

MICROECONOMICS 3

CASE MATERIAL #4

LAW & ECONOMICS

Speed cameras

Law & Economics (sometimes also referred to as the Economic Analysis of Law) consists in a broad application of (micro)economic theory to various branches of law, including criminal law and the phenomenon of crime itself. According to this approach we expect that incentives created by the law influence actions undertaken by actors making (rational) choices. Those designing the law may therefore encourage members of the society to perform actions allowing to achieve certain goals that are desired (by the society). A particularly important category included in these analyses is the *sanction*, i.e. a consequence of breaching the law, specified in the legal norm, applied and enforced by organs of the state. Economic analysis of law allows, inter alia, to determine the optimal sanction from the point of view of deterring from unlawful behavior, as well as suggests types of punishment that minimize the social costs of crime. Let us analyze, from this point of view, the functioning of speed cameras, a controversial issue for many societies around the world: Can they be an effective means for deterring drivers from speeding? Can their application be regarded as (cost)efficient? What purpose do they really serve – increasing road safety or improving the state of public accounts?

Speed management

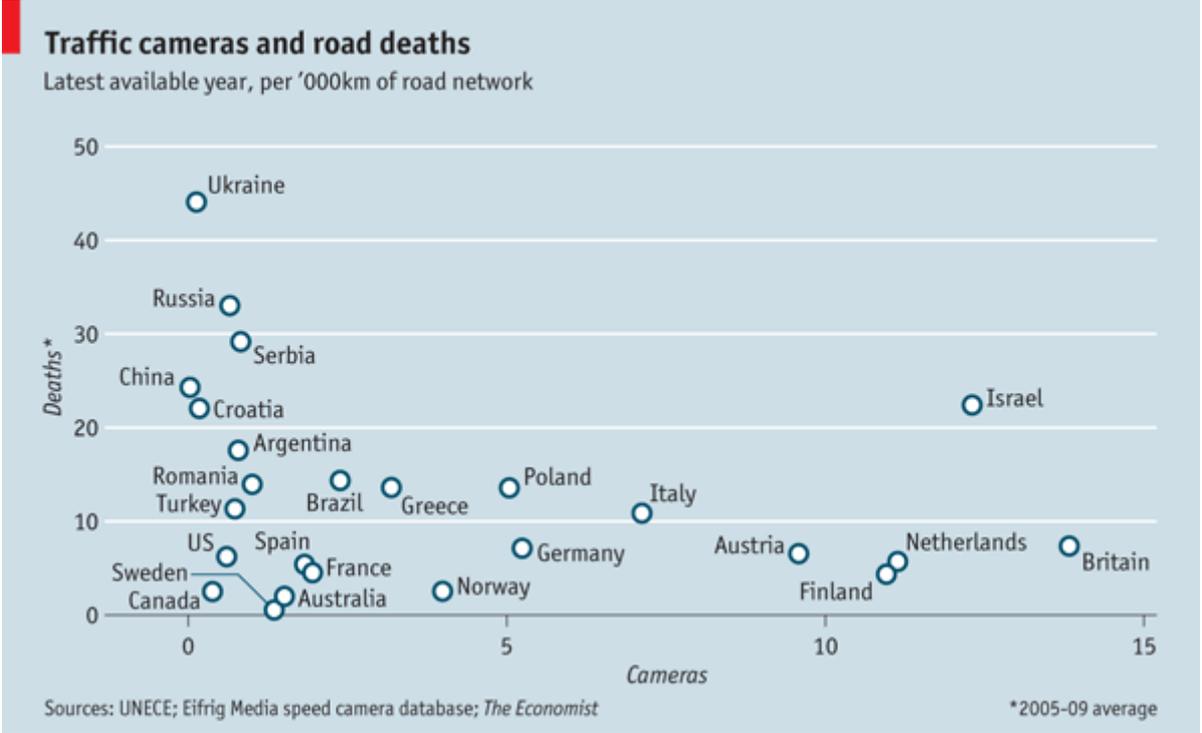
Thanks to speed people and goods reach their destinations sooner, but at a cost, especially in terms of death, injury and damage in collisions, and in the emission of carbon dioxide. The prevailing speeds stem from the choices that drivers make on each stretch of road as they drive on it. As drivers, we see ourselves as gaining immediately from higher speed through earlier arrival, and possibly the pleasure of going faster. We do bear some of the cost ourselves (mainly increased running costs and personal risk), but we tend to underperceive these costs. Additionally, in most cases we do not ourselves bear any of the human costs to others of collisions, or much of the resulting damage to the environment. Therefore, it is inherent in the road traffic system that many of us tend to go somewhat faster than is good for the society. It would thus be wrong for each of us to be free to choose how fast to drive. 'Speed management' is provided centrally by the government (at various levels) and consists primarily in moderating it. This does not just mean reining in a less responsible minority of blatant speeders; it requires all of us who drive to participate in it, even if we are tempted to think of ourselves as very responsible citizens (Allsop, 2010).

