A Radical Change in Traffic Law: Effects on Fatalities in the Czech Republic

Josef Montag*

Second draft: October 2012

Abstract

I evaluate the effects of a new road traffic law in the Czech Republic that became effective on July 1, 2006. The law brought in tougher punishments through introduction of demerit point system and manifold increase in fines, together with augmented authority of the policemen on the spot. I find a sharp 33.3 percent decrease in accident-related fatalities during the first three months. This translates into 34 to 239 saved lives with 95 percent certainty. However, my estimates of the effects going beyond the first year are zero. Unique data on traffic police activity indicate, that resources on enforcement were decaying in the aftermath of the change in law and that the traffic police may have shifted its focus towards more general enforcement activities.

1 Introduction

Each year, road traffic accidents (RTA) result in as many as 50 million injured and more than 1.2 million deaths, making it the ninth leading cause of death worldwide.

*Faculty of Law, Masaryk University and CERGE-EI. Email: josef.montag@law.muni.cz. I would like to thank to Daniele Bondonio, Brendan Dooley, Libor Dušek, Kateřna Holíková, Michael Kohl, Max Schansenbach, Franciska Weber, participants at the 2010 Conference on Empirical Legal Studies, the European Law & Economics Association 2012 Annual Conference, and workshop at the University of Economics, Prague for valuable comments and suggestions. Any remaining mistakes and imperfections are mine. I am also grateful to Headquarters of the Police of the Czech Republic, Statistics Austria, and Federal Statistical Office Germany for providing the data and to Lt. Col. Josef Sobotka, Lt. Col. Josef Tesařík, and Richard Urfus for valuable discussions. I was funded by doctoral fellowship from University of Turin, Czech Science Foundation grant no. P402/12/2172, and post-doctoral fellowship at Masaryk University financed by EU grant no. CZ 1.07/2.3.00/30.0009.

Over 90 percent of fatalities happen in low and middle income countries, while almost half of those killed are non drivers. Enacting comprehensive laws with appropriate penalties and ensuring necessary resources to enforcement are acknowledged as top instruments to improve road safety (World Health Organization 2009).

FIGURE 1 ABOUT HERE

This study evaluates the effects of new road traffic law in the Czech Republic that became effective on July 1, 2006 (Parliamant of the Czech Republic 2005). It was aimed at improving road traffic safety through tougher sanctions for traffic offenses and augmented authority of the police. The most important change introduced by the law was a demerit point system (DPS) under which accumulation of points for traffic offenses leads to suspension of driver's licenses. The parameters of the DPS introduced in the Czech Republic are quite strict. When a driver accumulates 12 points, his license is immediately suspended for one year, after which the driver must pass a driving test and starts with 12 points still sitting on his record.[1] There were more than 34,000 drivers who's license was suspend as of December 2011.

The law also introduced substantial, often manifold, increases in fines, while driving under heavy influence of alcohol became a jailable crime. The change in fines is illustrated in Figure 1, which plots monthly series of average fine per speeding ticket issued by the policemen on the spot. It is apparent from the figure, that the average fine jumped from 500 close to 1500 CZK immediately after the law became enforceable and remained that level.[2] Traffic police was newly given the authority to withdraw a driver's license or close off driver's vehicle, for instance if he refuses an alcohol test.[3] The municipal police became authorized to stop vehicles and impose fines for violation of the traffic law. Finally, new provisions potentially enhancing traffic safety (e.g. compulsory child seats, ban on the use of cell-phone while driving,

[1]The use of masculine is justified by the fact that male drivers' behavior is being more often associated with negative externalities than females', both in conventional wisdom as well as empirically. See e.g. Levitt and Porter 2001; Chipman and Morgan 1975; Redelmeier et al. 2003.
[2]Median wage before taxes was 19,500 Czech crowns (CZK) in 2006. One Euro equals approximately 25 CZK, one U.S. Dollar is about 19 CZK.
[3]The final decision on license revocation is made by a municipal authority within 5 days.

or compulsory all-day lightning) were enacted. I overview the changes introduced by the law in detail in section 2.

There is over a dozen of studies investigating the effects of similar changes in traffic laws recently adopted in other countries, which also included DPS.[4] I summarize these studies in Table 9. The common pattern of their findings is that the introduction of stricter traffic laws is followed by substantial decreases in RTA-related fatalities and other casualties, usually in the realm of 20 to 30 percent.[5] However, the effects going beyond the initial six months are ambiguous, as many of these studies are based on short-term data and there are contradictions among those that do look at long-run effects. For instance, one study for Ireland finds lasting effects, but other two do not. The odds are one to three in the case of Italy.[6] Some of the inconsistency in previous findings may be related to their research design, which is always based on within-country before-after comparison. One should therefore be careful before drawing strong inferences, as such results may be influenced by trends in the data and are fragile with respect to additional shocks, such as seasonality, weather, change in fuel prices, or business cycle.

This study evaluates the effects of the 2006 Czech road traffic law using the difference-in-differences (DD) estimator, whereas regions of neighboring countries (Austria and Germany) serve as a control group. I have collected monthly regional-level data on RTAs that occurred between January 2004 and December 2008 in the Czech Republic, Germany and Austria and matched it with other socio-economic and transport-related statistics. Because data on accidents and injuries may suffer from reporting biases that are correlated with the new traffic law, I focus on fatalities. To the extent the development of the variable of interest is similar across these countries, the control group allows estimating the counterfactual, i.e. the hypothetical

[4]Brazil did so in 1998, Ireland in 2002, Italy in 2003, Spain in 2006, and the United Arab Emirates in 2008.

[5]The study from the United Arab Emirates is an exception (Mehmood 2010) as it does not find any effects.

[6]Butler et al. 2006; Farchi et al. 2007; Healy et al. 2004; Hussain et al. 2006; Instituto Nazionale di Statistica 2005; Nicita and Benedettini 2009; Zambon et al. 2008.

scenario of what would have happened on Czech roads had the law not been enacted. Subtracting the observed values from the counterfactual then yields the estimate of the effect of the change in law. Validity of identifying assumptions is discussed in section 3, but note here that there is strong positive correlation in RTA-related fatalities across the three countries, they followed similar trends before the law was introduced,[7] and there was no major change in Austrian or German traffic laws during the period under study.

Consistent with experiences from the other countries I find a sharp 40.5 log points (s.e. 0.10) drop in fatalities during the first three months after the law became effective. This translates into 34 to 239 saved lives with 95 percent certainty. However, beyond the short run impact, this paper, extends the set of studies that do not find lasting effects of increased sanctions for traffic law violations. This result is robust to alternative specifications and controlling for GDP, car-population ratio, age of cars, and freight transport vehicle-kilometers. Looking closer at the initial period, the effect was concentrated in July (-83.3 log points). In addition, using daily country-level data on fatalities in the Czech Republic and Austria, I find that the effects during initial 3 months were concentrated on Fridays and weekends when most fatal accidents occur, while little is seen during the rest of the week. The effects on Fridays and weekends were continuously fading throughout the initial 3-month period.

So why were the effects short-lived? A possible concern is, that the intensity of enforcement may decay in the aftermath of an increase in punishment. Intuitively, traffic law enforcement is costly and resources spent on it have alternative uses, be it within the law enforcement or within the public sector in general. As the situation on the roads improves, alternatives may become more attractive.

I find evidence consistent with this reasoning using an unique monthly-regional level dataset with detailed information on traffic police activity during 2006 and

[7] See Figure 2 on page 30.

2007. Specifically, while the number of traffic policemen allocated to enforcement slightly increased, the total number of man-hours in enforcement decreased by some 22 percent across the two years. Even faster decay is seen in the number hours of use of speed guns by the traffic police. On the other hand, the traffic police found more people at large, more stolen vehicles, as well as conducted more vehicle and person searches. These results, although rarely statistically significant, suggest that some reallocation of resources may also have taken place within the traffic police itself. This may help explaining the absence of longer run effects. However, continuous changes in police activity do not explain the initial sharp drop in fatalities and bouncing back. It is plausible, that people simply overestimated the effects of the change in rules on effective punishments they faced. The salience of the change and lasting controversies in politics and media may have contributed to this.

The paper delivers three contributions. It provides estimates of effects of the new Czech road traffic law, that were not available hitherto. It introduces differences-in-differences methodology to the literature that so far relied solely on before-after design, making the inferences more robust. Third, it analyses the law enforcement intensity in the aftermath of the increase in punishment, an issue predicted by theory, but never directly addressed by previous studies.

The remainder is organized as follows: Section 2 describes the legal change. Section 3 describes the data and discuses empirical strategy and section 4 presents results. Section 5 analyzes activity of the traffic police after the change. Section 6 then concludes.

2 The Change in Czech Road Traffic Law

Although "demerit point system" was used as a synonym for the new Czech road traffic law, it in fact represented a bundle of changes of which the introduction of DPS was the most salient one. Apart from it, new provisions can be split into a

subset boosting deterrence and strengthening enforcement of traffic rules (mainly increases, often manifold, of fines, and strengthened police authority), and other changes that should enhance traffic safety (e.g. compulsory child seats,[8] all-day lightning, or ban on the use of cellphones while driving). Although the country has traditionally had zero-tolerance policy when it comes to alcohol and driving, punishments for alcohol-related traffic offenses were especially harshened.[9] Thus, even absent the DPS, changes introduced by the law would have been substantial.

