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Reckless Driving in Portugal: The Deterrent Impact of Increased Penalties on Traffic Accidents*

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Introduction

Portugal is among the few OECD countries that are often cited as examples every time traffic statistics are published. Unfortunately, the reason is that it tops the charts on accident and mortality figures. Also unfortunate is that the underlying causes remain a matter of speculation.

This paper is the first systematic look at traffic policy in Portugal. It is the first of three parts[1] of a government-funded effort at sponsoring an empirical analysis of Portuguese policy on road mortality. Given that temporal statistics on traffic accidents have only recently begun to be collected, we are limited to traffic policies that have been implemented in the 1990s. We are also limited to aggregate data, given that there is no systematic collection on individual-level data in Portugal. Specifically, we examine the impact of a sentencing policy that raised the statutory penalties for reckless driving and other traffic offences in the mid 1990s. In 1995, Portugal ranked second only to Hungary in fatality rates on motorways (Page 2001). Were Portuguese drivers deterred by this increase in the severity? To what extent is this policy change associated with a reduction in the accident rate resulting in injury? It has become commonplace in criminology, especially among European criminologists (Tonry 2005), to almost expect an absence of a relationship between criminal acts and punishment, thus, of course contradicting deterrence theory. The bulk of the deterrence literature does not support the theory that changes in the severity of punishment for a penalty for a given offence have an effect on the commission of that offence (Paternoster 1987; von Hirsch et al. 1999). This is particularly so when these changes are looked at independently of changes in the certainty of punishment and trade-off effects between deterrent

[1] Parts two and three involve the elaboration, administration and analysis of the first national survey of driving attitudes and behaviour.

components that level the rise in the expected cost of punishment are ignored (Grasmick and Bryjak 1980; Mendes and McDonald 2002).

We do not believe that we will find any evidence to support an affirmative answer to our research question. An unscrutinised look at the traffic accident figures numbers in the recent years certainly does not lead us in that direction. It is our opinion that any reduction in traffic accidents in Portugal is more likely to be the result of a change in civic attitudes and behaviour at the wheel than from changes in penalties. Given that our present research design does not allow us to fully pursue this hypothesis, it is, of course, too soon for us to be able to address this issue. For now, we can only settle on a test of a deterrent impact on the motor vehicle accident rate in Portugal.

The paper is organised as follows. Following a brief review of the literature on traffic accidents and mortality, we review the principal policies implemented in Portugal since the restoration of the democratic regime in the mid-1970s. Next, we conduct an interrupted time-series to analyse the particular policy interventions occurring between 1995 and 2004. We finish with a discussion of the results.

Traffic Safety: Deterrence vs. Civility

Although the beginnings of the literature on traffic safety date back to the late 1930s (Holcomb 1938), it was not until the late 1970s and early 1980s that empirical studies proliferated. It has since this time remained an active subject in applied public policy studies. One way to approach and summarize this literature is to identify two broad categories of studies dealing with traffic safety, independent of choice in the type of research design. One category of studies examines the effect of diverse government interventions aimed at deterring drivers from breaking the law, and, in this way, reducing traffic accidents and fatalities. The second category of studies looks at the

effects of policies that invest in road safety educational or awareness campaigns to achieve the same goal.

The first category of studies is by far more numerous. Most of the literature focuses on negative deterrence, both perceptual and aggregate level. These studies investigate the effect of one or both of two types of deterrent strategies: 1) the threat of detection and punishment through legal and administrative sanctions, and 2) the disincentive of alcohol consumption through economic control policies. Both sets of studies fit under the negative deterrence label (Ehrlich 1973), given that both subsets of literature are aimed at increasing the expected cost of drunk and reckless driving.

Most studies dealing with traffic safety investigate the efficacy of some form of punishment in discouraging traffic offences, most especially alcohol-related violations of the law. Since reckless and drunk driving is a form criminal behaviour, governments´ primary way of curbing it is to encourage compliance with the law by way of deterrence policies. Governments take it upon themselves to establish and enforce a system of controls so as to provide crime prevention and road safety. In doing so, they lay the foundation for an orderly transit system. Towards this end, governments rely on strategies that have, at least in theory, a chance of achieving these goals in the timeliest manner. Deterrence theory is a doctrine that makes that foundation possible by supplying a means with which to provide predictability in individuals´ behaviour. It is based on the assumption that individuals are rational beings. As such, individuals in society are induced to comply with the law through their reactions to incentives and disincentives.