Speed cameras and efficiency

One of the instruments used for controlling and moderating speed within the road traffic system are speed cameras. Traffic enforcement cameras (photo radars), in general, are cameras which may be mounted beside or above a road, as well as installed in an enforcement (usually police) vehicle, to detect traffic regulation violations, e.g. speeding (speed cameras), passing on a red traffic light, or unauthorized use of a bus lane. It may be linked to an automated ticketing system. The use of traffic cameras in many countries of the world is a highly controversial issue. While proponents of this solution maintain that an increase in the number of cameras results in fewer deaths in accidents on the roads, opponents complain that they are merely ‘money spinners’ for local governments at the motorist's expense.

Figure 1 presents some general evidence about the use of traffic cameras in different countries of the world and the number of deaths resulting from traffic accidents. The graph is certainly a biased reflection of the potential relationship between installing speed cameras and road deaths (e.g. it does not account for traffic volume and generally cannot reflect a causal relationship). Nevertheless, it provides a first look at the effectiveness of traffic cameras and the result is inconclusive. This can also be a consequence of many other factors contributing to road safety, such as population density, the conditions/quality of vehicles and roads, and other measures aimed at limiting speed and protecting pedestrians (see question 1).

Figure 1. Traffic cameras and road deaths



Source: http://www.economist.com/blogs/dailychart/2011/01/daily_chart_traffic_cameras_and_road_safety

In order to assess the efficiency of speed cameras from the point of view of economic analysis of law one should compare the expected (marginal) benefits from such solution with its (marginal) costs, taking at the same time into account incentives that the presence/threat of speed cameras, and the sanctions for breach of traffic laws (excessive speed) connected with them, generate for the driver, i.e. the *deterrent effect*. The classical theory differentiates between two types of deterrence – *general deterrence* and *specific deterrence*. In both cases the starting point is the microeconomic concept of utility and rational choice theory. It is assumed that users of roads decide whether to commit an offence consisting in a breach of traffic laws, or not, based on a rational calculation of expected (perceived) benefits and costs of such behavior. The key factors in this respect indicated by deterrence theory, also with regard to enforcing traffic laws, are: the perceived unavoidability of punishment, the swiftness in inflicting it, and the severity of punishment. General deterrence consists in exerting influence on a potential ‘road criminal’ by continuously informing him/her about the threat connected with detecting the offence and the consequences of it. Such actions are directed at all users of roads independently of whether they have already committed such offence or not. Examples of this are random tests for presence of alcohol in the breath of drivers or the possibility of a general random control by the police. Specific deterrence consists in discouraging persons who have already been caught as breaching traffic regulations, from committing subsequent offences, based on the experience connected with their seizure and the consequences that have been applied. An example of such mechanism are tickets. Comparing these two mechanisms one can conclude that the effects of specific deterrence actions have a much more limited scope than those allowing for general deterrence (the former influence only behavior of those, who have already breached, and can reach others only indirectly and in a limited extent). Therefore the severity of punishment is more important in the case of specific deterrence than general deterrence actions, in particular with respect to repeated breaches (see questions 2 and 3).