TABLE 1 ABOUT HERE

The mechanics of the newly introduced DPS, summarized in Table 1, is straightforward and relatively strict. The law newly specifies the number of demerit points for each offense, from 1, for minor ones, to 7, for the most serious offenses. Drivers may receive points for different offenses at one time. Selected offenses by demerit points are listed in Table 10. A driver who accumulates 12 points has his license revoked for 12 months, automatically and immediately. The license can be returned after this period upon completion of a driving test and the driver continues to carry 12 points on his record. Four points are deleted from driver's record after each 12 months during which he does not receive any new points.[10]

The introduction of DPS was complemented with general increase in fines. Maximum fines for offenses that can be solved on the spot, i.e. if driver accepts the ticket, were mostly raised twofold, fines for speeding were tripled as shown in Figure 1 on page 30, and policeman's discretion as to the actual amount of fine was removed in most cases. Similarly, fines were increased for the more serious offenses that are dealt with before the municipal office. Driving under heavy influence of alcohol became a jailable crime.

[8] Although, see Levitt 2008 for an evidence questioning the efficacy of this measure.

[9] See Levitt and Porter 2001 for an important study of externalities generated by drunk drivers.

[10] Before this change, driver's license could have been revoked only upon conviction of a specific offense or crime. It can still be revoked in such instances, regardless of the number of accumulated points and, in addition, the driver receives demerit points according to the offense he committed. If at the same time the driver happens to exceed his 12 points limit, the 12 month period begins only after the main revocation period is completed.

Other key changes the law introduced are summarized in Table 2. Notably, the authority of the police was elevated substantially as the law sought to strengthen enforcement. Police regained the capacity to retain driver's license on the spot, it can also close off vehicle or prevent driver from continuing if he refuses an alcohol test. Municipal police was newly awarded the authority to stop vehicles, impose fines, and give alcohol tests. Speed radar detectors became illegal, while child seats and all-day lightning made compulsory. Vehicle owners became obliged to provide information on identity of the driver in order to make enforceable the offenses documented by static speed cameras.

TABLE 2 ABOUT HERE

An important change was the raising of the minimum damage below which the police does not have to be notified about and accident from CZK 20,000 to CZK 50,000, in order to free police resources from dealing with minor accidents. This change has ramifications for this study, as the aggregate police data on traffic accidents become irrelevant for any evaluation of effects of the new law. It possibly also furthers the reporting bias in police data on injuries discussed in section 3 below.[11]

All in all, the law can be plausibly described as having substantially altered formal rules that govern road traffic in the Czech Republic. The rules of demerit point system are strict - only two or three offenses can add up to 12 points, resulting in license revocation. This change was accompanied by general increase in fines and augmented police authority.

The magnitude, factual as well as perceived, of the change can also be illustrated by noting attention and controversy the law received in media, public, and politics. Even before it came into effect, first proposals emerged that the rules of DPS should be softened (by an increase of the maximum amount of points, for instance),

[11]This rule may also work against the general philosophy of the new law, because offenders who cause minor accidents go unpunished, thus in fact lowering costs risky behavior on the road. I am grateful to Lt. Col. Josef Tesařík for pointing this out to me.

none of them succeeded so far, however. Those who drove during those days recall how everything slowed down, people became much more aware of traffic signs and speedometers in their cars. For instance, one hotly discussed topic in media around that time was how precise speedometers are, whether they normally overstate the actual speed and by what amount. The police had to repeatedly assure the public that they will tolerate speeding within 5km/h.

3 Data and Empirical Strategy

3.1 Descriptive Statistics and Measurement Issues

3.1.1 Data Collection

The main data set analyzed in this paper consists of monthly regional-level data on RTA-related casualties that occurred between January 2004 and December 2008 in the Czech Republic, Germany, and Austria, obtained upon specific requests from the Czech Police Headquarters and statistical offices of Germany and Austria.[12] I then merged this data with yearly regional-level data on population and number of cars from Eurostat and yearly country-level data on transport and economic statistics from the same source. In addition, I have received daily data on fatalities in Austria and the Czech Republic covering years 2005 to 2008. Finally, from the Czech Police Headquarters I have obtained pdf forms with detailed information on traffic police activity, such as man-hours, hours of use of speed guns, or number of cleared offenses and the amount of collected fines. From these forms I was able to parse a regional-level dataset covering monthly police activity in the Czech Republic in 2006 and 2007.

[12] I have also made data requests to Polish, Slovakian, and Hungarian statistical offices, however I was not successful in those cases.

3.1.2 Fatalities and Injuries

Table 3 summarizes the data on RTA-related casualties in Austria, the Czech Republic, and Germany (split by former East and West) split by July 1, 2006.[13] Looking at levels of fatalities, the Czech Republic had the highest rate per million inhabitants as well as per million cars in both periods. From the first column it is also apparent that the two neighboring countries have experienced decline in the number of RTA-related fatalities, which was (with the exception of former East German regions) comparable to decline in fatalities in the Czech Republic. However, the number of cars cruising Czech roads grew 3 to 4 times faster compared to Austria and Germany, as seen in the last column.[14] If number of cars reflects the intensity of traffic in a country, the rate of fatalities per car is more likely to capture safety situation on roads. This adjustment leads to 14 percent decline of fatalities in the Czech Republic and former East Germany compared to 8 and 9 percent decrease in Austria and Germany, respectively.

TABLE 3 ABOUT HERE

The picture is quite different when we look at injuries, however. First, the Czech Republic exhibits the *lowest* injury rates for both serious and slight injuries. The difference is substantial, Czech rates of RTA-related slight and serious injuries per million inhabitants, are about 50 percent lower compared to Austria and Germany, while number of injuries per million of cars is still about 1/3 smaller. This looks somewhat at odds with larger fatality rates in the Czech Republic relative to its neighbors. Regarding changes over time, we see that - despite the declines fatalities - injuries per million inhabitants in Austria and Germany remained relatively stable, only serious injuries declined by about 4 percent in former Eastern Germany. Similarly injuries per million of cars declined rather modestly in these two countries. In all cases, the decline in injuries is much smaller than decline in fatalities. However in

[13] First and last 6 months are dropped to make within-country comparison free of seasonal effects.
[14] The estimate of number of cars in Germany was revised downwards in 2007. Since this variable was developing virtually linearly, I replace the revised numbers with linear extrapolation.

the case of the Czech republic, the declines in injuries always exceed the decline in fatalities, notably for the seriously injured.

There are two sources of concerns about comparability of police data on injuries across the three countries as well as over time. First, police resources are likely to differ across these countries and drivers have incentives to avoid calling the police to an accident involving injury in order to sidestep additional punishment. In marginal cases, drivers may also strike a deal and settle the damages privately. As a consequence, there may be differences in the share of accidents the police ever learns about.

Second and more importantly, I it is very likely that these reporting issues have been aggravated by the change in Czech road traffic law. As noted above, the amount of damage below which the police does not have to be called in - and insurance companies do not require police protocol in order to liquidate the damage - was raised by 150 percent. Further, as the punishments become harsher, the incentives not to call the police strengthen. Both factors are likely to increase the pool of accidents and injuries without any involvement of the police. At the same time, the police or the doctors may have an incentive not to record some minor injuries, or classify injuries on the margin as minor, if the related punishment would now seem inappropriate. The importance of these factors possibly increases in the corruptibility of the police.

This scenario seems to fit the development of RTA-related injuries in the Czech Republic and the inconsistency in dynamics when compared with Austria and Germany. It is also consistent with larger decline in serious injuries compared to slight injuries, seen in Table 3, as some injuries on the margin between serious and slight injury may be more often classified as slight and some slight injuries get concealed. Since such possibility does not occur in case of fatalities, this effect of classification should be stronger in the case of serious injuries than slight injuries.

Such reporting issues are unlikely to play a role in the of fatalities. First, it is

hard to conceal a RTA involving fatality before the police. Second, there are no marginal fatalities that could be labeled otherwise. Third, any private settlement is hardly feasible.[15]

To probe things further, I compared the police data with yearly data on road traffic fatalities and injuries from the Office of Health-care Statistics and Information of the Czech Republic. With the exception of Prague, the health-care data on fatalities were very similar to the police data.[16] The comparison looks different for injuries. While the police observed a sharp, 14.6 percent, decline in RTA-related injuries in 2006, the health-care figure remained essentially unaltered (it was slightly higher in fact). The following year the police figure rose by about 4 percent while the health-care Figure was about 11 percent down from the previous year.[17] These comparisons support the claim, that the police data on RTA-related injuries are problematic. For these reasons I focus solely on data on fatalities in what follows.

Prague is excluded from the analysis in this paper as the data exhibited very different behavior compared to other regions and it constitutes an influential outlier. Also there were discrepancies between the police data and data from the Office of Health-care Statistics and Information of the Czech Republic. [18]

3.1.3 Transport Statistics

TABLE 4 ABOUT HERE

Table 4 presents summary of transport statistics and GDP from Eurostat. Entries in panel A represent means of values for 2004 and 2005 and means of values for 2007

[15]It is possible that some RTA related fatalities may be labeled as not related to RTA. I do consider this possible effect of the law unimportant.

[16] The proportional differences between health-care and police statistics were -0.048, -0.019, 0.023, 0.021, and 0.085 between 2004 and 2008. If the doctors' data were correct, the police data slightly overstate number of fatalities in first two years in our main sample and understate it from 2006 onwards, notably in 2006, biasing results in this study in favor of finding negative effects of the change in law on fatalities. Nevertheless figures from both sources are comparable both in level as well as their behavior over time.

[17]The proportional differences between the health-care and the police statistics were, 0.13, 0.24, 0.44, 0.24, and 0.18 in years 2004 to 2008.

