Such a comparison might yield the effect of high fines but also the effect of unobserved differences between the two groups. In the next section our experimental design is explained.

3 Method

The ideal research design to determine the effect of the height of traffic fines on traffic behavior would be an experiment where the height of a fine differs randomly between groups of road users. Two groups can be defined using a lottery, one group of road users would receive the normal fine when violating the rules and the other group would receive a fine that is x % higher. Afterwards several research questions, for instance the questions this paper deals with can be analyzed. It is possible to check whether or not differences arise in recidivism, the sum of fines and the time till the next foul in the next year. The difference in traffic behavior can be completely attributed to the higher fines because it is not plausible that there are more differences because the height of fines is randomly assigned by drawing lots. However, this approach is not feasible because in democratic societies we cannot randomly vary the height of traffic fines between road users. Therefore, we have to look for other sources of arguably exogenous variation in the height of traffic fines. The increase in traffic fines with 20% at April the 1st of 2008 provides a nice opportunity to approach this ideal design. We start with assuming that road users are badly informed about traffic fines. The information about the height of a fine is received when someone receives a letter with the fine. The time this takes after the foul is approximately two weeks. It is possible to create an experimental ("April-group") and a control group ("March group") of road users just before and after the increase of the 1st of April. For example, road users who received a fine for committing the same traffic offense can be compared. The April group receives a fine which is 20% higher than the March group. The effect on recidivism can be estimated with a regression of the following form:

$$y_i = \alpha_0 + \alpha_1 t_i + \varepsilon_i$$

y_i Is a dummy variable for recidivism for individual i, but it can also be a continuous variable for the sum of fines or the number of fines someone receives in the next year. t_i Is a dummy variable for the month (April = 1 and March = 0) and α_0 is a constant. ε_i Include the unobserved characteristics of road user i. This error term is assumed to be independently and identically distributed. When the road users who received a fine in March are comparable with that of April 2008 the causal effect of the increase in the fines is given by α_1. A crucial point for the validity of this research is that the people in the two groups do not differ in a substantial way that influences the results.

A first step to make these groups better comparable is to include a set of control variables. The causal effect of the increase of the fines is still given by α_1 and the effects of different characteristics are given by the vector of regression coefficients in α_2. The control variables used are discussed in the Data section. A very important one is the history of fines. Further in this section we will categorize offenders, based on their fines in the years before. x_i Is the Kx1 vector of control variables for individual i, where K is the total number of control variables. The error term ε_i is assumed to be independently and identically distributed. The updated model is of the form:

$$y_i = \alpha_0 + \alpha_1 t_i + \alpha_2 x_i + \varepsilon_i$$

Comparing the March and April group can still give a biased estimate if there are seasonal patterns in traffic fines. By using data from a previous year we can correct for this seasonal bias. It is possible to estimate a so called difference-in-differences model. [5] In short, the difference of March and April in 2007 is deducted from the difference between March and April 2008. The

[5] Cameron. A. Colin, & Trivedi, P. K., Microeconometrics; methods and applications, Cambridge, 2009, p 71 – 81.

difference-in-difference model with control variables can have the following form:

$$y_i = \alpha_0 + \alpha_1 t_i + \alpha_2 j_i + \alpha_3 t_i j_i + \alpha_4 x_i + \varepsilon_i$$

t_i is the dummy variable for the month (April = 1 and March = 0) and j_i is the dummy variable for the year (2008 = 1 and 2007 = 0). The interaction effect, α_3, can be interpreted as the causal effect of the increase of the fines. ε_i Is the error term, which is assumed to be independently and identically distributed. The assumption in this model is that the seasonal effect of 2007 would also have occurred in 2008 if there would not have been an increase in speed fines.[6]

A fourth step taken in improving the comparability of the groups is to zoom in on the cutoff of April the 1st. Zooming in on the cutoff makes the offenders more and more comparable and also eliminates the seasonal trend in fines. Although we already calculated difference-in-difference estimates we will estimate them locally by using the distance in days to the cut-off. The local difference-in-difference analyses are done for four groups of the population of offenders in March and April 2008.

1) All the offenders from March and April 2008
2) The offenders one week before and one week after the cutoff
3) The offenders the Tuesday till Thursday before and the Tuesday till Thursday after the cutoff
4) The offenders of only the Wednesday before and the Wednesday after the cutoff

Offenders can be categorized as heavy, medium or light offenders. This classification is based on the historical data of 2007 (for the offenders in 2008) and 2006 (for the offenders in 2007). Road users are classified as heavy offenders if they offended more than four times the year before. Light offenders are the offenders who offended not more than one time the year before. Medium offenders are in between and are not separately discussed. We estimate the main

[6] Cameron, A. Colin & Trivedi, P. K., Microeconometrics; methods and applications, Cambridge, 2009, pp. 878, 879.

models separately for the total, heavy and light sample.

4 Data

The data used in this paper have been obtained from the Central Fine Collection Agency (CFCA). We received data on all individuals that have received a fine in March and April of 2007 and 2008. This includes 1.976.063 offenses of 1.337.014 individuals. Beside the offenses of road users in this period we also have all other offenses of these offenders between January the 1st of 2005 and 31 December of 2010. The data include the fines for offenses of exceeding the maximum speed till 30 km/h within built-up areas and 40 km/h outside built-up areas. The data only include natural persons who are living in the Netherlands. Each observation contains information about this fine and offense. In addition, information is available of the age of the offender, the amount of exceeding the maximum speed at a reoffense and the height of the fine first fine and the reoffense. By using this dataset we created the necessary dependent and independent variables in order to analyze our main research question. In the next paragraphs the outcome, independent and control variables are discussed. Furthermore we investigate the descriptive statistics and perform a probability-regression to check whether or not the March and April group are comparable.