The most researched deterrence policies in the literature on traffic safety fall into three groups: 1) enforcement policies; 2) punishment policies; 3) regulatory policies. The first group of policies deals with the certainty of punishment in that they increase

the probability of getting caught breaking the law. Empirically speaking, of the three groups, this one is generally found to have the most significance; many studies only report significant results for this category. These policies include more visible police patrol efforts, sobriety checkpoints, and breath tests (Rhee and Zhang 1993; Jessie and Yuan 1998; Benson, Rasmussen, and Mast 1999; Schults et al. 2001; Fell et al. 2003; Richardson and Houston 2005). With respect to the second category, punitive policy tools in the literature on traffic safety fall under the category of legal and/or administrative sanctions. These basically refer to changes in fines and jail terms, as well as administrative forms of punishments, such as mandatory license suspension/revocation, and vehicles impoundment (Lanza-Kaduce 1988; Ross and Gonzales 1988; Legge Jr. 1990a; 1990b; Legge Jr. and Park 1994; Yu 1994; Dougherty 1999; Benson, Rasmussen, and Mast 1999; McCarthy 1999; DeYoung 2000; Schults et al. 2001; Briscoe 2004; Richardson and Houston 2005). Regulatory policies refer to changes in the blood alcohol limit, changes in the minimum legal drinking age, mandatory seat belt laws, mandatory vehicle inspections, and ignition interlock inhibition programs (Fuchs and Leveson 1967; Cook and Tauchen 1984; Loeb and Gilad 1984; Asch and Levy 1990; Legge Jr. 1990a; Legge Jr. and Park 1994; Loeb 1990; Keeler 1994; Fowles and Loeb 1995; Weinrath 1997; Jessie and Yuan 1998; Mann et al. 2001; Dee 2001; Eisenberg 2003).

Since deterrence is about creating and modifying existing opportunities available to individuals, alcohol consumption control policies are also deterrent strategies. They are based on the increase in the cost of the consumption of alcohol. The idea of raising the price of alcohol through taxation so as to discourage its consumption is of course sensitive to the elasticity of demand. Numerous studies have examined the price elasticity so as to infer an effect of such policies on drunk driving (Grossman et al.

1987; Saffer and Grossman 1987; Coate and Grossman 1988; Laixuthai and Chaloupka 1993; Chaloupla et al. 1993; Kenkel 1993; 1996; Mullahy and Sindelar 1994; Chaloupka and Wechsler 1996).

A second grand category of studies on traffic policies is grounded on a moral dimension of human behaviour. The goal here is not to discourage prospective reckless driving by upping the costs associated with it, but rather to foster law-abiding driving by appealing to or instilling a sense of civility.[2] Some authors believe the threat of legal sanctions to be ineffective, especially with its target population—frequent drunk and reckless drivers. In fact, although it makes sense to expect that individuals respond to incentives, these authors believe that this segment of the population does not perceive the threat of legal punishment in the same way as individuals who drink socially or who do not drink and drive at all (Houston and Richardson Jr. 2004). At best, deterrent policies end up deterring those drivers who on occasion break the law, thus, contributing minimally, if at all, to the reduction of the accident rate.

A different type of road safety policy is directed at changing drivers´ attitudes and behaviours through publicity and advertisement campaigns that create a negative social construct surrounding the undesired or offending behaviour—in the case at hand, reckless and drunk driving (Ross 1984; West et al. 1989; Tay 1999; 2002; 2004; 2005) and produce a sort of "threat of embarrassment" (Berger and Snortum 1986; Lanza-Kaduce 1988; Green 1989; Akers 1990; Grasmick, Bursik, Jr., and Arneklev 1993). This approach is based on the premise of social learning theory that claims that criminal behaviour, as any other behaviour, is learned and that it is the result of exposure to different ideas and practices. In this way, greater self-discipline on the motorways is something that can be aspired to by changing patterns of behaviour, cultures, customs,

[2] Some authors argue that deterrent strategies promote this positive change in drivers´ behaviour in the long run (Andenaes 1971; Snortum and Berger 1989; Deshapriya and Iwase 1996).

and definitions that are contrary to the ones initially instilled or taught to be socially acceptable.