[18]I discuss this in more detail in section 4.1 of the earlier version of this paper available online or upon request. Results that include Prague are reported in that version as well.

and 2008. Entries in panel B represent proportional changes between the two periods. Compared to Austria, kilometers driven by Czech cars increased substantially. At the same time, the average number of passengers per car was decreasing, in fact canceling out the increase in kilometers driven and resulting in a slight decrease in passenger-km per car in the Czech Republic over the period under study. The average age of cars increased marginally in the Czech Republic and Austria and remained constant in Germany. High intensity of transport traffic after the Czech Republic became a member of the European Union in 2004 was an often mentioned as potentially elevating riskiness of Czech roads. During the years 2004-2008, the volume of freight transport (including empty truck movements) in the Czech Republic increased substantially, but it also did Germany. The length of highways increased substantially in the Czech Republic and only marginally in Austria and Germany indicating improvements in Czech road infrastructure over the period. Finally, second half of 2000s was an era of rapid economic growth in the Czech Republic - real GDP per capita measured in 2005 Euros increased by 32 percent.[19] The expectation of the effect of GDP growth on RTA-related fatalities per car is ambiguous; in the short run, one would expect increased traffic to dominate, implying positive correlation between GDP and fatalities. In the medium and longer perspective, people may acquire better cars as their incomes increase, families may buy a second car, and also public infrastructure may improve resulting with a negative effect on fatalities.

3.2 Empirical Strategy

3.2.1 The Outcome of Interest

As we saw in Table 3, number of cars grew much faster in the Czech Republic compared to Austria and Germany. Assuming cars are bought to be driven, number of cars should be positively related to the total number of kilometers driven in a

[19] This partially reflects strengthening of Czech Crown throughout the period, however the growth in Crowns would still be at 20 percent.

country. This suggests, that the intensity of road traffic was changing and grew faster in the Czech Republic relative to the two neighbors. Under such circumstances, it is not feasible to take number of accidents or fatalities in a country as a measure of traffic safety, as risk exposure changed.[20] I therefore use the number of fatalities per one million cars as a measure of road safety and the variable of interest.

However, an issue with using number of cars to adjust for changes in traffic intensity can be that the number of kilometers per car or the average number of passengers sitting in a car may change. Both variables are very likely positively related to fatalities.[21] According to statistics available at Eurostat (Table 4), passenger-kilometers per car declined by almost 5 percent in the Czech Republic (kilometers driven grew by 20 percent, but the decrease in the number of passengers per car offset it) and did not change in Austria between 2004 and 2008.[22] This indicates, that using number of cars as a measure of exposure to the risk of dying in a traffic accident is biased upwards in the case of the Czech Republic after 2006; implying a downward bias of estimates of the effect of the legal change on fatalities, i.e. making it more likely that a - long run - negative effect of the law on fatalities will be found.[23]

3.2.2 Empirical Model

This paper employs the difference-in-differences (DD) estimator using neighboring countries as a control group. Specifically, denote y the outcome of interest, then the

[20] For instance, if people decided to double the number of kilometers driven per day, it would not be surprising to see an increase in the number of accidents, while it would be difficult to make any statement as to the implied change in traffic safety.

[21] Other things remaining equal, more kilometers driven imply more opportunities for accidents to happen, while more passengers in a car more people may get injured or killed in any given accident.

[22] Data for Germany is not available.

[23] This reasoning abstracts from an indirect effect of higher number of car-kilometers on probability of accident working simply through more cars meeting on the road. Also, new-coming marginal drivers may be more likely to cause an accident, a factor possibly at work in the Czech Republic with its rapidly growing stock of cars. (On the other hand new cars are safer.) I suggest these factors are likely to be dominated by the mechanics of kilometers driven and passengers sitting in a car.

DD regression can be written as

$$y_{it} = \alpha_i + \boldsymbol{\beta_t} + \boldsymbol{\gamma'} \boldsymbol{x_{it}} + \delta T_{it} + \epsilon_{it}, \tag{1}$$

where i denotes a region, t denotes date, α_i is region i's fixed effect, $\boldsymbol{\beta_t}$ is a set of time effects picking up common trends, shocks, and seasonal regularities, $\boldsymbol{x_{it}}$ is a vector of controls, T is a dichotomous variable taking on value 1 if y_{it} is affected by the treatment and zero otherwise, and ϵ_{it} is the residual. $T = 1$ if region i is in the Czech Republic and date t is larger or equal to July 1, 2006. The parameter of interest δ captures the net effect of the treatment on the outcome.

The well known advantage of this estimator is that it helps with controlling for any unobserved shocks, as long as they affect the treated as well as the control group. This facilitates more robust inference about the casual effect of the change in road traffic law on RTA-related casualties relative to before-after comparisons employed in hitherto studies. Identifying assumptions of DD estimator are common trends between the treated and the control group and absence of any unobserved shock specific only to the control countries or to the treated country. In other words, DD requires that after controlling for relevant differences between control and treated group, the only systematic difference between the two is the presence/absence of the treatment.

3.2.3 Validity of Assumptions

The neighboring countries offer themselves as natural control group. There are good reasons to expect that factors generating shocks to RTA-related fatalities are shared among the Czech Republic, Austria, and Germany. Specifically, common border and relatively small size of the Czech Republic make it likely that weather conditions will affect these three countries similarly. Czech economy is export oriented - exports represented over 60 percent of its GDP in 2006, while Germany is the main trading

partner with 1/3 share on Czech exports. Thus, economic shocks are correlated across these three countries. Finally, there was no substantial policy change in either control country.[24]

FIGURE 2 ABOUT HERE

Since our data span 30 months before the new road traffic law was introduced in the Czech Republic, we can use this information to probe the identifying assumptions of regression (1). Figure 2 provides visual evidence suggesting similar log-linear trends in fatalities per car before 2006 as well as high similarity of seasonal regularities across the Czech Republic, Austria, and former West Germany.[25] Pearson's correlation coefficients of log monthly fatalities per million cars between the Czech Republic and either control country from January 2004 until June 2006 are above 0.7 and are statistically significant at any conceivable level.

To assess the pre-treatment similarity between the Czech Republic, Austria, and Germany more formally, I construct a Chow test of systematic deviations of fatalities in the Czech Republic from the control group. Specifically, I take pre-July 2006 subset of the data and run a regression of log-fatalities per car on regional fixed effects, full set of time effects (i.e. year-month dummies), and set of interactions between time effects and a dummy for the Czech Republic. Time effects in this regression pick up trends and shocks common to all three countries, while the interactions capture deviations specific to the Czech Republic. The test of the hypothesis that all coefficients on interaction terms are equal to zero produces $F-$statistic (29, 754)

[24] I have sent inquiries about changes in traffic law or policies between 2004 and 2008 to ministries of transport of Austria and Germany. A detailed answer came from the Austrian ministry, listing all changes that occurred in that period. These are very specific adjustments and marginal improvements, such as obligation to carry a reflective vest (2005) or use winter tires (2006, the only change in that year) or increase of fine for using cell phone to 50 Euro in 2008. I did not receive any response from the German ministry, however researching publicly available resources did not result in finding any substantial law or policy change in Germany.

[25] Because regions of former East Germany exhibited very different trend compared to the rest of the countries in the region, namely, fatalities were falling much faster in Eastern Germany than elsewhere, I drop them from the data. As discussed below, I also studied yearly regional-level data from Eurostat which are available for all neighboring countries. This uniqueness of former East Germany applies not only with respect to the three countries covered in our main data, but to other two neighboring countries, Poland and Slovakia, as well as to Hungary.

= 0.71, in other words, there is no evidence, that fatalities before July 2006 were behaving differently in the Czech Republic than in Austria and Germany.

To double-check this contention, I run the same test using the Eurostat yearly regional level data on fatalities between 1999 and 2005 for all neighboring countries, replacing year-month dummies with year dummies. This data include Austria, Czech Republic, West Germany, Poland, and Slovakia.[26] $F-$ statistic (6, 228) on the hypothesis, that year effects for the Czech Republic are equal to zero is 0.889. Running the same test on data for that only include the Czech Republic, West Germany, and Austria produces $F-$statistic (6, 156) = 0.7947.

These findings suggest strong similarities in development of fatalities between the Czech Republic, Austria, and Germany before July 2006. That in turn justifies the use of difference-in-differences estimation strategy.

3.2.4 Meaning of Estimates

In our case, the coefficient δ from regression 1 represents the treatment effect on the treated, as the policy change was designed and introduced by the Czech Republic itself, unlike in a random assignment. Thus δ evaluates the effect of the treatment in the Czech Republic and cannot be thought as an estimate of the treatment effect in an experimental sense.[27] There can also be a potential endogeneity bias in the sense that the timing of the treatment may not be random. A recent experience of unusually high number of serious accidents may make it more likely that a policy change will be put in place. This would constitute a bias in the direction of finding an effect due to regression fallacy, as a random spike in fatalities is likely to be

[26] While data are available from 1996, there are frequent revisions, especially in statistics on number of cars, making the earliest data less reliable. Also, the Czech Republic experienced a financial crisis in 1997 recovering in 1999. I therefore drop observations before 1999. As discussed in footnote 25, I exclude regions of former East Germany, since it exhibits very different trend from all other countries.

[27] This self-selection should make it more likely for the treatment to work compared to a randomly assigned treatment. Also, as apparent from Table 3 Czech roads were more dangerous than German and Austrian, the likely benchmarks, and there was no sign of convergence in fatalities per capita before 2006. Thus, some treatment might have been be thought as necessary.

followed by values closer to the average (Friedman 1992). However, the length of the legislative process and the time-span between passage of the law and the date from which it is effective - 9 months in the case we study - make this factor unlikely to be driving our results in an important way.[28] Importantly, these biases work against the finding of no significant effect of the treatment and therefore making the conclusions of this paper conservative.