4.1 Outcome variables

We constructed the following outcome variables. 1) A dummy variable for recidivism in the 12 months after receiving the fine (Yes=1 and No=2). Taken into account is the time it takes, approximately 14 days, before the offender receives the fine. Therefore they are only able to reoffend after 14 days from their first observation/foul. After the fine is received the offender can reoffend in the period of 12 months.[7] By incorporating the period of two weeks the focus is on the effect of actually receiving a fine. 2) A discrete variable for the number of fines in this period of twelve months. 3) A continuous variable for the sum of fines in euros in this period for a possible reoffense. 4) A discrete variable for the time in days it takes till the first reoffense. If the offender appeared more than once during the study period for a driving offense, the first

[7] CJIB

appearance was selected as reference offense. 5) A continuous variable with the amount of kilometers someone exceeds the maximum speed at the first reoffense.

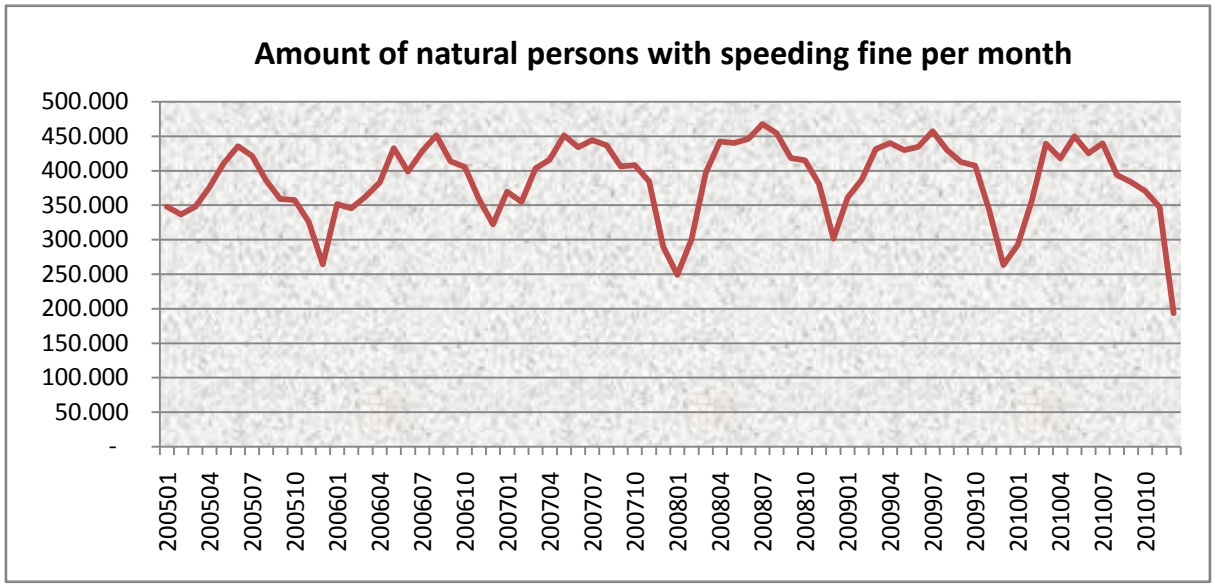
4.2 Independent variables and controls

We constructed the following independent variables and controls. 1) A weekend control: (Yes=1 and No=0). 2) A heavy offender variable (Yes=1 and No=0). We call somebody a heavy offender when he or she offended more than four times the year before. 3) A light offender variable (Yes=1 and No=0). A light offender is defined as an offender who received a maximum of one fine in the year before. Furthermore there are dummies made for the years (2008=1 and 2007=0) and for the months (April=1 and March=0).

4.3 Seasonal effect in speed fines

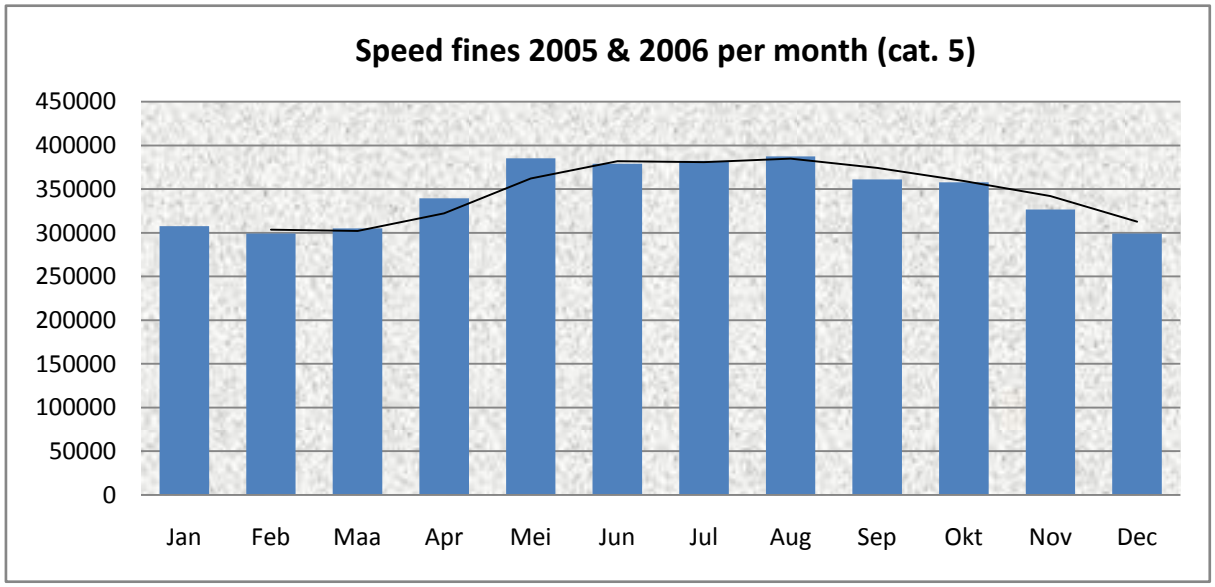
We observe a seasonal pattern in the amount of natural persons each month that receive a speeding fine. The differences between months can be substantial (Figure 1). Offenses are more common in the summer than in the winter. This can be due to several reasons. Possible explanations might be that road users in summer and winter months differ on a few characteristics. Also it might be that due to better road circumstances road users are able to drive faster. The figures with the seasonal patterns give a good overview of all the speed fines in 2005 till 2010. We zoom also in on the history of the road users in our sample (2005 & 2006). In Figure 2 we can see that the seasonal pattern for the offenders in our sample holds.