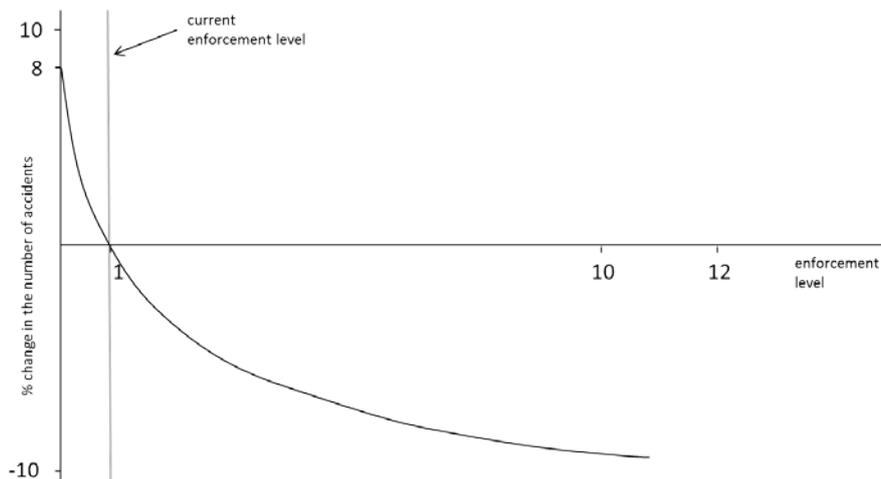
The potential influence of installing speed cameras on the reduction of the number of road accidents (in particular those resulting in death) has been the topic of numerous empirical studies conducted for various countries. To start with, they indicate the following factors directly influencing accident rates:

- the driving speed (as a certain feature of a given car in a given situation on the road, not a traffic rule),
- compliance with traffic regulations (e.g. driving on the appropriate side of the road, using turn signals – in general, actions making the functioning of the road traffic more predictable),
- the driver’s capabilities (including constraints stemming from alcohol consumption or fatigue),
- technical condition of the vehicle.

Driving with a high speed is an additional factor limiting the driver’s capabilities (by strongly constraining the possibilities of his/her reactions to various situations on the road), as well as increases the negative consequences of accidents (including the probability of fatal accidents). It is via this ‘driving speed channel’, as well as ‘compliance with traffic regulations’, that the influence of traffic cameras on accident rates is revealed. On the basis of a series of empirical studies Elvik (2001) presents a generalized relationship between the intensity of enforcing speed limits and accident rates, as illustrated by Figure 2. The relationship is not linear, we can notice diminishing marginal

benefits from increasing the enforcement level¹. The marginal benefits are positive up to 10-12 times the baseline enforcement level (baseline level = 1). Although it is sometimes mentioned that speed cameras may actually contribute to accidents because drivers tend to brake rapidly just before the camera and then accelerate to an even higher speed once they have passed it, studies taking this aspect into account still confirm a generally positive influence of speed cameras on the reduction of the number of victims of accidents (e.g. Allsop, 2010).

Figure 2. Speed enforcement and accidents



Source: based on Elvik R., 2001, Cost-Benefit Analysis of Police Enforcement, Escape Project Working Paper no. 1, Fig. 12, http://virtual.vtt.fi/virtual/proj6/escape/escape_wp1.pdf.

However, the decrease in the number of accidents can also be partially caused by the so-called regression to the mean (or towards the mean) phenomenon (RTM). Speed cameras are often installed in places where high accident rates were earlier reported, due not only to dangerous road conditions but also because of random factors. In such localizations one could expect a drop in the number of accidents/victims irrespectively of installing the cameras. Some of the newer studies take also this phenomenon into account, however the conclusions regarding the significance of speed cameras for decreasing accident rates remain valid (e.g. Allsop, 2010).

Comparing the benefits of the functioning of speed cameras with their costs (e.g. relating to production, installation and maintenance) allows to confirm the existing positive net benefits (i.e. marginal benefits exceed marginal costs) [e.g. for Norway – Elvik (2001); for Spain (Barcelona) – Mendivil et al. (2012)]. Since a vast majority of studies conducted for various countries demonstrates effective influence of speed cameras on decreasing the driving speed and the number of fatal injuries in road accidents, while at the same time indicating net benefits of such solution for the society, why are there so many controversies about speed cameras...?