The last potential bias is related to pre-treatment effects of the treatment. Everyone was long aware of the change of the road traffic law is coming soon; and this may affect pre-treatment outcomes, in fact generating some effects of the treatment before it actually takes place.[29] This would be likely to create a downward bias in δ as the level of fatalities in treated country prior the treatment would be lower and the potential pre-treatment decrease should be attributed to the treatment itself, since it would not have occurred otherwise. This bias is likely to be the less dramatic the longer the data for the pre-treatment period are. There are also simple strategies to address this, one can include dummy for some part of the period prior the treatment and interact it with the dummies of the treated group. I also inspect daily data and find little evidence for strong pre-treatment effects

4 Results

4.1 Main Results

The main set of ordinary least squares estimates of effects of the new Czech road traffic law on fatalities using regression (1), are reported in Table 5.[30] The coefficient

[28] The traffic law was passed on September 21, 2005 and became enforceable from July 1, 2006.

[29] For instance, police may have acquired new assets or invested in new technologies before the treatment, or it may strategically increase its effort prior the treatment, or engage in saber rattling in media. Also, drivers may begin to drive more carefully or pay more attention to signs. They may also expect the police to increase effort around the treatment.

[30] Because there are some month-region observations where no accidents occurred, and I code those as zero. OLS coefficients are biased due to censoring. I rerun the analysis using Tobit model instead, the differences in coefficients were barely discernible. Dropping those observations did not change the results either. I therefore prefer to report OLS results.

on T in specification (1) suggests a decrease in fatalities per car of 7.2 percent ($= [e^{-0.075} - 1] \times 100$) but standard error of the estimate doesn't allow us to rule out zero or positive result.[31] Specification (2) adds dummies for two quarters before the law became enforceable. Both coefficients are close to zero, suggesting there is no indication of any important pre-treatment effects that should be taken into account.

TABLE 5 ABOUT HERE

Specification (3) allows us to see how fatalities developed over the first year after the new traffic law was introduced in the Czech Republic, and I will refer to it as our benchmark result. The immediate effects following the introduction of the new traffic law were substantial. The point estimate suggests that the decline in fatalities during the first three months exceeded 33 percent.[32] After that the effect fades and is never statistically significant, individually or jointly.[33] Variable T now picks up any long run effects of the change in law, that is anything beyond the initial 12 months. After accounting for the initial shock the estimated long run effect is zero.

Last two columns of Table 5 check the robustness of specification (3). First, I drop the distant regions of Austria and Germany. The idea is, that neighboring regions will be more alike in their behavior over time and affected by similar factors. This results in a slightly smaller estimate on the third quarter of 2006, yet the big picture remains very similar to specification (3). Then, I replace the outcome variable, log of fatalities per car, by log of fatalities per passenger-kilometer. Because the data on passenger-kilometers are not available for Germany, the data includes only the Czech Republic and Austria. The results from specification (3) are again corroborated, although the initial effects seem to decay faster - everything beyond the initial 6 months has positive point estimates. To summarize, these findings provide strong evidence of substantial immediate effects of the new road traffic law on fatalities in

[31] Following recommendations of Bertrand et al. (2004), reported standard errors allow for clustering on regions.

[32] Most of this decline was concentrated in July, the first month the law was in place, the drop in fatalities was 55 percent. I do not report this regression to save space.

[33] Testing whether last three interactions are equal to zero yields F-statistic 1.05.

the Czech Republic, but not much is apparent beyond that.

TABLE 6 ABOUT HERE

Table 6 probes the base results with additional control variables described in section 3. I first include GDP per capita, which grew faster in the Czech Republic than in Austria, as seen in the last column of Table 4. Then I plug in the number of kilometers driven by trucks and lorries. The increase in freight transport after the Czech Republic joined the EU,[34] was often criticized by media and politicians as adversely affecting the safety of Czech roads. Also, the number of cars per capita grew faster in the Czech Republic than in Austria and Germany. This may negatively influence the number of fatalities per car, because the number of passengers sitting in a car may decrease (see Table 3) and the new cars may be safer. Lastly the age of cars may capture changes in the composition of quality of cars. Signs of coefficient estimates are as expected, except freight transport does not seem to positively affect fatalities. However none of these variables is statistically significant on its own. The initial effects of the new traffic law remains highly statistically significant an substantively large in all four cases, also coefficients on remaining quarters are quite stable, but newer significant. The coefficient on T is somewhat unstable.

In specifications (5) and (6) I include all control variables simultaneously, whereas specification (6) is run on the restricted sample. Coefficients on control variables generally have the same signs and magnitudes across all six specifications. Notably the two coefficients of interest are virtually the same as in specification (4) and (5) in Table 5. The base results are corroborated by results in Table (6).

In summary, our results show that there were substantial short run effects concentrated within the first quarter after the law became effective. This is consistent with findings of previous studies in other countries (see Table 9 for summary of these papers). Although the point estimates are mostly negative, the estimated effects fade as we move away from July 2006. The estimates of long run effects, that is

[34]It did so on May 1, 2004.

beyond the first 12 months, are substantively and statistically insignificant.

4.2 Short Run Development

Availability of daily country-level data on RTA-related fatalities for Austria and the Czech Republic makes it possible to study the response in more detail. First, I run a Tobit regression of fatalities on a constant, a dummy for the Czech Republic, full set of week effects, and full set of interactions between the dummy for the Czech Republic and week effects using daily data ranging from 2005 to 2008.[35] Pane A of Figure 3 plots demeaned coefficients on the interactions capturing average weekly change in Czech fatalities net of common shocks.[36] July 1, 2006 is marked by solid a vertical line, dashed lines mark one week before and three months after the date. There is no apparent positive or negative trend, which is reassuring. The figure corroborates our main finding that the effects of the law were concentrated in the first three months, specifically in July and October, following the introduction of new traffic law. The Figure also suggests, that the law saw its first effects in the very first week it was enforceable.

FIGURE 3 ABOUT HERE

Panels B, C, and D of Figure 3 zoom in, plotting Czech "unexplained" daily fatalities during the period starting one month before and ending four months after the change in traffic law. Vertical lines indicate the same dates as in Panel A. Plotted datapoints are residuals from a Tobit regression of fatalities on a dummy for the Czech Republic and full set of month×day-of-week interactions run on daily data on fatalities in Austria and the Czech Republic, ranging from 2005 to 2008 as above.

[35] Fatalities are indexed by change in number of cars. I tested the equality of pre-July 2006 development between Austria and the Czech Republic with results far from any rejection criteria. Pearson's correlation coefficient of pre-July 2006 weekly fatalities in the two countries is 0.43 and is highly statistically significant.

[36] Since the level of fatalities in Austria is about one third smaller than in the Czech Republic (1.95 versus 2.88 fatalities per day on average), time effects do not take out all common variability. As result the mean of the coefficients on interactions is positive. Using data normalized by standard deviations does not alter the resulting figure.

In panel B we see how things were slowly returning "back to normal" during the three-month period following July 1, 2006. Because the average number of fatalities in the Czech Republic and Austria is 26 and 24, respectively, percent higher during Fridays and weekends compared to the rest of the week, panels C and D break up the residuals along that line. The Figure suggests that initial reduction of fatalities in the Czech Republic was concentrated in days where most fatalities occur and this effect faded over time. On the other hand, there seem to be little effect in the other days, except the very first week after July 1.

5 Is the Police to Blame?

5.1 A Sketch of the Theory: Size of Punishment and Enforcement Effort

As discussed in Introduction, enforcement levels may not be sustained in the aftermath of an increase in punishments. Tsebelis (1989) was the first to study the relationship between fine and the effort chosen by the enforcement body. He develops a succinct game theoretical model producing a counter intuitive prediction - change in fine does not influence the number of committed infractions, only the probability of capture.[37]

In an earlier version of this paper,[38] I have developed a simple model grasping this scenario in a constrained optimization setting. I begin with a straightforward deterrence model, whereas drivers choose the number of offenses given a monetary constraint. The cost of an offense is a fine multiplied by the probability that the offense will be intercepted by the police. In the next step, the police is allowed to optimize their effort, directly influencing the probability of interception and through it the number of offenses the drivers chose to commit. The police dislikes effort

[37]See also Holler (1993) and Andreozzi (2002) who further discuss the model.
[38]It is available online or upon request from the author.

as well as offenses. The model predicts that the deterrence effect of higher fine is followed by relaxed police effort, which offsets some of the former.

There are various reasons why this simple model may capture some of reality. Resources allocated to traffic police have alternative uses, within the police and within the public sector in general. It is also plausible, that when changes in the law, like ours, are adopted, the traffic police may be already overstretched. If added deterrence resulting from increased punishments leads to an improvement of road safety indicators, the levels of enforcement may then be adjusted downwards; and this may be socially optimal to and extent. Finally, politicians may loose their interest in traffic safety, especially if things improve initially. If they later revert, there may not be much to be done for them as the law has been passed already.

