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An assessment of the safety effects of the French speed camera program

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ABSTRACT

This article presents the results of an evaluation of the speed camera program implemented in France in November 2003. The effects of this program on traffic casualties were estimated using interrupted time-series analyses. Various parametizations were attempted in order to capture changes in the constant and the slope of our traffic injury series. Results of the study reveal significant decreases in both fatal and non-fatal traffic injuries on the whole road network following deployment of the speed camera program. The fatality rate per 100,000 vehicles fell by 21% whereas the decrease in non-fatal traffic injuries displayed a decay function: a 26.2% reduction was recorded in the first month but dropped to 0.8% for the last observation of the series.

1. Introduction

Speeding is one of the leading causes of traffic injuries. Between 30 and 50% of all fatal crashes are speed-related (WHO, 2004). In order to prevent speed limit violations, numerous countries have implemented speed camera programs (Blais and Dupont, 2005; Wilson et al., 2011). In their systematic review, Pilkington and Kinra (2005) report that: (1) all but one study found evidence that speed cameras were effective in reducing average speeds and (2) all studies reported decreases in fatal as well as non-fatal traffic crashes.

Some studies have also investigated specific issues related to automated speed enforcement programs (ASEP) (see Cameron and Delaney (2006) for a synthesis about specific effects according to specific speed camera programs). It is well documented that compared to the localized effect of visible cameras on speeds and crashes, hidden cameras produce general effects on all the roads of a traffic network (Keall et al., 2001, 2002). Evidence from the British–Columbia program in Canada, also suggests that the impact of an enforcement program on speeds is greater when a fine is imposed as compared to just sending a warning letter (Chen et al., 2000).

There is nonetheless little knowledge about the long-term effect of introducing an ASEP or about the functional form of its relation to traffic crashes. Most previous studies used rather short time periods and conducted simple before-and-after comparisons or modeled the effect of the program as a step function (Chen et al., 2000, 2002; Keall et al., 2001, 2002; Perez et al., 2007; Retting and Farmer, 2003). Using such an approach rests on the questionable assumption that introducing a speed camera program will produce an immediate and permanent change in the constant of the series of crashes. This approach is also limited since it gives relatively little guidance about the optimal allocation of resources to speed enforcement (Tay, 2005; Elvik, 2011).

These previous observations echo those found in two recent studies. First, in a Cochrane review of speed enforcement detection devices based on 35 studies, Wilson et al. (2011) reported that it was difficult to either estimate the overall magnitude or the significance of the effects of speed camera programs on traffic casualties. Studies integrating relevant confounding factors and based on lengthy follow-up periods are needed (Wilson et al., 2011). Second, Elvik (2011) developed an accident modification function to describe the functional form of the relationship between traffic law enforcement by police officers and a decrease in crashes. Based on 63 data points found in 13 studies, it appears that the relationship between accidents and enforcement is best expressed as a logarithmic or inverse function.

Using the case of the French ASEP, the following study attempts to estimate the effect of this program on traffic injuries and fatalities using a seven-year follow-up period. Attempting to model the effect of the ASEP using different functions will shed light on the long-term effect of the French ASEP and also on the relationship between the number of citations issued by speed cameras and relative decreases in crashes. This article is organized as follows: this section presents the characteristics of the French ASEP. Section 2

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describes the methodology used while the last two sections present and discuss the results.

1.1. The French context

Before implementation of the ASEP, France's traffic fatality rate was higher than that of several OECD countries. In 2000 for instance, its traffic fatality rate was 13.6 per 100,000 population in comparison to 9.1, 7.7 and 6.7 for Germany, Finland and Sweden, respectively. The OECD average stood at 11.6 (Australian Transport Safety Bureau, 2008). For the same period, according to the *Observatoire national interministériel de la sécurité routière* (ONISR), speed limit violations were a major concern for French authorities. Over 60% of all recorded speeds exceeded the prescribed speed limits: 40% by more than 10 km/h, 5% by more than 30 km/h (ONISR, 2006).

Part of the problem was the lack of effective enforcement. A survey conducted by the ONISR (2006) showed that one could exceed the speed limit by 10 km/h for a period of 2000 h before being arrested. The arrest risk in Denmark, for instance, was 75 times greater. In order to improve the situation, President Chirac announced, in July of 2002, that traffic safety was among the top priorities of his next five-year term. A few weeks later, three distinct traffic safety measures were announced: (1) implementation of the ASEP, (2) increased severity of penalties for traffic violations and (3) creation of new traffic offenses. In the period between Chirac's announcement and the effective introduction of the ASEP, print and visual media provided wide and positive coverage of the new policy (Carnis, 2011).