Figure 1: Amount of natural persons per month that receive a speed fine, 2005-2010



Source: CJIB

Figure 2: Speed fines in 2005 and 2006 for the road users in our sample



4.4 Overview of descriptive statistics

In Table 3 the sample means and standard deviations are reported for all the main variables for four different samples. The total March group can be compared with the April group, the last week of March with the first week with April, the last Tuesday Wednesday Thursday of March with that of April and the last Wednesday of March with the first Wednesday of April. By

observing the statistics we can describe an average license plate holder as being 49 years old, receiving approximately 35 euro's at the first observations and drives nearly 9 kilometers too fast at this first offense. The speed of driving at the time of the first offense is around 80 kilometers/hour. The main statistics to focus on are the recidivism-percentage 12 months later, number of fines in 12 months after, sum of fines in 12 months after, the number of days till the first reoffense and the kilometers by which someone exceeds the maximum speed level. For the total months the percentage of recidivism is quite the same; however when we focus on the smaller samples around the cutoff a difference of around 6 percent can be observed. It seems that drivers in April tend to reoffend more. The time it takes till the first reoffense is for all April groups somewhat shorted than for the March groups, this might be due to the seasonal effects discussed earlier. The difference in difference analysis will correct for this. The number and sum of fines of the last week of April in the next 12 months is higher than that of the March group. At the same time we can observe that the last week of April-group is a more aggressive group, containing 17% heavy offenders instead of 13%. We will deal with this in the sensitivity analysis by creating a more aggressive March group in such a way that their fines history is highly comparable. With regard to the number of kilometers by which an average driver exceeds the maximum speed at the first reoffense we can conclude that this is for each group nearly 9 kilometers per hour.

4.5 Probability model

Understanding the importance of having comparable groups of offenders in March and April also a probability model is estimated. The dependant variable t (April=1 & March=0) is regressed on all covariates. x_i Is the vector Kx1 of all the covariates per individual. α_0 Is a constant and the error term ε_i is assumed to be independently and identically distributed. To check whether or not variables have an effect on offending in March or April a probability model can be estimated of the following form:

$$t_i = \alpha_0 + \alpha_1 x_i + \varepsilon_i$$

The probability model is estimated to see whether or not the offenders of the last week of March and the first week of April differ in their age and history. This is important for the reliability of the main estimation results. In order to be sure that the findings are caused by an increase in fines of 20% we must exclude as good as possible the possibility of other (omitted) variables that can cause differences in the outcomes. The results of this regression are shown in Table 1 and 2.

For all variables we find significant coefficients, except for the number of fines in the year before. There is no reason for concern, because due to the very large sample still a very small effect can be significant. For instance if we look at the sizes we see that they are very small. For instance the sum of fines only differs with 0.007 Euro. From this we can conclude that there are no major differences between the two groups.

Table 1: Estimation results of the probability-model for the last week of March and the first week of April, for 2007 & 2008.

Dependant variable: T (April=1 & March=0)	*Coeff.*	*Std. Err.*	*t*	*P > |t|*
Age	0.00168	0.00035	4.75	0.000
Age^2	-0.00002	0.00000	-5.00	0.000
Number fines year before	0.00001	0.00059	11.48	0.367
Sum fines year before	0.00671	0.00001	0.90	0.000
Constant	0.50911	0.00876	58.11	0.000

Table 2: Estimation results of the probability-model for the last week of March and the first week of April, for 2008.

Dependant variable: T (April=1 & March=0)	*Coeff.*	*Std. Err.*	*t*	*P > |t|*
Age	0.00209	0.00050	4.18	0.000
Age^2	-0.00002	0.00000	-3.87	0.000
Number fines year before	0.00000	0.00002	8.92	0.668
Sum fines year before	0.00734	0.00082	-0.43	0.000
Constant	0.49922	0.01229	40.62	0.000