5.2 The Data on Police Activity

FIGURE 4 ABOUT HERE

This subsection presents an analysis of an unique dataset parsed from internal monthly regional-level reports on traffic police activity in 2006 and 2007 I have obtained from the Headquarters of the Police of the Czech Republic. The thrust of the of the findings is captured in Figure 4, which plots development of manpower and man-hours in enforcement as well as number of hours of speed gun use by the traffic police across Czech Regions. The number of policemen assigned to enforcement exhibits general upwards pattern in 2006 and 2007. Despite that, the man-hours worked by these men were declining in all regions but one. The number of hours the police spent behind speed guns was falling even more rapidly.[39]

A note of caution should be stated here. One could be tempted to use the data on traffic police activity as an explanatory variable to check whether it explains the development in fatalities in the Czech Republic after July 1, 2006. However, this

[39]Certainly the enforcement infrastructure was improving in recent years. Many static cameras were put in place, so that drivers' speed may be measured with higher frequency. However, speeding captured by static radars gets recorded, and only a subset proceeds through the administrative procedure and possibly results in punishment of the driver, with a delay.

would require, that traffic police activity is exogenous to accidents and casualties–an unlikely assumption. Doing this would lead to results lacking proper interpretation. I therefore present only descriptive analysis of police activity.

TABLE 7 ABOUT HERE

Tables 7 and 8 study traffic police activity in more detail. I simply regress logs of police activity indicators on year×quarter dummies, where the second quarter of 2006 is the omitted category. One may worry, that some variability may be driven by seasonal regularities, an issue hard to deal with properly with two years of data. I use half-yearly country-level data on man-hours in enforcement ranging from 2005 to 2008 and estimate a coefficient for second half-year, which I then use to deseason the data.

Column (1) of Table 7 suggests that the total number of policemen remained constant throughout 2006 and 2007, while the number of policemen in enforcement was slowly increasing as seen in column (2) and Figure 4. In other words, there is no sign that fewer policemen were available for traffic law enforcement after June 2006.[40] Nonetheless, the total amount of traffic police man-hours dedicated to enforcement was declining from the third quarter of 2006 onwards. The declines are statistically significant at 5 percent level and their pace was accelerating. Since man-hours in enforcement are usually smaller in the second half of a year - although fatalities are higher -, the results for deseasoned data places the beginning of the decline to the first quarter of 2007. Nonetheless, there were almost 9% fewer traffic policemen seen on the streets and roads in the first quarter following the introduction of the new traffic law compared to the preceding one, and the decline came close to 24% at the end of 2007. The decay is even more dramatic in the case of number of hours of mobile speed guns use by the traffic police. The number of targeted actions - that is temporarily heightened presence of traffic police in a specific area with a purpose to increase the number of checks and salience of police presence - remained steady

[40] Also, as noted in section 2, the municipal police was newly authorized to stop vehicles an fine offenders.

through 2006, then declined in the first half of 2007 and later increased substantially. The presence of the police in media decreased in 2007, as it was probably unusually high in 2006.

TABLE 8 ABOUT HERE

Table 8 looks at those activities of the traffic police other than direct traffic law enforcement. Specifically, I looked at numbers of persons and cars at large found, and numbers of suspicious items and persons checked. Although, most coefficients are not statistically significant, however there seem to be a general increase in those measures, despite fewer working hours in enforcement. This suggests that the traffic police may have given higher priority to general law enforcement activities, relative to direct enforcement of traffic rules.

5.3 What Does (Not) the Traffic Police Activity Explain?

In sum, the police data reveal, that enforcement levels were declining in the aftermath of the introduction of the new road traffic law and traffic police may have put higher share of resources on general law enforcement and police work, away from direct enforcement of traffic rules. This development is in line with the outlined theory, however one should be careful not to interpret this result strictly causally. Only two years of data are available, so we cannot rule out preexisting trends, or factors driving the changes in police data other than the change in traffic law.

Be it coincidence or not, can changes in police enforcement explain the development of fatalities after the change in Czech road traffic law? It can hardly do so with respect to the sharp short run decline in fatalities as the police presence on the roads was apparently lower during the third quarter of 2006, relative to first half of that year. This effect is more likely to be driven by uncertainty in expectations that were possibly misjudged due to high salience of the change as well as intense media coverage and long lasting controversies regarding the DPS. On the other hand,

systematically lower enforcement levels after the law was introduced may play an important role in explaining the absence of long run effects.

6 Conclusions

This study evaluates the effects of introduction of new road traffic law on RTA-related fatalities in the Czech Republic. The law became effective on July 1, 2006 and introduced number of provisions that increased sanctions for traffic offenses. In particular, fines increased substantially, the traffic police gained more authority, and a strict demerit point system was introduced. The law was long disputed as the severity of increase in punishment was controversial. The main object of controversy was the demerit point system. Yet it also had strong supporters, notably the police, as it was expected to bring a major improvement in drivers' behavior and road traffic safety.

Consistent with the literature, studying the effects of similar changes in traffic laws in other countries, I find a substantial initial response to the law. Fatalities were about one third lower during first three months after the law was introduced, in other words 34 to 239 human lives were saved with 95 percent certainty. Nonetheless, the effects - concentrated on Fridays and weekends - were fading during this period already. The estimated effects after this initial period are generally negative, substantively moderate, but never statistically significant. The point estimates of the effects going beyond the first 12 months are close to zero, although moderate positive or negative effects cannot be ruled out. These findings hold across various specifications and are robust to controlling for number of cars per inhabitant, GDP per capita, age of cars, and intensity of freight transport.

This study extends the set of studies that find strong immediate but little, if any, sustained effects of tougher punishments for traffic law violations. Because the expected punishment is what drivers should care about, the key issue is the

development of police resources and effort devoted to enforcement of the law. I study a unique and detailed dataset parsed from internal reports, that regional traffic police offices provide to the Czech traffic police headquarters. The data reveals, that resources allocated to enforcement were decaying, namely man-hours and intensity of use of speed guns. There are also indices, that traffic police may have shifted its attention towards ancillary activities and more general law enforcement. It is noteworthy in this context, that traffic intensity, measured by number of cars, kilometers driven, or intensity of freight transport, was increasing substantially during the period under study. So that traffic intensity-adjusted enforcement levels may have decayed even faster.

The paper does not imply that the law was not an improvement. To the contrary, it created a legal environment that is closer to standards found in the rest of Europe. By introducing demerit point system, sanctions became more independent of income (at least formally), thus providing added deterrence and incapacitation of drivers that may not perceive fines as biting enough. There were as many as 34,000 drivers, whose drivers license was revoked through DPS as of December 2011. Nevertheless, the effective sanctions that offenders care about are function of enforcement. The expectation that a nominal increase of penalties fix the problem may take enforcement out of the focus and the police and/or politicians may have incentives to ease on it, especially if things seem to go well initially. This this is consistent with the data on police activity and may help explaining the absence of any long run effects.

The paper contributes to the existing literature in four ways. It provides estimates of effects of the new Czech road traffic law hitherto unavailable. It introduces differences-in-differences methodology to literature that so far relied solely on fragile before-after design. Third, it shows that it its possible to construct a meaningful counterfactual, as cross-country development in road traffic safety follows a common pattern. Lastly, unique data on traffic police activity support the suspicion, noted in previous literature and predicted by theory, that there may be problems with

enforcement following the change in punishments.

The paper also confirms, that people respond to incentives and are willing to change their behavior if the perceived costs increase. If the change in cost if mis-perceived, they quickly update, and adjust their behavior accordingly. Thus, achieving lasting discontinuous improvement, however desirable, may require keeping an eye all relevant parameters, not only statutory punishments for infractions.

References

Andreozzi, L. (2002). Oscilliations in the enforcement of law: an evolutionary analysis. *Homo Oeconomicus*, 18:403–428.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we trust Differences-in-Differences estimates? *Quarterly Journal of Economics*, 119(1):249–275.

Butler, J., Burke, J., Healy, D., Stephens, M., Manus, F. M., Cormack, D. M., O'Byrne, J., and Poynton, A. (2006). Trends in RTA related spinal injuries: the post penalty points era. *Irish Journal of Medical Science*, 175(1):20–23.

Chipman, M. L. and Morgan, P. (1975). The role of driver demerit points and age in the prediction of motor vehicle collisions. *British Journal of Preventive and Social Medicine*, 29(3):190–195.

Farchi, S., Chini, F., Rossi, P. G., Camilloni, L., Borgia, P., and Guasticchi, G. (2007). Evaluation of the health effects of the new driving penalty point system in the Lazio Region, Italy, 2001–4. *Injury Prevention*, 13(1):60–64.

Friedman, M. (1992). Do old fallacies ever die? *Journal of Economic Literature*, 30(4):2129–2132.

Healy, D. G., Connolly, P., Stephens, M. M., O'Byrne, J. M., McManus, F., and McCormack, D. (2004). Speed and spinal injuries. *Injury*, 35(9):908–912.

Holler, M. J. (1993). Fighting pollution when decisions are strategic. *Public Choice*, 76(4):347–356.

Hussain, O., Nayyar, M., Brady, F., Beirne, J., and Stassen, L. (2006). Speeding and maxillofacial injuries: Impact of the introduction of penalty points for speeding offences. *British Journal of Oral and Maxillofacial Surgery*, 44(1):15–19.

Instituto Nazionale di Statistica (2005). Statistica degli incidenti stradali, anni 2003-2004.

Levitt, S. D. (2008). Evidence that seat belts are as effective as child safety seats in preventing death for children aged two and up. *Review of Economics and Statistics*, 90(1):158–163.

Levitt, S. D. and Porter, J. (2001). How dangerous are drinking drivers? *Journal of Political Economy*, 109(6):1198–1237.

Mehmood, A. (2010). Evaluating impact of demerit points system on speeding behavior of drivers. *European Transport Research Review*, 2(1):25–30.

Nicita, A. and Benedettini, S. (2009). Rational drivers, irrational enforcers, and road safety. *SSRN eLibrary*.