Portuguese Legal Reforms

The seriousness of the traffic problem in Portugal has prompted the national government to enact several laws throughout the last ten years. The approval of the 1994 Driver's Code,[3] replacing the previous 1954 Code, was the first organized and coherent effort to adopt comprehensive traffic policy legislation. In January 1998, the Portuguese parliament approved new legislation increasing fines for serious and very serious driving offences. The goal of this shift in legislation was to increase severity under the presumption that this would curb reckless driving, resulting in a significant reduction in the number of traffic accidents and road injuries and deaths. All previous laws had been piecemeal attempts to solve specific traffic problems and had failed to induce desirable road behaviour.

Our period of analysis excludes these piecemeal legislative changes prior to 1994, beginning January 1995 and ending December 2004. This period is marked by three major modifications to the Code. Firstly, in January 1998, the Portuguese government approved legislation targeted at specific deterrence, i.e. individuals with reckless driving recurrent behaviour. This legislation established criteria to characterize drivers as recidivistic and to increase the maximum limits of traffic fines.

The second major change during this ten-year period was the introduction of a legal limit of 0.2 g/l (grams per litre) of blood alcohol level.[4] Drunk-driving offences are regarded by the general public as one of the major causes of traffic accidents and fatalities, and this new, extremely stringent limit was considered to be a way to produce

[3] Law-Decree 114/94, May 3.
[4] Law-Decree 162/2001, May 22 and Law-Decree 265-A/2001, September 28.

significant reductions in these statistics. However, this decision did not hold for a long period of time. In fact, only eleven months after its statutory adoption, the 0.2-g/l level was revoked and the 0.5 g/l level was restored as the legal limit again[5] as a result of pressures from the wine industry, one of the largest interest groups in the Portugal.

The third main change in traffic policy was the introduction of mandatory "on-the-spot" payment of fines.[6] In order to assure higher efficacy in the application and collection of fines, this policy makes it compulsory for drivers stopped for a specific offence, to immediately pay the fine for that offence, as well as any other outstanding fines he or she may have.

The policy changes enacted throughout the period, clearly point to an emphasis on the severity component of deterrence, although celerity of punishment is addressed by mandatory "on-the-spot" payment of fines approved in October 2001. The effect of both components is relatively easy to test when compared to the effect of changes in the certainty of punishment. Portuguese traffic policy has systematically failed to concentrate on the certainty component of deterrence.

Data and Methods

In this section, we conduct an interrupted time-series analysis. Specifically, a Box-Tiao impact assessment analysis is employed to test the impact of the increase in fines as well as the introduction of "on-the-spot" payment of fines upon the number of traffic accidents and victims per registered vehicle. Public authorities promoting these policies anticipate a reduction in the rate of accidents, injuries and fatalities. Below we describe

[5] Law 20/2002, August 21. A 0.5 g/l level is a 0.05 BAC (Blood Alcohol Concentration) or 0.05 of alcohol by volume.
[6] Law-Decree 265-A/2001.

the empirical models estimated, including the dependent variables, control variables, and intervention variables.

The interrupted time series structural model is

$$yt = X_t\beta + \mu_t$$

where μ_t is the noise component of the series modelled as an ARIMA process.

Following the model-building procedures recommended by McDowall et al. (1980), we identified an ARIMA $(0,1,1)(0,1,1)_{12}$ model specification characterising the noise component (μ_t) of our interrupted time series models. The series were regularly and then seasonally differenced. The regularly and seasonally differenced series were then set equal to 1st and 12th-order moving averages. The disturbance of the structural equation is modelled as:

$$\mu_t = \varepsilon_t - \theta_1\varepsilon_{t-1} - \theta_{12}\varepsilon_{t-12}$$

Similar noise components characterise the fatalities per registered vehicles series and the injuries per registered vehicle series.

We examine three dependent variables: 1) Accidents with victims per registered vehicle (Accident Rate) 2) Fatalities per registered vehicle (Fatality Rate), and 3) Total injuries in traffic accidents per registered vehicle (Injury Rate) from January 1995 to December 2004. These data were provided by the *Direcção Geral de Viação* (*Department of Motor Vehicles*). The Portuguese Automobile Trade Association provided the number of registered vehicles.