Table 3: Descriptive statistics for the main variables used in this research

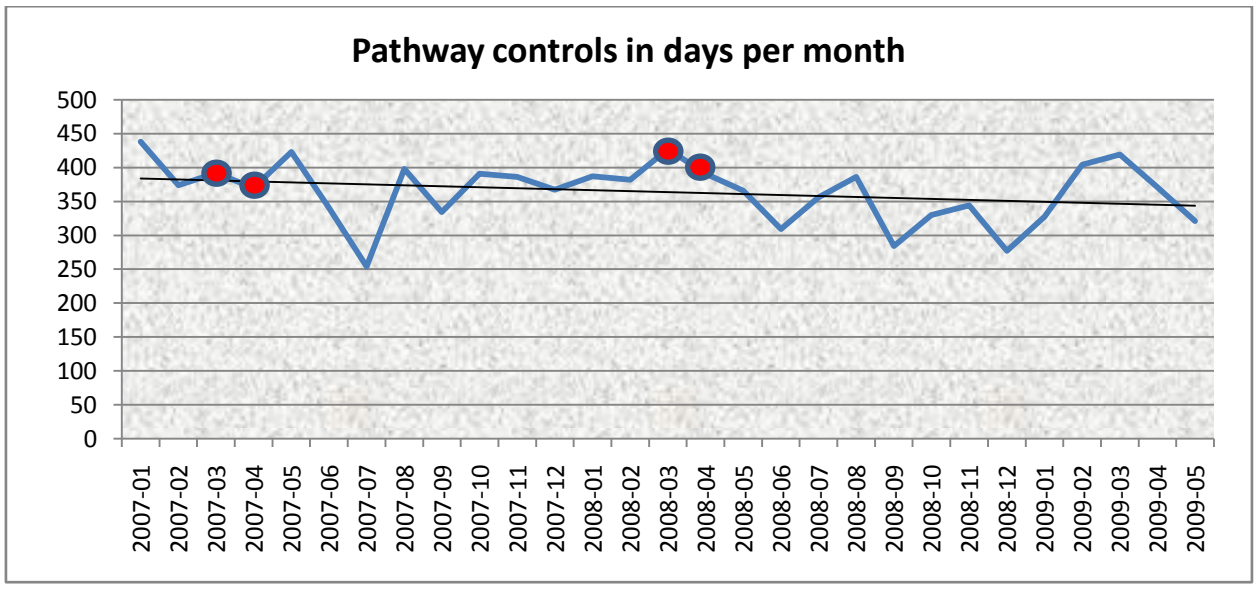
	March 2008		April 2008		Last week March 2008		First week April 2008	
Variables	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Age	49.01	13.77	49.23	13.89	48.79	13.94	48.91	13.71
Height fine first obs. in period	35.26	26.53	41.83	31.58	35.42	27.05	42.14	31.46
Speed of driving	79.73	24.35	77.37	23.05	79.16	24.31	77.07	22.64
Exceeding max. speed	8.90	5.34	8.84	5.32	8.91	5.40	8.95	5.36
Number fines 12 months after	2.14	3.35	2.27	3.59	1.93	2.78	2.63	4.63
Sum fines 12 months after	91.84	160.16	97.46	170.83	82.87	134.19	113.64	218.81
Recidive 12 months later (%)	0.66	0.47	0.67	0.47	0.65	0.48	0.69	0.46
Days till first reoffense	140.34	87.61	120.82	94.04	138.62	88.62	116.13	92.32
Height fine reoffense	41.46	31.31	41.70	31.29	41.82	31.64	41.77	31.40
Km too fast at reoffense	8.86	5.29	8.83	5.26	8.84	5.29	8.84	5.27
Fines in 2007	2.39	4.08	2.26	3.91	2.07	3.10	2.64	5.21
Sum fines 2007	87.88	164.56	82.99	157.27	75.97	127.22	97.39	206.75
Heavy offenders (%)	0.15	0.36	0.15	0.35	0.13	0.34	0.17	0.38
Low offenders (%)	0.55	0.50	0.57	0.50	0.58	0.49	0.54	0.50
Observations	390421	-	435247	-	82239	-	108968	-

	Last Tue/Wed/Thu March 2008		First Tue/Wed/Thu April 2008		Last Wed March 2008		First Wed April 2008	
Variables	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Age	48.85	13.80	48.95	13.71	48.89	13.78	49.08	13.67
Height fine first obs. in period	35.81	27.13	43.03	32.06	36.59	27.82	43.43	32.38
Speed of driving	76.57	24.17	76.40	23.07	77.62	24.17	77.84	23.79
Exceeding max. speed	8.93	5.39	9.10	5.45	9.12	5.51	9.23	5.56
Number fines 12 months after	1.98	2.91	2.79	5.46	1.99	2.94	2.76	5.00
Sum fines 12 months after	85.61	141.55	121.34	255.56	85.50	139.85	120.64	236.80
Recidive 12 months later (%)	0.65	0.48	0.70	0.46	0.65	0.48	0.70	0.46
Days till first reoffense	139.39	88.01	114.41	91.55	140.01	88.24	115.25	91.77
Height fine reoffense	42.11	32.09	42.02	31.69	42.10	31.80	42.45	31.79
Km too fast at reoffense	8.87	5.34	8.89	5.31	8.87	5.29	8.97	5.34
Fines in 2007	2.12	3.24	2.79	6.22	2.11	3.19	2.74	5.32
Sum fines 2007	78.29	133.15	103.76	245.42	78.14	130.33	101.79	213.54
Heavy offenders (%)	0.14	0.34	0.18	0.38	0.14	0.34	0.17	0.38
Low offenders (%)	0.58	0.49	0.54	0.50	0.58	0.49	0.54	0.50
Observations	34950.00	-	46253.00	-	12839.00	-	16761.00	-

4.6 Changing behavior of the CFCA?

Road users can simply control the amount of speed fines they may receive, due to that they can decide themselves whether or not driving too fast. When they would never drive too fast, there would be no institution that could issue them a speeding fine. However, this is not the case. Regarding the issued fines we can conclude that road users do not offend each day the same amount. We already earlier observed the seasonal effect, but there are still other differences between the days. On the other hand, when road users are driving too fast and there are no controls, there also would be none issued fines. The level of control, which is determined by the government, can differ each day. Elvik and Christensen (2007) already suggested that that compliance is not just determined by penalties but also by the risk of detection. This could influence our main estimation results. In the Netherlands there are sixteen pathway control systems that can be turned on and off every day. As a measure for the activity of the institutions that supervise traffic offenses, we take the total number of days that the pathway controls are turned on. For example, when there is one system that is functioning ten days and another one is functioning for three days, the total number of pathway control days is 13. Figure 4 below shows an overview of the pathway controls in days per month.

Figure 3: Overview of the pathway controls in days for January 2007 till May 2009.



Source: CJIB

The trend line we observe is slowly decreasing. We observe that in 2007, as well as in 2008, there are some more pathway controls in March than in April. Therefore we can conclude that we do not have to worry about that the results could be biased because of more controls in April 2008. More pathway controls in April 2008 would have given biased estimations. This could have been the fact due to that higher fines make it more attractive to control.

5 Main estimation results

We will discuss the effects of the increase in fines by 20% with the results of the local difference-in-difference models on the relevant outcomes. We discuss the effects for the total, heavy, and light sample respectively. The interaction effects, shown in the different tables, can be interpreted as the causal effects of the increase of the fines on the relevant dependent variable. Standard errors are given in parentheses.