Parliamant of the Czech Republic (2005). ZÁKON ze dne 21. září 2005, kterým se mění zákon č. 361/2000 sb., o provozu na pozemních komunikacích a o změnách některých zákonů, ve znění pozdějších předpisů, zákon č. 200/1990 sb., o přestupcích, ve znění pozdějších předpisů, zákon č. 247/2000 sb., o získávání a zdokonalování odborné způsobilosti k řízení motorových vozidel a o změnách některých zákonů, ve znění pozdějších předpisů, a některé další zákony.

Redelmeier, D. A., Tibshirani, R. J., and Evans, L. (2003). Traffic-law enforcement and risk of death from motor-vehicle crashes: case-crossover study. *Lancet*, 361(9376):2177–2182.

Tsebelis, G. (1989). The abuse of probability in political analysis: The robinson crusoe fallacy. *American Political Science Review*, 83(1):77–91.

World Health Organization (2009). *Global Status Report on Road Safety: Time for Action*. World Health Organization, 1 edition.

Zambon, F., Fedeli, U., Milan, G., Brocco, S., Marchesan, M., Cinquetti, S., and Spolaore, P. (2008). Sustainability of the effects of the demerit points system on seat belt use: A region-wide before-and-after observational study in Italy. *Accident Analysis & Prevention*, 40(1):231–237.

Figures

Figure 1: Average Fine for Speeding in 2006 and 2007

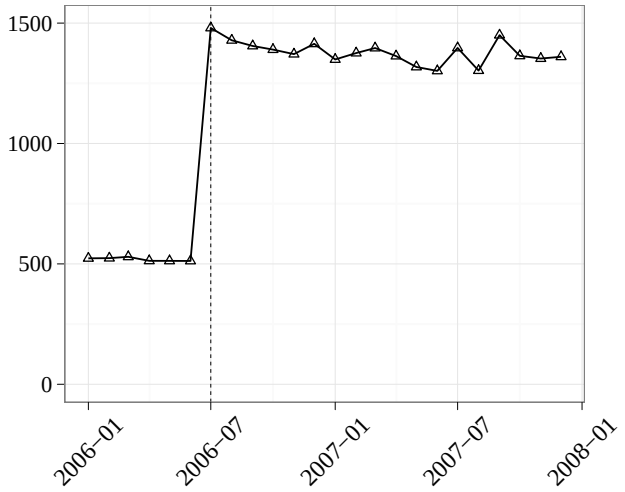


Figure 2: Fatalities per 10^6 Cars (2004-2008)

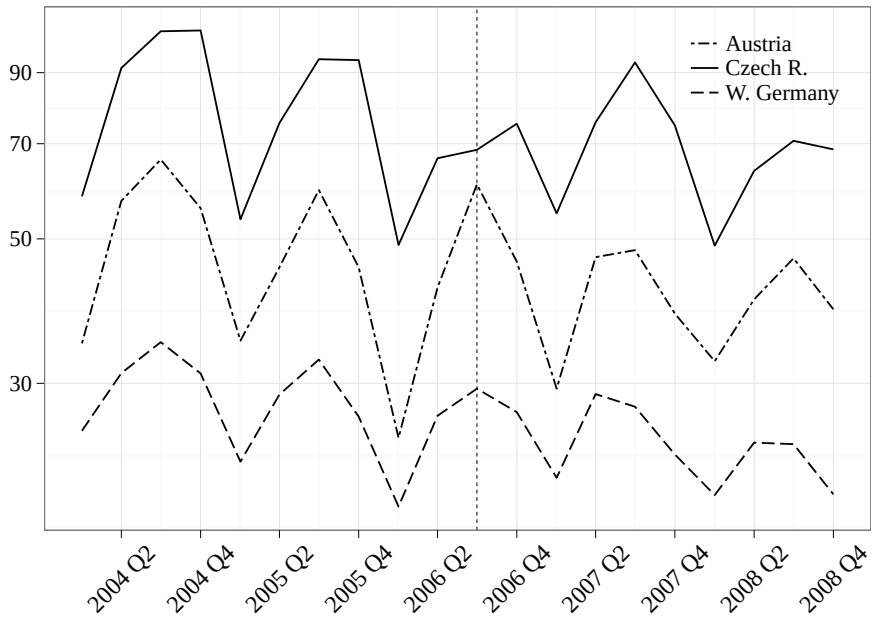


Figure 3: Unexplained fatalities

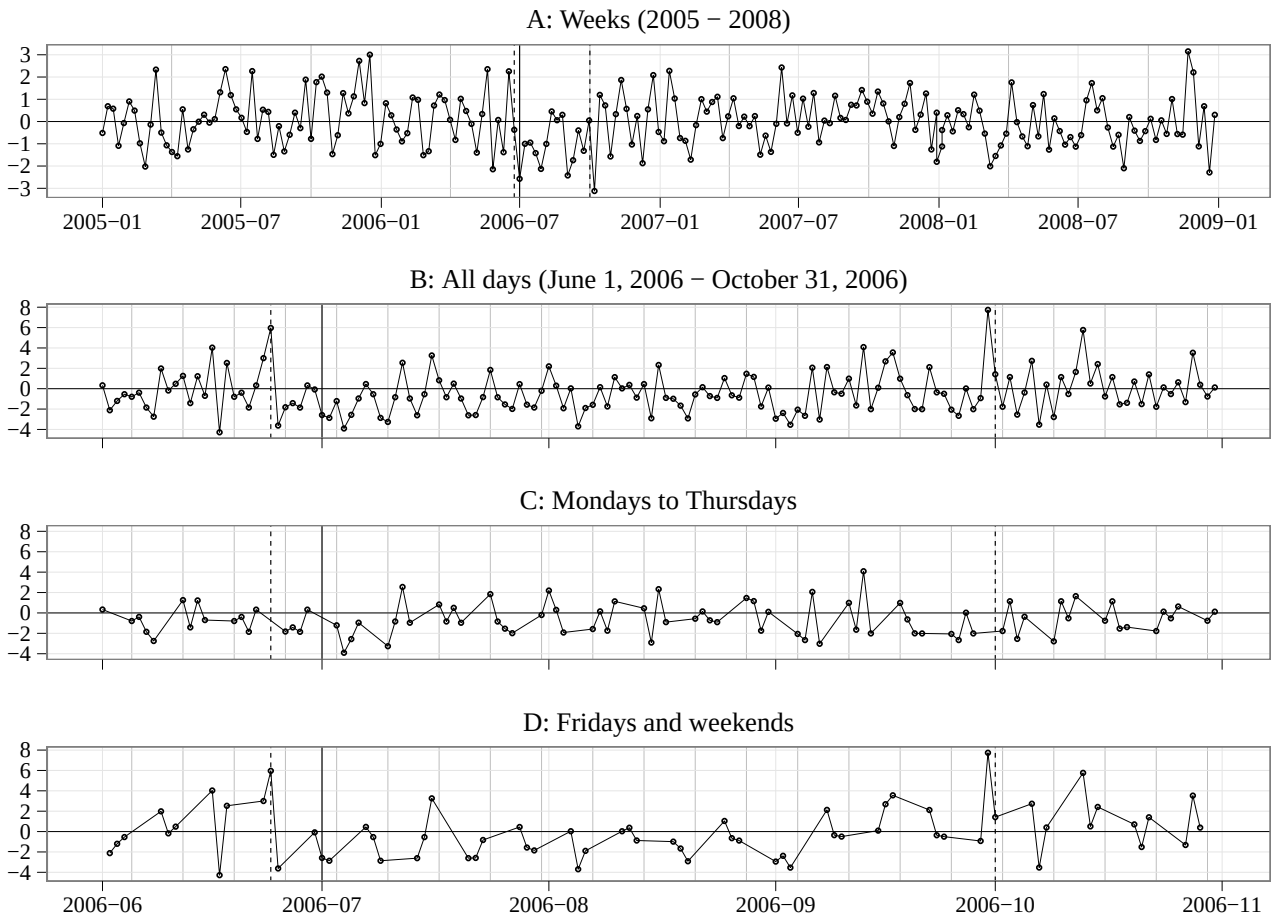
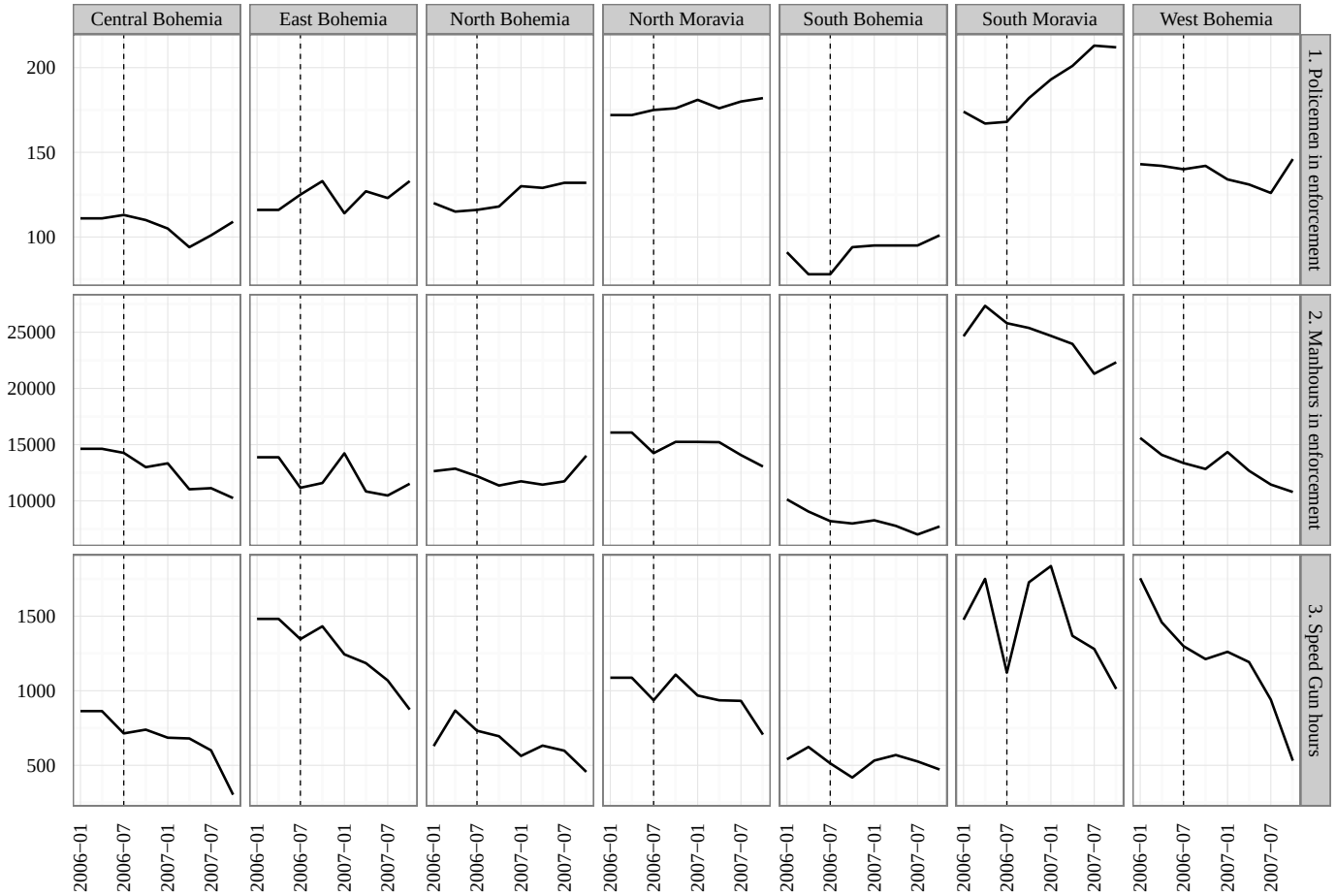