¹ The baseline driving speed enforcement level is measured by authors of these studies in various ways – by the number of road patrol hours (per km or mile in a given time period), by the number of police officers involved, or by the number of hours of radar operations in a given area and time period. According to Elvik (2001), the conclusions regarding the relationship between enforcement levels and accident rates are also applicable to speed camera enforcement.

Safety improvement or a source of budget revenues?

Those, who oppose the use of speed cameras, often raise the argument that ‘under the cover’ of improving road safety cameras actually serve as a means to acquire additional budget revenue for the public administration. Such allegations are also often pronounced in the public debate about speed cameras in Poland. According to a recent inspection of the speed camera system by the Supreme Audit Office (*Najwyższa Izba Kontroli – NIK*), there are communities (*gminy*) in Poland, which acquire even 40% of their budget revenues from the operation of speed cameras. While cameras maintained by the local government are usually installed in spots, where dangerous accidents earlier took place, “[p]ortable speed cameras in use by local and municipal police are localized mainly in ticket-abundant places and not there, where accidents frequently occur” (own translation) – emphasized Krzysztof Kwiatkowski, NIK President, during his presentation of the NIK report of the results of inspection in the field of road safety at the Polish *Sejm* (lower chamber of Parliament) in November 2014². This inspection also revealed that local governments incorrectly included the revenues from tickets in their budget accounts and as a result NIK could not assess whether revenue originating from speed cameras’ operation were actually devoted to financing improvements in infrastructure and other actions connected with road safety, as stated in the relevant legal provisions.³

This problem, raised also in other countries, was subject to detailed research by, inter alia, Garrett and Wagner (2009). For the state of North Carolina (US) in the period 1990-2003 they found significantly more tickets issued in the year succeeding a drop in state revenues, while the ticket issuing activity did not diminish in the years succeeding revenue increases. Elasticity estimates showed that a 10% increase in revenue was reflected in a 6.4% increase in the ticketing rate. These results suggest that tickets actually serve as means to generate revenue, not to improve road safety (Garrett, Wagner 2009).

References:

Allsop R., 2010, The Effectiveness of Speed Cameras, A Review of Evidence, RAC Foundation, <http://www.racfoundation.org/research/safety/effectiveness-of-speed-cameras>.

Elvik R., 2001, Cost-Benefit Analysis of Police Enforcement, Escape Project Working Paper no. 1, http://virtual.vtt.fi/virtual/proj6/escape/escape_wp1.pdf.

Garrett T. A., Wagner G. A., 2009, "Red Ink in the Rearview Mirror: Local Fiscal Conditions and the Issuance of Traffic Tickets," *Journal of Law and Economics*, Vol. 52(1), s. 71-90.

² NIK President Kwiatkowski presented the details in the following way: „[L]ocal and municipal police organize their control activity, as the law requires, in places agreed upon with the state police, but this is so only at the beginning and end of their activity. In the meantime, with their mobile speed cameras, they move to places, which were not agreed upon with the state police, however bring higher revenues for the *gmina* or municipality. Preventive and repressive actions of some local and municipal policemen, is almost completely concentrated on maintaining speed cameras.” (NIK President’s speech at the *Sejm* on November 27, 2014, <http://www.nik.gov.pl/plik/id,7588.pdf>, in Polish, own translation)

³ <http://forsal.pl/artykuly/838301,nik-przenosne-fotoradary-sa-ustawiane-dla-pieniedzy-a-nie-dla-bezpieczenstwa.html> (in Polish)

Mendivil J., García-Altés A., Pérez K., Marí-Dell'Olmo M., Tobías A., 2012, "Speed cameras in an urban setting: a cost-benefit analysis", *Injury Prevention*, 18(2), s. 75-80.

Tay R., 2010, "Speed Cameras. Improving Safety or Raising Revenue?", *Journal of Transport Economics and Policy*, Vol. 44(2), s. 247–257.