5.1 Total sample

Table 4: Estimations Local Difference-in-Difference Model for the Total Sample

	One month	One week	Three days	Wednesday
Recidivism (%%)	0.016**	0.004	-0.019**	-0.013
	(0.001)	(0.003)	(0.007)	(0.008)
Time till reoffense	6.617**	0.319	-1.188	-0.890
	(0.328)	(0.665)	(1.563)	(1.679)
Number of fines	0.201**	0.103**	0.101*	0.131**
	(0.009)	(0.019)	0.047)	(0.047)
Sum of fines	7.647**	1.897*	1.276	5.14*
	(0.422)	(0.934)	(2.279)	(2.305)
Km too fast	0.073**	-0.078*	-0.319**	-0.149
	(0.019)	(0.038)	(0.090)	(0.096)

Note: All models include as controls: age, age^2, weekend, daystillcutoff, daystillcutoff^2, height of fine at first observation, and number of fines in the year before (For offenders of March and April 2008 in 2007 and for the offenders in March and April 2007 in 2006). * p<0.05; ** p<0.01.

We expect to find 'reducing effects' of the higher fines. A 'reducing effect' does not imply a negative sign of the coefficient. If the sign of a coefficient is negative for the first, third, fourth, or fifth dependant variable, then this effect can be interpreted as a 'reducing effect' of the

higher fines on the relevant variable. For the second dependant variable however, time till reoffense, a positive estimate implies a 'reducing effect'. We check for 'reducing effects' on five variables enumerated below.

1) Do higher fines reduce *recidivism*?
2) Do higher fines reduce *the number of fines* of an offender in the year after his first offense?
3) Do higher fines reduce *the sum of fines in euros* of an offender in the year after his first offense?
4) Do higher fines increase *the time it takes till the first reoffense*?
5) Do higher fines lead to a *lower exceeding of the maximum speed at the first reoffense*?

Our main focus is on the estimates of the Tuesday, Wednesday, and Thursday before and after the cutoff. We expect the road users to be the most similar in this period. The desired effect of the government of a lower probability on a reoffense is achieved for the Tuesday/Wednesday and Thursday just before and after the cut-off. The point-estimate is -1.9% and is significant at a 1% significance level. For all the offenders in the months March and April a significant positive effect is found, which indicates that despite there is an increase in fines, the probability of a reoffense within 12 months is around 1.6% higher for the April-group. This increasing effect seems to us as a not so plausible result, because it may not be very logical that road users will reoffense more when paying a higher price. The effect for Wednesday just around the cutoff is not significantly different from 0, but the point-estimate is in line with the estimate for the three days. The higher fines do have an effect on the time it takes till the driver reoffenses. For the April group it takes approximately seven days longer for the analysis for the whole months. This suggests that the offender feels the pain of the fine for a couple of days and is aware of the amount he or she is obligated to pay. The height of the fine is probably not high enough for staying attentive to avoid a fine for a longer period of time. However, for the other three periods analyzed the point-estimates are all around 0 and not significant. This indicates that the 'time-effect' of the higher fines is possibly negligible. The April-group receives a slightly higher number of fines, which also leads to a higher sum of fines in euros. The results are significant;

on average the group offenders on the first Tuesday, Wednesday, and Thursday in April receive 0.1 fine more in the year after their first offense. Road safety is strongly related to the speed of driving. Except the effect for the period of one month all the point-estimates are negative, indicating that offenders of the April-group tend to drive slower at a reoffense than the March-group. For our main period, the effect is -0.319 km/hour. At the first reoffense offenders from April tend to exceed the maximum speed level with 0.319 km/hour less than the March-offenders. This result suggests that an increase in fines does have an effect on the speed of driving.

5.2 Heavy sample

Table 5: Estimations Local Difference-in-Difference Model for the Heavy Sample

	One month	One week	Three days	One day
Recidivism (%%)	0.01**	0.005	0.002	-0.005
	(0.002)	(0.004)	(0.009)	(0.011)
Time till reoffense	0.205	-0.980	2.166	3.327
	(0.586)	(1.167)	(2.641)	(2.918)
Number of fines	0.605**	0.226*	0.149	0.135
	(0.043)	(0.098)	(0.244)	(0.245)
Sum of fines	24.605**	3.560	-3.297	9.588
	(2.078)	(4.684)	(11.369)	(11.552)
Km too fast	0.051	0.038	-0.148	0.100
	(0.049)	(0.100)	(0.235)	(0.256)

Note: All models include as controls: age, age^2, weekend, daystillcutoff, daystillcutoff^2, height of fine at first observation, and number of fines in the year before (Sample of March and April 2008 with at least four offenses in 2007 and for the offenders in March and April 2007 with at least four offenses in 2006). * $p<0.05$; ** $p<0.01$.

The heavy sample contains individuals that received more than four fines in 2007. For our main period of three days we do not find any significant result. This suggests that the group of heavy offenders is insensitive for higher fines and do not change their road behavior. Except the significant positive effect for one month, which indicates an increasing effect of the higher fines on recidivism of 1%, the April group tend to reoffense as much as the March group. We do not find any significant positive or negative effect when we zoom in at the cutoff. Furthermore we see that around the cut-off the April group tends to reoffense about two/three days later than

the March group. The fact that they received a 20% higher fine than the March group makes sense a few days. However, the estimate is not significant. Unless that they tend to reoffense a few days later, there are positive point-estimates for this April group on the number and sum of fines within twelve months later. The effects for these two dependant variables are not significant and the sizes are small. The amount of kilometers by which someone exceeds the maximum speed limit does also not differ among April and March drivers. Where road-safety is strongly related to the speed of driving we do not observe that higher fines diminish the amount of kilometers that reoffenders exceed the maximum speed level. In general, the results suggest that the heavy group of offenders is insensitive for higher fines and does not change their road behavior.