Two control variables are used: vehicle inspections and precipitation. Vehicle safety inspections were made mandatory in Portugal in 1993. The number of automobile safety inspections per registered vehicle has increased significantly over the years covered by

our series and is thought to have had some impact in reducing the rate of road accidents. The rate of traffic accidents is likely to increase as a result of bad weather. The amount of precipitation (in millilitres) is employed to control for weather conditions. Vehicle inspections data is also available from the Department of Motor Vehicles and rainfall amounts are collected and made available by the Portuguese Institute of Meteorology. Table 1 presents descriptive summary statistics of all of the variables used.

Ideally, certainty should be measured by indicators such as the probability of arrest or convictions for traffic violations, but these are not currently available in Portugal. We acknowledge that, in testing deterrence-based policies, it is important to include variables for all deterrence components, at this point, data limitations do not allow a full test of deterrence-based traffic policies.

At this time, we also do not have data allowing the estimation of these interventions on gender or age groups. It is certainly possible that only certain groups change their behaviour as a product of these policy decisions, but, at this point, nothing can be stated regarding this.

With regard to the policy interventions, the first intervention took place in February 1998, the 37th month of these series. The second intervention occurred at on October 2001, the 81st month of our series, when "on-the-spot" payment of fines began. Figures 1, 2, and 3 represent both interventions in the non-differenced series. The first month of each series is January 1995, which allows us to conclude that each series peaks seasonally in the months of July and August. The three series show a clear downward trend during the period of analysis, without any abrupt shifts.

[Figures 1-3 about here]

Findings

Table 2 show the results of the Box-Tiao Intervention estimation. The findings show that none of the policy interventions caused the reductions observed in the three series under analysis. Portuguese drivers also do not appear to fear being stopped for reckless driving. One rival reason for the lack of significant intervention results is the absence of implementation of these deterrence-based policies. The increase in the upper interval of the amount of fines charged may fail to dissuade reckless driving behaviour if police officers systematically apply fines in the lower bound. This kind of downward biased implementation is likely to render ineffective the increase in fines.

As we have previously argued, the certainty component of deterrence cannot be tested at this moment, but the fact that drivers' perceptions of being caught (and punished) are likely very low is the most plausible reason for the ineffectiveness of "on-the-spot" payment of fines.[7]

The automobile inspections variable has a negative impact on accidents, fatalities and injuries, confirming our prior expectations that safety inspections are fundamental when it comes to accident prevention. The result for the fatalities' series is extremely robust, and it can be interpreted that each 100,000 vehicle-inspections saves 12 human lives. The cost-benefit impact of this result is certainly arguable, but the role played by inspections in accident prevention is incontrovertible.

The other control parameter—precipitation—is positive across the board and statistically significant in two out of three estimations. This is consistent with the idea that bad weather conditions negatively affect road safety.

[7] We also tested the impact of changes in BAC levels, but the findings were never statistically significant. The frequent law changes on the subject sends mixed signals and stimulate erratic rather than predictable behaviour.

Discussion

These results do not come as a surprise, since prior findings by Houston and Richardson (2002) indicate that deterrence-based policies may increase perceptions of severity and certainty of punishment, but fail to translate into a significant change in behaviour. This argument certainly explains why public authorities and the general Portuguese public are usually extremely supportive of policy measures aiming at cracking down on reckless driving, but these policies do not translate into substantial impacts on the number of accidents and victims.

There are two possible reasons for why these numbers do not reveal any deterrent effect associated with the increased severity of punishment, aside from the model specification limitations discussed above. As mentioned above, three features that produce the expected cost and that are under the immediate control of government authorities are: certainty of punishment (through the probability of arrest and/or the probability of convictions), the severity of punishment, and the celerity of punishment. Authors often argue that merely raising the penalties without investing in the perception of a higher probability of detection is the easy way for legislators to raise the expected cost of punishment. To register a dissuasive effect in the potential criminal's mind, conviction must follow arrest and punishment must follow conviction; if criminals go unpunished, arresting loses much of its influence. On the flip side, if the severity of punishment for a given crime increases and drivers perceive that they are not getting caught, the increase in severity loses its dissuasive effect. For deterrent strategies to have any chance for success, they need to address the criminal behaviour as a "package" (Mendes and McDonald 2002; Mendes 2004).

