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Transportation Research Part A 40 (2006) 205–226
TRANSPORTATION RESEARCH PART A
www.elsevier.com/locate/tra

Traffic safety: Speed limits, strict liability and a km tax

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Received in revised form 29 May 2005; accepted 10 June 2005

Abstract

This paper focuses on two specific determinants of accidents: speed and the activity level. If there is no government intervention, people do not take into account the full cost of their driving and they will drive too fast and too much. In our setting, the government can use three instruments to influence the behaviour of people: speed limits, strict liability and a kilometre tax. We analyse the choice of the speed and activity level under the different instruments and determine the optimal combinations. Given our assumptions we never reach the social optimum. The results are illustrated with a numerical example.

JEL classification: R41; R48; K13

Keywords: Transport; Law and economic; Liability; Regulation; Accidents

1. Introduction

Road accidents are a serious public health problem and impose a serious economic burden. They are estimated to represent up to 4% of GDP in some countries (OECD, 2002). Therefore it is not surprising that there is intensive activity in many European countries to combat road accidents. The government can use different instruments to improve traffic safety such as regulation (speed limits,[1] vehicle standards, etc.) and its enforcement, liability rules (strict liability,

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[1] Note that speed limits only influence traffic safety if there is no congestion.

0965-8564/$ - see front matter
doi:10.1016/j.tra.2005.06.003

negligence), physical measures (roundabouts, speed humps, etc.), economic instruments (road pricing, insurance, etc.), education and sensitisation.

One of the main causal factors of accidents is the behaviour of people; 85% of all accidents are mainly due to road users' error, 10% is attributed to imperfect roadway design and other environmental factors and 5% to vehicle defects (Lonero et al., 1995). Here we focus on the behaviour of people; more particularly, we focus on their choice of speed and on the number of kilometres they drive. We consider three specific instruments: a speed limit, strict liability[2] and a kilometre tax. Car drivers may be induced to drive at a reasonable speed by letting them bear the accident cost (liability) and/or by setting speed limits and enforcing them (regulation). The activity level, this is the number of kilometres one drives can be influenced by strict liability and by the use of a tax. Indirectly, the activity is influenced by regulation because it is a function of speed.

We use a theoretical model of traffic accidents based on Shavell (1984)[3] to analyse the choice of speed and activity of people under the different instruments. The aim is to provide rules for the optimal combination of these instruments.

The structure of the paper is as follows. We first explain the assumptions we use to build our model. Secondly, we consider each instrument, strict liability, regulation and a kilometre tax as an instrument on its own. Next, we consider the behaviour of people under combinations of instruments. Note that in the base model we assume that people comply with regulation. This is obvious a strong simplification, which we relax in Section 5. Next, we illustrate the model with a numerical example. Finally, we conclude.

2. The model

We consider unilateral accidents. In this kind of accidents only one party, the injurer, can prevent the accident and the other party, the victim, bears all the losses. We assume that the losses can be expressed purely in pecuniary terms. Furthermore, we assume that both parties are risk neutral. Hence there is no need for insurance.

As an example throughout the text, we think of an accident between a bicycle and a car. We assume that only the car driver can take care by adjusting his speed and that if an accident happens only the cyclist experiences the losses.[4]

For the individual car driver the cost of driving, $C(x,t)$ is a continuous function of speed, x, and the value of time, t. $C(x,t)$ comprises the time cost of the trip (with t the value of time), the resource costs and the own accident cost.[5] We assume that the cost of driving for a given value of time is decreasing and convex in the level of speed. The cost of driving at a given level of speed is increasing and linear in the value of time, $C_t > 0$, $C_{tt} = 0$. We also assume that if speed rises, the

[2] Strict liability means that if A damages B, then A is liable for that damage.

[3] Shavell's model (1984) provides a framework which considers regulation and liability as means to control accident risks. We apply this model to traffic safety and extend it by incorporating the activity level, a kilometre tax and imperfect compliance with the speed limits.

[4] In reality, the cyclist also influences the probability of an accident.

[5] Given that we assume unilateral accidents, the own accident costs are zero in our model. See for example Peirson et al. (1998) for a discussion of which costs are external and which are internal to the driver.