5.3 Light sample

Table 6: Estimations Local Difference-in-Difference Model for the Light Sample

	One month	One week	Three days	One day
Recidivism (%%)	0.017**	0.004	-0.020*	-0.016
	(0.002)	(0.005)	(0.010)	(0.010)
Time till reoffense	9.944**	1.363	-2.430	2.654
	(0.519)	(1.057)	(2.531)	(2.681)
Number of fines	0.086**	0.038*	0.003	0.005
	(0.007)	(0.016)	(0.030)	(0.036)
Sum of fines	2.872**	0.475	-1.549	-0.909
	(0.363)	(0.792)	(1.822)	(1.934)
Km too fast	0.078**	-0.060	-0.319**	-0.291*
	(0.024)	(0.049)	(0.116)	(0.123)

Note: All models include as controls: age, age^2, weekend, daystillcutoff, daystillcutoff^2, height of fine at first observation, and number of fines in the year before (Sample of March and April 2008 with at most one offense in 2007 and for the offenders in March and April 2007 with at most one offense in 2006). * $p<0.05$; ** $p<0.01$.

The light sample consists of offenders who did not receive more than one fine in 2007. The results, estimated with a local difference-in-difference model, differ for the chosen periods. For our main period, the Tuesday, Wednesday, and Thursday, we see a negative and significant point-estimate of -0.02 of the higher fines on recidivism. Offenders in April tend to reoffend 2% less than people in the March group in the next twelve months, due to the higher fines. This

suggests that the higher fines have a 'reducing effect' on recidivism. The point estimate for only the Wednesday around the cutoff is also negative, but not significant. The found coefficient is in line with the estimation for the three days. Higher speed fines do not extend the time till the next offense. Furthermore we note that the effect on the number and sum of fines is very small. Close at the cutoff we also see significant 'reducing' effects for the speed of driving at a reoffense. Except the effect for the period of one month all the point-estimates are negative, indicating that offenders of the April-group tend to exceed the maximum speed level with a lower speed at a reoffense than the March-group. All coefficients are significantly different from zero. The effect for the light sample, -0.319, is significant at a 1% significance level. For the heavy group we did not find a significant 'reducing effect' of higher fines on this variable. The estimation -0.149 for this regression was not significant. This suggests that heavy drivers are more immune for the height of traffic fines and do not weigh the height of a fine as much as light offenders in deciding whether or not driving too fast.

6 Sensitivity analyses

In this section several sensitivity analyses are performed. First we analyze whether or not the observed difference in aggressiveness between the March and April group influences our main estimation results. Then in the next analysis we will compare the last week of March with the second week of April. In the third sensitivity analysis we perform our analyses for all the young offenders in our dataset.

6.1 Small difference in aggressiveness March & April group

Using the summary statistics we can conclude that the group of offenders in the first week of April is a more aggressive group than the offenders in the last week of March, based on the number and sum of fines in the year before. The offenders in the last week of March 2008 received on average 2.07 fines in 2007 and the offenders in April 2.64 fines. To create more comparable March and April groups we perform two tests. In the first test we increase the aggressiveness of the March group; in the second test we diminish the aggressiveness of the

April group. The first test selects the offenders in the last week of March who received between 1 and 8 fines in 2007. The drivers with only 0 fine in 2007, or drivers with more than 8 fines in 2007 are deleted. After this adaptation the groups appear to be very similar. In Table 7 below the means are given for the variables: number of fines the year before and the sum of fines year before.

Table 7: Overview of the means of the variables: "number of fines" and "sum of fines" after the adjustment.

Group	*Mean "number of fines"*	*Mean "sum of fines"*
Last week March 2007	2.591	95.083
First week April 2007	2.578	97.941
Last week March 2008	2.581	93.688
First week April 2008	2.643	97.514

We perform the same regressions with the new created sample for four different periods. Table 8 shows the results.

Table 8: Estimations of local difference-in-difference model for total sample

	One month	One week	Three days	Wednesday
Recidivism (%%)	0.019**	0.013**	0.006	0.001
	(0.002)	(0.003)	(0.005)	(0.010)
Time till reoffense	6.859**	1.031	-0.157	-1.035
	(0.333)	(0.747)	(1.121)	(1.882)
Number of fines	0.21**	0.097**	0.145**	0.14**
	(0.009)	(0.023)	(0.037)	(0.057)
Sum of fines	8.137**	1.651	3.544*	5.194
	(0.435)	(1.123)	(1.790)	(2.763)
Km too fast	0.092**	-0.007	-0.061	-0.06
	(0.019)	(0.044)	(0.068)	(0.113)

Note: All models include as controls: age, age^2, height of fine at first observation, and number of fines in the year before (For offenders of March and April 2008 in 2007 and for the offenders in March and April 2007 in 2006). * $p<0.05$; ** $p<0.01$.

The second test makes the first week of the April-group less aggressive. The heavy drivers of the first week of April of 2008 are deleted and only the light and medium drivers of this week stay in the sample.

By creating a more aggressive March group or making a less aggressive April group we expect to find more 'reducing effects'. This would be in line with the findings of section 5.3, because the effects of the higher fines are the most visible when the light groups of offenders are compared.

Table 9: Estimations of local difference-in-difference model for total sample

	One month	One week	Three days	Wednesday
Recidivism (%%)	0.016**	0.004	-0.005	-0.013
	(0.001)	(0.003)	(0.004)	(0.008)
Time till reoffense	6.565**	0.26	-1.221	-0.89
	(0.327)	(0.667)	(1.009)	(1.679)
Number of fines	0.204**	0.105**	0.165**	0.131**
	(0.009)	(0.019)	(0.030)	(0.047)
Sum of fines	7.819**	1.982*	4.595**	5.14*
	(0.423)	(0.931)	(1.473)	(2.305)
Km too fast	0.072**	-0.079	-0.136*	-0.149
	(0.019)	(0.038)	(0.058)	(0.096)

Note: All models include as controls: age, age^2, height of fine at first observation, and number of fines in the year before (For offenders of March and April 2008 in 2007 and for the offenders in March and April 2007 in 2006). * $p<0.05$; ** $p<0.01$.