Even as "packages", deterrent policy mixes may be doomed to failure. Bad driving may be the result of important factors other than what deterrence effects can tell us.

Portugal is often criticized for having long, winding roads. Several of the main highways are often cited as being unsafe. This, one would think, would require cautionary driving, however, the typical Portuguese driver is not known for being courteous. The friendliness disappears once he or she gets behind the wheel. Hidden police surveillance videos often reveal the most shocking and aggressive manoeuvres. Generally speaking, Portuguese drivers are risk takers; as such, the perceived expected cost of punishment behind deterrent prospective isolated changes in policies is likely to be underestimated. A different and/or complementary policy approach—one that shoots for self-discipline—is needed.

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Figure 1

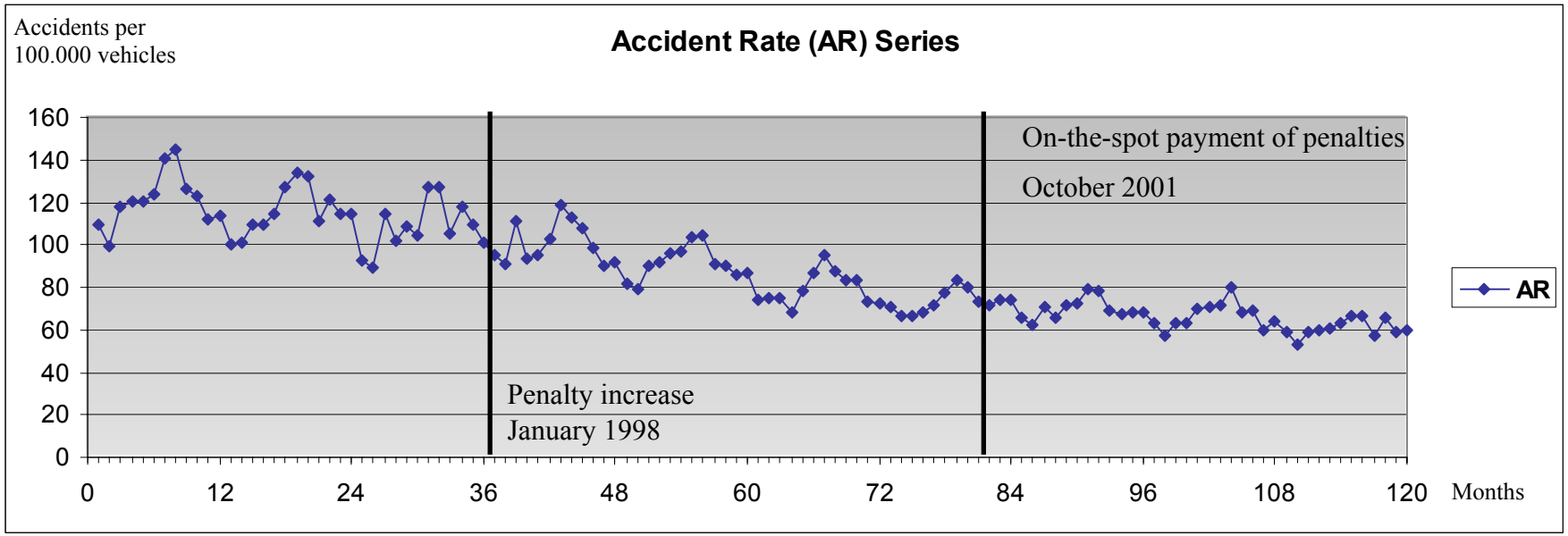
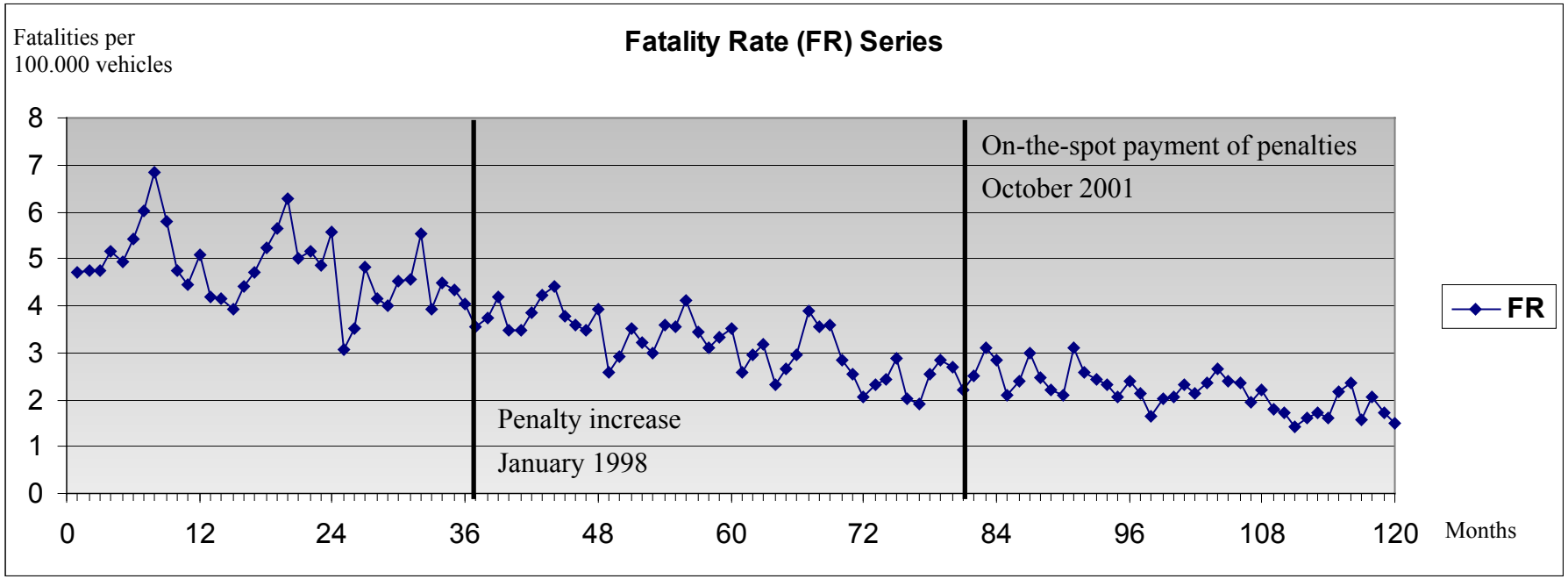