Figure 4: Traffic police manpower and man-hours in enforcement by Czech regions in 2006 and 2007



Tables

Table 1: The Mechanics of Czech Demerit Points System

Points must be recorded in the registry within 5 days from allotment.	
Drivers are not notified about accumulated points but must be informed upon request.	
Driver may receive points for multiple offenses at one time.	
4 points are deduced after each year without pointable offence.	
Driver who accumulates 12 points	
	has automatically his license suspended for 12 months.
	must be immediately notified that suspension has occured.
	has to give up his licence to authorities whithin 5 days since the notificaton.
	has to pass a driving test before licence can be returned after 12 months.
	he then starts with 12 points.

Table 2: Overview of Novel Provisions in 2006 Traffic Law

New Duties of Road Traffic Participants
Compulsory use of
lights, thoughout the day and year.
child seats.
helmets by cyclists.
cell phone while driving.
Owner of an vehicle is obliged to provide information on identity of a driver.
Prohibition of use of
police radar detectors.
cell phone while driving.
heavy vehicles to launch an overtake, on road with less than therr lanes.
heavy vehicles from entering highways and mainroads on Friday evenings during summer hollydays.
New Police Powers
Police can
withdrav driver's licence on the spot. Final on revocation decision is made by a municipal authority whithin 5 days.
close off a vehicle to prevent driver from continuation in driving.
prevent drived from driving if he refuses alcohol or drug test test.
require a bail security if it suspects driver of avoiding authorities.
Municipal police can measure speed, stop drivers, impose fines, and require alcohol test.
New Prison Sanctions
Driving while heavily drunk can be qualified as crime with up to one year imprisonment.
The maximum sentence for driving while heavily drunk raises from one to three years in cases of repeated offenders, public transport drivers, or in case of an accident.

Table 3: Summary Statistics of RTA Related Casualties (July 2004 - June 2008)

Country	Period	Fatalities	Serious Injuries	Slight Injuries	Per 10^6 Inhabitants			Per 10^6 Cars			Population / 10^6	Number of Cars / 10^6	Cars per Inhabitant
					Fatalities	Serious Injuries	Slight Injuries	Fatalities[1]	Serious Injuries	Slight Injuries			
A: Totals by periods before and after July 1 2006													
Czech R.	Before	2264	9089	55743	221.4	888.82	5451.15	572.49	2298.32	14095.65	10.23	3.95	0.39
	After	2089	7829	49699	202.78	759.98	4824.38	489.55	1834.72	11646.9	10.3	4.27	0.41
Austria	Before	1550	14015	80354	188.91	1708.15	9793.57	372.86	3371.4	19329.69	8.2	4.16	0.51
	After	1452	14262	80254	174.96	1718.54	9670.41	342.03	3359.5	18904.31	8.3	4.25	0.51
W. Germany	Before	8238	118533	575241	125.45	1805.01	8759.7	222.56	3202.37	15541.09	65.67	37.01	0.56
	After	7682	116706	579315	116.97	1777.05	8821.09	202.26	3072.76	15252.8	65.67	37.98	0.58
E. Germany	Before	2579	35605	130202	153.29	2116.35	7739.17	305.31	4215.09	15413.95	16.82	8.45	0.50
	After	2258	33898	130770	135.64	2036.22	7855.23	263.07	3949.3	15235.4	16.65	8.58	0.52
B: Proportional change between before and after periods													
Czech R.	-	-0.08	-0.14	-0.11	-0.08	-0.15	-0.12	-0.15	-0.2	-0.17	0.01	0.08	0.071
Austria	-	-0.06	0.02	0	-0.07	0.01	-0.01	-0.08	0	-0.02	0.01	0.02	0.010
W. Germany	-	-0.07	-0.02	0.01	-0.07	-0.02	0.01	-0.09	-0.04	-0.02	0	0.03	0.026
E. Germany	-	-0.12	-0.05	0	-0.12	-0.04	0.02	-0.14	-0.06	-0.01	-0.01	0.02	0.027

NOTES: First and last 6 months were dropped to make within-country comparison free of seasonal effects. Number of fatalities for the Czech Republic refer to people who died within 24 hours of an accident, for Austria and Germany to people who died within 30 days of the accident.
SOURCES: Headquarters of the Police of the Czech Republic, Statistics Austria, Federal Statistical Office Germany, and Eurostat.

Table 4: Summary of Transport and Economic Statistics (Means of 2004/2005 and 2007/2008)

Country	Period	Km driven per Car	Passengers per Car	Passenger-km per Car	Age of Cars	Freight Transport (Vehicle-km/10^6)	Highways (km)	GDP per Capita in 2005 Euros
A: Totals by periods before and after July 1 2006								
Czech R.	Before	9180	1.89	17338	10.7	15230	555	9297.8
	After	11128	1.50	16715	11.1	16760	657	12283.7
Austria	Before	15737	1.08	16972	8.3	10197	1677	29444.8
	After	15943	1.06	16963	8.6	9972	1696	31466.7
W. Germany*	Before	N.A.	N.A.	N.A.	8.2	103378	12268.5	29065.9
	After	N.A.	N.A.	N.A.	8.1	117538	12594	30161.2
E. Germany	Before	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	20142.9
	After	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	21203.4
B: Proportional change between before and after periods								
Czech R.	-	0.212	-0.205	-0.036	0.041	0.100	0.184	0.321
Austria	-	0.013	-0.014	-0.001	0.034	-0.022	0.011	0.069
W. Germany	-	N.A.	N.A.	N.A.	-0.011	0.137	0.027	0.038
E. Germany	-	N.A.	N.A.	N.A.				0.053

Notes: Values of age of cars, freight transport, and highways refer to whole Germany.
Sources: Eurostat.

Table 5: Effects of the New Traffic Law on Fatalities

	(1)	(2)	(3)	(4)	(5)
T	−.075	−.074	−.004	.031	.007
	(.055)	(.052)	(.058)	(.055)	(.081)
2006 Q1 × Czech R.		.023			
		(.123)			
2006 Q2 × Czech R.		−.015			
		(.130)			
2006 Q3 × T			−.402*	−.341*	−.431*
			(.103)	(.111)	(.131)
2006 Q4 × T			−.097	−.036	−.151
			(.121)	(.141)	(.173)
2007 Q1 × T			−.138	−.163	.096
			(.159)	(.172)	(.270)
2007 Q2 × T			−.068	.026	.048
			(.110)	(.157)	(.143)
adj. R^2	.599	.599	.600	.549	.337
N	1560	1560	1560	840	960

Notes: The outcome variable in specifications (1) to (5) is monthly log of fatalities per 10^6 cars in Austrian, Czech, and German regions between 2004 and 2008. Specification (5) is run on a sample without distant regions of Austria and Germany. The outcome in specification (6) is log fatalities per 10^{11} passenger-kilometers (data available only for Austria and the Czech Republic). All specifications include region dummies and unrestricted set of month-year effects. Huber-White standard errors clustered on regions are in parentheses: * $p < 0.01$.
Sources: Headquarters of the Police of the Czech Republic, Statistics Austria, Federal Statistical Office Germany, and Eurostat.