We can conclude from the results of Table 8 that close at the cut-off there are no reducing effects. On average the April-group does not tend to reoffense less and this group also collects the same amount of fines in the twelve months after their first offense as the March group. For the other dependant variables also no effects of a notable size are found. For the total months we see significant effects. The April group as a whole tends to offend nearly 2% more than the March group. The only positive 'reducing effect' we find here is the time it takes till the reoffense. On average it takes approximately 7 days longer till the April group reoffends. We suggest that this can be interpreted as a short-term effect of being aware of the negative feeling of a fine

.

6.2 Comparing the last week March with second week April

In the figure below we observe the number of offenders just before and after the cutoff. The drawn trend line is positive, indicating more offenders in the April-group than in the

March-group. For 2007 and 2008 this pattern is the same, so by using a local difference-in-difference model this seasonal effect can be eliminated.

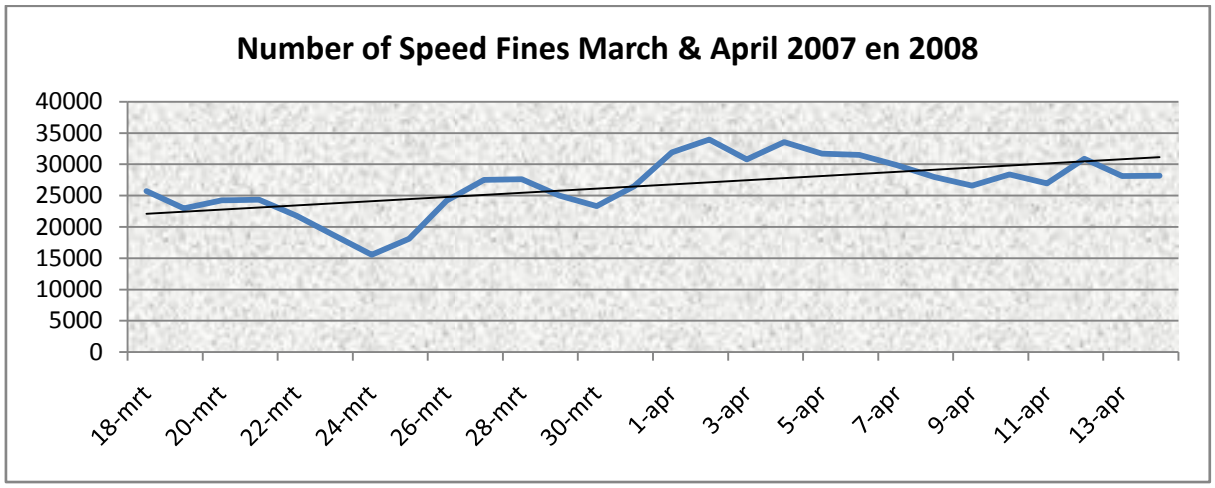


Figure 4: Number of speed fines in March and April of 2007 and 2008

We furthermore notice that in the second week of April there are fewer offenses than in the first week of April. Because the number of offenses in this week seems to correspond more with the last week of March than the first week of April a sensitivity analysis is done. We perform the regression for the last week of March and the second week of April.

Table 10: Estimations of local difference-in-difference model for total sample

	Week	Tue/Wed/Thu	Wednesday
Recidivism (%%)	0.013**	0.015**	-0.002
	(0.003)	(0.005)	(0.007)
Time till reoffense	2.602**	0.743	2.271
	(0.692)	(1.032)	(1.734)
Number of fines	0.14**	0.17**	0.104*
	(0.017)	(0.026)	(0.044)
Sum of fines	4.291**	5.052**	2.043
	(0.838)	(1.282)	(2.128)
Km too fast	0.058	0.075	-0.098
	(0.039)	(0.059)	(0.097)

Note: All models include as controls: age, age^2, height of fine at the first observation, and number of fines in the year before (For offenders of March and April 2008 in 2007 and for the offenders in March and April 2007 in 2006).
* $p<0.05$; ** $p<0.01$.

For the period of a week and three days the group offenders of April tend to reoffend more than the March group. The estimate for the Wednesday before and after the cut-off is nearly

zero and not significant. This is a more plausible result, because it does not sound very logical that road users will offend more with higher fines. The only 'reducing effect' of the higher fine is the time it takes till a reoffense, this effect is about 2 days. The other effects of the higher fines are negligible and/or not significant. In general, no significant 'reducing effects' are found.

6.3 Young drivers

Young drivers are of particular interest to policy makers because this group tends to be the most at risk on the road. As young drivers we qualify everyone under 25.[8] We investigate in this subsection whether or not the main results hold for this group.

Table 11: Estimations Local Difference-in-Difference Model for the Young Sample

	One month	One week	Three days	Wednesday
Recidivism (%%)	0.013	-0.006	0.024	0.050
	(0.014)	(0.025)	(0.042)	(0.056)
Time till reoffense	3.695	5.597	4.019	18.411
	(3.519)	(6.826)	(11.164)	(19.797)
Number of fines	0.199**	0.149	0.345	0.724
	(0.074)	(0.164)	(0.254)	(0.496)
Sum of fines	8.159	6.485	21.661	42.127
	(4.121)	(8.884)	(13.975)	(0.634)
Km too fast	-0.092	-0.059	0.774	-0.173
	(0.209)	(0.421)	(0.634)	(1.081)

Note: All models include as controls: age, age^2, height of fine at the first observation, and number of fines in the year before (For offenders of March and April 2008 in 2007 and for the offenders in March and April 2007 in 2006). * p<0.05; ** p<0.01.