Questions for discussion:

1. What factors may cause that with a relatively low number of installed speed cameras the accident rate is also low? (looking at Figure 1 compare e.g. Canada or Sweden with Russia or Ukraine)
2. Provide examples of actions directed at limiting excessive speed on the roads, which allow for general deterrence and specific deterrence. What are their advantages and disadvantages? Which could be expected to be more effective?
3. In Poland, as in many other countries, visible road signs inform the driver about approaching a speed camera. Compare the expected effects of the functioning of such solution with a situation when the camera would operate 'by surprise'. Why are such signs applied?
4. To punish or to reward? That is a question... It is not surprising that drivers usually complain about speed cameras. How would they react to a solution, where those driving below the speed limit would be photographed by the cameras so as to allow them to be 'rewarded' for complying with the speed limit? Such experiment, called the Speed Camera Lottery, was organized in 2010 in Stockholm. Pictures of drivers complying with the speed limit, made by a speed camera, were entered into a lottery and eligible to win 20 000 Swedish kronor (slightly less than 10 000 zloty). The rewards were to be financed from the amount raised from tickets paid by the speeding drivers 'captured' by the camera. During 3 days of the camera's operation 25 000 cars passed by it. The average speed on the road, where the experiment was organized, dropped from an initial 32 km/h to 25 km/h (reduction by 22%⁴). A similar solution was proposed in Queensland, Australia, but the police objected arguing, in the words of the Queensland Police Minister, that "[w]e will reward drivers who don't speed by not fining them"⁵. Discuss the advantages and disadvantages of the Stockholm solution. What could be the reasons for anxiety in Australia?⁶
5. In the period 1995-1998 there was no speed limit on interstate highways in Montana, US. Signs indicated that one should drive in a way which is 'reasonable and prudent'. Data gathered by the Federal Highway Administration for Montana following the introduction of speed limits in 1999 showed that in absence of limits people drove slower and safer. The number of deaths resulting from accident doubled (increased by 111%) when more restrictive laws limiting speed were introduced. Paradoxically, the effects of introducing speed limits, desired from the safety point of view, were

⁴ http://wheels.blogs.nytimes.com/2010/11/30/speed-camera-lottery-wins-vw-fun-theory-contest/?_php=true&_type=blogs&_r=1

⁵ <http://nudges.org/2010/10/12/what-do-stockholm-police-think-of-the-speed-camera-lottery/>.

⁶ For those, who are interested, the Speed Camera Lottery discussed through the lens of gamification: <http://www.gamification.co/2013/04/25/gamification-breakdown-of-the-speed-camera-lottery/> <http://pl.paweltkaczyk.com/czy-fotoradary-moga-byc-fajne-grywalizacja-kodeksu-drogowego/> (in Polish)

actually achieved in the absence of limits (the so-called Montana Speed Limit Paradox). How was this possible? What kind of behavior of drivers could have led to such result?

6. How could roadside memorials dedicated to victims of road accidents (usually taking the form of symbolic crosses) influence the behavior of drivers? Could they substitute speed cameras?

7. The number of road accidents in Poland has been steadily falling during the recent years – see Table 1 below. The main cause of fatal accidents caused by drivers is the failure to adjust the driving speed to the traffic conditions (ca. 42% of all accidents and deaths in accidents caused by drivers in 2013). What factors could have influenced this downward trend? To what extent could it be an effect of the functioning of the speed camera system?

Table 1. The number of road accidents and their consequences in the period 2004-2013

Year	Accidents		Deaths		Injured	
	Total	2004=100%	Total	2004=100%	Total	2004=100%
2004	51069	100	5712	100	64661	100
2005	48100	94.2	5444	95.3	61191	94.6
2006	46876	91.8	5243	91.8	59123	91.4
2007	49536	97	5583	97.7	63224	97.8
2008	49054	96.1	5437	95.2	62097	96
2009	44196	86.5	4572	80	56046	86.7
2010	38832	76	3907	68.4	48952	75.7
2011	40065	78.5	4189	73.3	49501	76.6
2012	37046	72.5	3571	62.5	45792	70.8
2013	35847	70.2	3357	58.8	44059	68.1

Source: Polish Police Headquarters (Komenda Główna Policji), 2014, Road accidents in Poland in 2013, p.7, <http://statystyka.policja.pl/download/20/137223/WYPADKIDROGOWE2013.pdf>.