Table 6: Effects of the New Traffic Law, Controlling for GDP and Transport Variables

	(1)	(2)	(3)	(4)	(5)	(6)
T	−.057	.001	.134	−.081	−.008	−.027
	(.085)	(.056)	(.098)	(.133)	(.137)	(.139)
2006 Q3 × T	−.377*	−.405*	−.489*	−.326*	−.408*	−.338*
	(.091)	(.102)	(.121)	(.142)	(.141)	(.158)
2006 Q4 × T	−.074	−.084	−.184	−.022	−.105	−.022
	(.120)	(.138)	(.137)	(.157)	(.155)	(.195)
2007 Q1 × T	−.115	−.140	−.161	−.128	−.093	−.110
	(.162)	(.159)	(.161)	(.161)	(.159)	(.169)
2007 Q2 × T	−.055	−.060	−.091	−.058	−.052	.060
	(.109)	(.113)	(.116)	(.112)	(.116)	(.168)
Log GDP per capita	.261				.848*	.966
	(.374)				(.377)	(.572)
Log of freight transport		−.174			−.029	−.103
		(.374)			(.457)	(.591)
Log cars per capita			−1.687		−2.645*	−1.316
			(1.067)		(1.271)	(1.003)
Average age of cars				.495	.328	−.035
				(.599)	(.711)	(.499)
adj. R^2	.600	.600	.601	.600	.601	.548
N	1560	1560	1560	1560	1560	840

Notes: Outcome variable is log of fatalities per 10^6 cars. Specification (6) is run on a sample without distant regions of Austria and Germany. All specifications include region dummies and unrestricted set of month-year effects. Huber-White standard errors clustered on regions are in parentheses: * $p < 0.01$.
Sources: Headquarters of the Police of the Czech Republic, Statistics Austria, Federal Statistical Office Germany, and Eurostat.

Table 7: Czech Traffic Police Activity in 2006 and 2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Manpower	Manpower in Enforcement	Manhours in Enforcement	Speed Gun Hours	Targeted Actions	Media Activity	Manhours in Enforcement	Speed Gun Hours	Targeted Actions
2006 Q1	.029†	.031	−.019	−.102†	−.034	−.059	−.019	−.102†	−.034
	(.015)	(.021)	(.037)	(.053)	(.076)	(.058)	(.037)	(.053)	(.076)
2006 Q3	.021	−.001	−.092†	−.196†	−.021	.026	.044†	−.060	.115†
	(.019)	(.005)	(.025)	(.045)	(.049)	(.054)	(.025)	(.045)	(.049)
2006 Q4	.031†	.048†	−.130†	−.195†	−.013	−.045	.006	−.059	.123
	(.012)	(.017)	(.019)	(.040)	(.135)	(.076)	(.019)	(.040)	(.135)
2007 Q1	.030†	.030	−.057	−.137†	−.213	−.281†	−.057	−.137†	−.213
	(.018)	(.039)	(.037)	(.058)	(.163)	(.100)	(.037)	(.058)	(.163)
2007 Q2	.028	.038	−.139†	−.179†	−.136	−.366†	−.139†	−.179†	−.136
	(.024)	(.047)	(.033)	(.045)	(.149)	(.152)	(.033)	(.045)	(.149)
2007 Q3	.030	.055	−.187†	−.262†	.228	−.311†	−.051	−.126†	.364†
	(.024)	(.046)	(.043)	(.050)	(.151)	(.127)	(.043)	(.050)	(.151)
2007 Q4	.034	.100†	−.272†	−.583†	.573†	−.377†	−.136†	−.447†	.709†
	(.028)	(.038)	(.060)	(.084)	(.181)	(.166)	(.060)	(.084)	(.181)
Deseazoned	-	-	-	-	-	-	yes	yes	yes
adj. R^2	.965	.956	.808	.819	.611	.944	.808	.819	.611
N	192	192	192	192	192	192	192	192	192

Notes: Outcome variables are in logs, 2006 Q2 is the omitted quarter. All specifications include region dummies. Deseasoning is done using coefficient for second half-year estimated on country-level half-yearly data on man-hours in enforcement from 2005 to 2008. Huber-White standard errors clustered on regions are in parentheses: † < 0.1.
Sources: Headquarters of the Police of the Czech Republic.

Table 8: Czech Traffic Police Alternative Activities in 2006 and 2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Persons at Large Found	Stolen Cars Found	Persons Checked	Suspitious Items Checked	Persons at Large Found	Stolen Cars Found	Persons Checked	Suspitious Items Checked
2006 Q1	.124	.297†	.074	−.176	.124	.297†	.074	−.176
	(.199)	(.162)	(.089)	(.165)	(.199)	(.162)	(.089)	(.165)
2006 Q3	.000	.320	.247	−.375	.136	.456†	.383†	−.239
	(.160)	(.234)	(.208)	(.314)	(.160)	(.234)	(.208)	(.314)
2006 Q4	.357†	.603†	.240	−.371	.493†	.739†	.376†	−.235
	(.175)	(.231)	(.164)	(.312)	(.175)	(.231)	(.164)	(.312)
2007 Q1	.337†	.630†	.493†	−.005	.337†	.630†	.493†	−.005
	(.136)	(.271)	(.256)	(.355)	(.136)	(.271)	(.256)	(.355)
2007 Q2	.341†	.256	.400†	.349	.341†	.256	.400†	.349
	(.205)	(.209)	(.201)	(.232)	(.205)	(.209)	(.201)	(.232)
2007 Q3	.285	.437†	.366†	.246	.421†	.573†	.502†	.382
	(.177)	(.230)	(.198)	(.320)	(.177)	(.230)	(.198)	(.320)
2007 Q4	.331†	.521	.333†	−.174	.467†	.657†	.469†	−.038
	(.124)	(.346)	(.155)	(.431)	(.124)	(.346)	(.155)	(.431)
Deseazoned	-	-	-	-	yes	yes	yes	yes
adj. R^2	.277	.514	.900	.687	.277	.514	.900	.687
N	181	130	192	192	181	130	192	192

Notes: Outcome variables are in logs, 2006 Q2 is the omitted quarter. All specifications include region dummies. Deseasoning is done using coefficient for second half-year estimated on country-level half-yearly data on man-hours in enforcement from 2005 to 2008. Huber-White standard errors clustered on regions are in parentheses: $\dagger < 0.1$.
Sources: Headquarters of the Police of the Czech Republic.

Table 9: Before-After Studies From Other Countries

Country [DPS Introduced] Study	Data Description	Length of After-Period	Effects	
			Initial 6 Months	Beyond
Brazil [January 22 1998]				
Maffei de Andrade et al. (2008)	Death certificates city of Londrina.	7 years	Yes	Yes
Liberatti et al. (2001)	Pre-hospital care city of Londrina.	6 months	Yes	N.A.
Poli de Figueiredo et al. (2001)	Public data on RTA casualties for Brazil and emergency room data for downtown Sao Paulo.	12 months	Yes	N.A.
Ireland [October 31 2002]				
Butler et al. (2006)	Retrospective survey of all acute admissions of traumatic aetiology.	2 years	Yes	No
Donnelly et al. (2005)	RTA related hospital admissions.	6 months	Yes	N.A.
Healy et al. (2005)	Hospital admissions with RTA related spinal injuries and public data on fatalities.	12 months	Yes	No
Hussain et al. (2005)	Retrospective survey of patients who had operations for RTA related maxillofacial injuries.	12 months	Yes	Yes
Lenahan et al. (2005)	RTA related acute trauma services in Cork Univ. Hospital.	12 months	Yes	N.A.
Italy [June 30 2003]				
Benedettini & Nicita (2009)	Aggregate public data on fatalities and speeding infractions.	5 years	Yes	No
Zambon et al. (20082007)	Observational study of seat belt use (Veneto region) and public data on casualties.	18 months	Yes	Yes
Farchi et al. (2007)	Healthcare data on emergency department visits hospitalizations and deaths (Lazio region).	12 months	Yes	No
ISTAT (2005)	Police data on deaths and injuries.	18 months	Yes	No
Spain [July 1 2006]				
Paulido et al. (2010)	Public time-series on accidents with fatalities in non-urban areas.	18 months	Yes	Yes

Notes: Effects beyond initial 6 months are marked as N.A. if the after-period does not extend beyond 6 months, or it is 12 months long but study does not disaggregate analysis into shorter periods.

Table 10: Czech DPS - Selected Offenses

7 points	
	Driving under heavy influence of alcohol. Refusal of blood or breath test. Causing of an accident resulting in death or serious injury. Not announcing or running off an accident with casualties or high damage. Driving without appropriate license.
6 points	
	Driving under influence of alcohol (blood alcohol concentration over 0.03%). Violation of ban of overtaking . Driving into grade crossing while it is not allowed. Driving despite licence revocation. U-turns, backing, or driving in wrong dirrection, on highways or places whete it not allowed.
5 points	
	Speeding in a municipal area by more than 40 km/h or outside of municipality by more than 50 km/h. Driving an automobile without valid technical certificate or health certificate. Not stopping after a signal orderitng to stop the vehicle, or instruction by an entitled person.
4 points	
	Not allowing/jeopardising pedestrian to cross on crosswalk. Failing to give a right of way. Driving under light influence of alcohol (blood alcohol concentration under 0.03%).
3 points	
	Holding of cell phone while driving. Jeopardising of another driver while changing lines. Speeding in a municipal area by more than 20 km/h or outside of municipality by more than 30 km/h. Running off an accident.
2 points	
	Driving in tram lane, unless allowed. Failing to use seat belt or usechild seat. Failing to stop on a crosswalk.
1 point	
	Driving into pedestrian zone. Unlawful use of restricted lane. Unlawful parking. Failing to use lights. Failing to obey other traffic signs.