The sample contains only 419 offenders, this sample size is far smaller in earlier analyses. Due to this we see that there is only one significant effect. The number of fines in the twelve months after the offense is for the April-group somewhat higher than for the March-group. Close at the cut-off we see that the effect of the higher fine on recidivism is positive and quite large. For the three days this effect is 2.4% and the group of the Wednesday in April after the cutoff tends to reoffend 5% more than the March group. This is probably not a very plausible result, because it does not sound very logical that road users will offend more with higher fines. Due to the

[8] Center for disease control, 2009

implications of a small group size we have to be careful with making conclusions based on these findings. In addition, the found effects are not significant.

7 Conclusion and discussion

This paper examines to what extent an increase in the height of speed fines reduces recidivism. By exploiting variation from a governmental increase of speed fines with twenty percent on April the 1st of 2008 we estimate local difference-in-differences models using population data of all offenders from the months before and after the introduction of the higher speed fines. Concerning the effect of receiving a higher speed fine, it can be concluded that we see only a few significant 'reducing effects'. These 'reducing effects' cover positive effects observed for the April group, which received the higher fine, compared to the March Group. However, next to 'reducing effects', we also find estimates where the higher fines do not influence the indicators for the behavior of road users.

We observe heterogeneous effects of the higher fines on recidivism. For the total sample and light sample we see a 'reducing effect' of about 2% for the individuals in the April group for the Tuesday/Wednesday and Thursday just after the cutoff. These results are significant at a 1% significance level. However, this 'reducing effect' is not present for the heavy group offenders. For the heavy group we do not find significant effects of the higher fines on recidivism. Furthermore we find heterogeneous effect regarding the speed of driving at the first reoffense. Significant effects are found for the total and light sample. The speed by which light drivers from the April group exceed the maximum speed level at their reoffense is approximately 0.3 km/hour lower than light drivers in the March group. No significant effect is found for the heavy sample.

For the three other indicators we do not find 'reducing effects'. For the time till the first reoffense we do not find significant coefficients. There is also no indication that the April group of drivers, due to higher speed fines, tend to receive a lower number and sum of fines and thus behaving more conform the traffic rules. The point-estimates are positive, but small and only

the estimate for the total group is significant at a 5% significance level. We make a short calculation to provide insight in the government earnings, regarding the higher fines. The increase in the height of speed fines is 20% and the increase in the number of fines is 0.1. By making use of the average fine (35 euro's) for the March 2008 group, we can draw up the conclusion that the government earns, per individual, 0.1 * 0.2 * 35 = 0.70 euro more than before the increase in fines. The March group of offenders consists of 390.000 offenders, which results into a total increase in earnings for this group of +- 273.000 euro in the next twelve months.

In the introduction of the paper we pointed out the discussion between the government and other stakeholders. The government stated that increasing fines would lead to an improved road safety. The other group argued that the increase in fines is simply fund raising for the government. By using the results of the main estimation results we can draw up the general conclusion that the analyses can support both the view of the government and the view of the other stakeholders. The 'reducing effects', consisting of the diminishing effect on recidivism and a lower speed of driving at the reoffense, support the statement of the government that higher fines improve road safety. On the other hand, we do not find much evidence that the behavior of road users is influenced in a substantial way regarding the effect for the sum and number of fines. Concerning these indicators there is no evidence that higher fines improve road safety. Furthermore we noticed that the income of the government earned by issuing speed fines increased. Due to the findings of this paper the two stakeholders will use different results to answer the question whether or not the raise in speed fines can be justified.

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9 Appendix

9.1 Estimations for total sample by using OLS

Table 4: Estimations with OLS for the Total Sample

	One month	One week	Three days	Wednesday
Recidivism (%%)	0.011**	0.047**	0.046**	0.049**
	(0.001)	(0.002)	(0.003)	(0.006)
Time till reoffence	-19.516**	-22.490**	-24.978**	-25.413**
	(0.246)	(0.514)	(0.780)	(1.297)
Number of fines	0.134**	0.7**	0.815**	0.805**
	(0.008)	(0.018)	(0.032)	(0.054)
Sum of fines (euro's)	5.613**	30.773**	35.722**	33.894**
	(0.366)	(0.864)	(1.517)	(2.566)
Km too fast	0.076**	0.419**	0.419**	0.361**
	(0.013)	(0.028)	(0.043)	(0.072)

Note: * $p<0.05$; ** $p<0.01$.

9.2 Estimations for total sample of OLS-model with controls

Table 5: Estimations OLS-Model with controls for the Total Sample

	One month	One week	Three days	One day
Recidivism (%%)	0.015**	0.036**	0.041**	0.041**
	(0.001)	(0.002)	(0.011)	(0.005)
Time till reoffence	-19.715**	-19.729**	-23.684**	-23.502**
	(0.247)	(0.523)	(0.080)	(1.286)
Number of fines	0.19**	0.396**	0.467**	0.545**
	(0.006)	(0.015)	(0.080)	(0.046)
Sum of fines	7.288**	15.801**	17.885**	20.782**
	(0.304)	(0.712)	(3.805)	(2.178)
Km too fast	0.073**	0.25**	0.192	0.231**
	(0.013)	(0.028)	(0.135)	(0.071)

Note: All models include as controls: age, age^2, weekend, daystillcutoff, daystillcutoff^2, height of fine at first observation, and number of fines in the year before. * $p<0.05$; ** $p<0.01$.

9.3 Estimations for total sample of DID-model

Table 6: Estimations Difference-in-Difference Model for the Total Sample

	One month	One week	Three days	One day
Recidivism (%%)	0.013**	0.001	-0.007	0.019*
	(0.002)	(0.002)	(0.005)	(0.008)
Time till reoffence	6.744**	0.204	-1.656	-3.072
	(0.334)	(0.680	(1.035	(1.807)
Number of fines	0.177**	0.104**	0.203**	0.34**
	(0.011)	(0.024	(0.039	(0.069)
Sum of fines	7.386**	2.865*	7.497**	12.233**
	(0.522)	(1.179	(1.884	(3.306)
Km too fast	0.081**	0.468**	-0.087	0.070
	(0.019)	(0.027)	(0.059)	(0.104)

Note: * $p<0.05$; ** $p<0.01$.