Accidents per
100.000 vehicles
Accident Rate (AR) Series
160
140
120
100
80
60
40
20
0
0
12
24
36
48
60
72
84
96
108
120
Months
On-the-spot payment of penalties
October 2001
Penalty increase
January 1998
AR

Figure 2


Fatalities per
100.000 vehicles
Fatality Rate (FR) Series
On-the-spot payment of penalties
October 2001
Penalty increase
January 1998
FR
Months
0
1
2
3
4
5
6
7
8
0
12
24
36
48
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72
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96
108
120

Figure 3

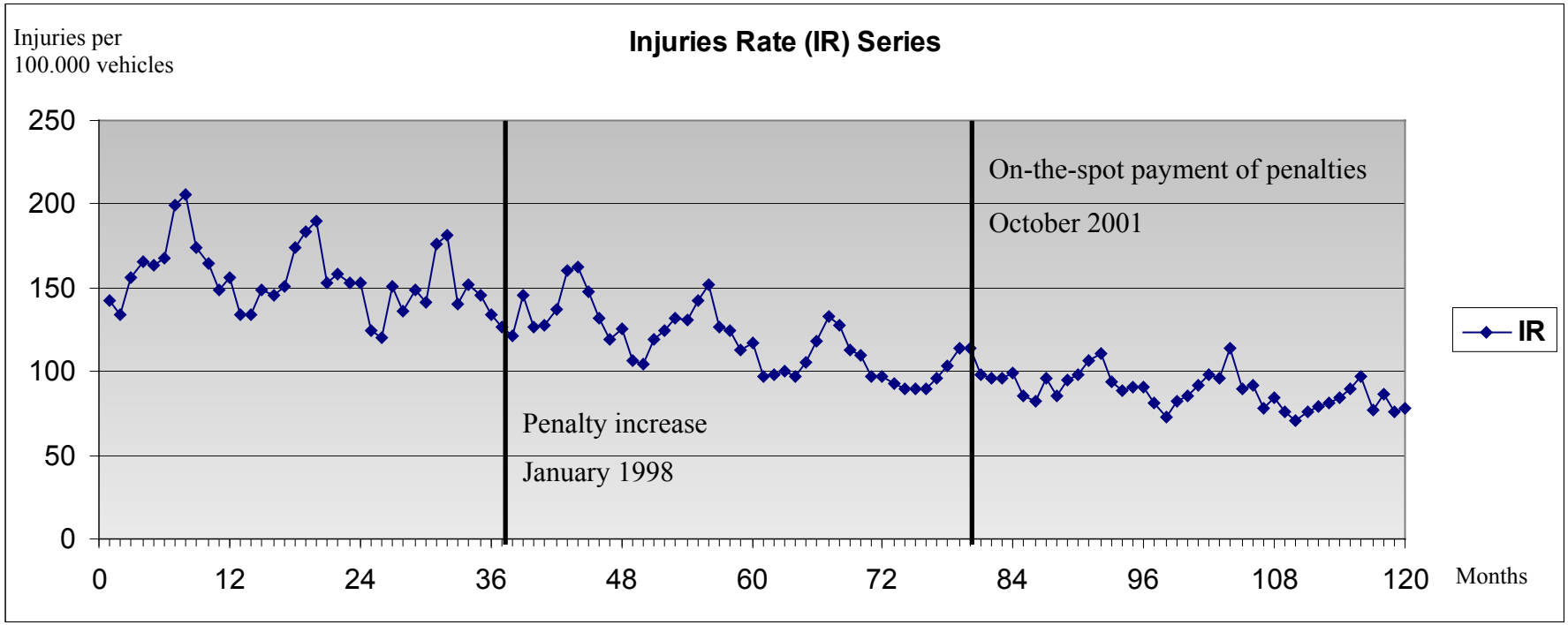
Injuries per
100.000 vehicles
Injuries Rate (IR) Series
250
200
150
100
50
0
0
12
24
36
48
60
72
84
96
108
120
Months
Penalty increase
January 1998
On-the-spot payment of penalties
October 2001
IR

Table 1 – Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
Accident Rate Series	88.68556	22.32678	53.43077	144.519
Fatality Rate Series	3.336469	1.217721	1.402263	6.830723
Injury Rate Series	119.6753	31.58426	70.772	206.0552
Fines (0-1)	.7	.460179	0	1
On the spot Payment (0-1)	.325	.4703387	0	1
Automobile Inspections	6266.783	1557.065	2678.22	10837.68
Precipitation	74.985	73.532	.2	321.3

Table 2 – Box-Tiao Intervention Analysis (Step Function Models)

	Accident Rate	Fatality Rate	Injury Rate
Intervention Parameters			
Fines	.059	.023	.272
	(.765)	(.055)	(1.10)
	0.08	0.42	0.25
On the spot Payment	.209	-.004	.312
	(.763)	(.050)	(1.10)
	0.27	-0.07	0.28
Control Parameters			
Automobile Inspections	-.0012	-.00012***	-.0020
	(.0008)	(.00005)	(.0013)
	-1.45	-2.69	-1.46
Precipitation	.008*	.0004	.013**
	(.005)	(.0003)	(.006)
	1.79	1.44	2.04
Noise Parameters			
MA (1)	-.397***	-.456***	-.402***
	(.149)	(.136)	(.130)
	-2.67	-3.36	-3.10
MA (12)	-.700***	-.585***	-.661***
	(.166)	(.165)	(.151)
	-4.23	-3.54	-4.37
σ	5.156***	.428***	7.27***
	(.501)	(.039)	(.670)
	10.29	11.10	10.85
Constant	-.730	-.051	-1.32
	(.597)	(.050)	(.814)
	-1.22	-1.03	-1.62
χ^2	27.19	29.26	28.86
Prob > χ^2	0.000	0.000	0.000
N	107	107	107

Standard Errors in parentheses; t-statistics below standard errors;
σ is the estimated variance of the white noise parameter