1.2. Program description and strategy

The first photo radar devices were installed in November 2003 after a trial period (between March and November 2003). Since then, roughly 500 radar devices have been installed each year. By 2010, more than 2,756 speed cameras — 1,823 fixed devices and 933 mobile ones — were operating throughout the public road and highway network (Carnis, 2011). Warning signs alert drivers to the presence of fixed photo radars but not to mobile ones and controls are conducted in unmarked police vehicles.[1] Fixed devices are generally installed close to "black spots", or near areas experiencing high levels of speed limit violations whereas location of the mobile radars used in various speed enforcement contexts will depend on police officers' knowledge and strategy.

The ASEP can be considered as a combination of general and specific deterrence, since fixed photo radars should dissuade potential offenders from speeding whereas mobile devices should deter those who are caught and penalized. The expected effectiveness of the ASEP rests on three basic principles of deterrence theory (Gibbs, 1979). The first invokes the certainty of punishment, which is the probability of being detected and sentenced for a speed limit violation. Building a credible ASEP means gridding the road network with enough speed cameras to yield a high probability of detection and punishment. The second principle is swift punishment. The fine is sent to the car owner in less than 8 days following detection of the offense and demerit points are then added to the driver's record. The third principle concerns the severity of punishment. Accordingly, the amount fined and the demerit points added are proportional to the speed excess (Carnis, 2008, 2011).

1.3. Prior investigations of the French ASEP

Implementation of the ASEP led to a radical increase in traffic citations issued for speed limit violations. Respectively, 110,000 and 502,000 citations were issued per month before-and-after the introduction of the program. More than 87% of all citations are now issued by speed cameras (Carnis, 2008). Estimates of average speeds show a marked drop since 2002: the average was 90.5 km/h in the first quarter of 2002 and 81.6 km/h in the third quarter of 2007. Significant reductions have also been observed in the proportion of speeding vehicles. The rate of infringements of more than 10 km/h over the speed limit decreased by 56% for private cars and by more than 33% and 36%, respectively, for motorcycles and trucks (ONISR, 2006).

A first evaluation concluded that the ASEP was responsible for 75% of the decrease in traffic fatalities for the 2002–2005 period (ONISR, 2006). This estimate should be considered with caution since it is based on a rough application of Nilsson's formula (Nilsson, 2004).[2] The variation in the mean traffic speed is not necessarily related to introduction of the ASEP and a short time period was considered. Furthermore, it appears that the formula is sensitive to the road environment. In a recent study, Cameron and Elvik (2010) show that Nilsson's power model does not appear to be directly applicable to traffic speed change on urban arterial roads.

Further studies investigating the long-term effect of the ASEP are required, with special emphasis on the form of the relationship between the introduction of the program and its evolution through time (Carnis, 2008). Such studies are especially relevant since the French Government plans to further increase the number of photo radar devices in use to 4500 by 2012, in order to lower the number of traffic fatalities to about 3000, which would represent a reduction of 15% in comparison to 2010 (when 3499 fatalities were recorded).

2. Method

2.1. Data

Data on traffic injuries come from the *Fichier national des accidents corporels de la circulation*, a national database managed by the ONISR, which contains information about traffic crashes and injuries. The ONISR defines a crash as an event in which damages are caused by a moving vehicle. The database contains the essential information gathered at the crash scene by police officers. The police officer on duty at the scene of a crash must fill up a *Bulletin d'Analyse d'Accident Corporel de la Circulation* (BAAC): a report detailing the main characteristics of the crash scene, vehicles and victims. Data on the French vehicle fleet are published by the *Comité des constructeurs français d'automobiles* (CCFA).[3]

2.2. Variables under analysis

2.2.1. Dependent variables

In the present study, the effect of the ASEP is estimated based on two dependent variables. The first dependent variable is the number of non-fatal traffic injuries per 100,000 registered vehicles (property-damage-only crashes are excluded from this category).

[1] Following the proposition of a ministerial committee, gradual removal of warning signs has been in effect since the second half of 2011.

[2] Nilsson developed a power model to estimate the relationship between changes in speeds and variations in traffic crashes at various level of injury severity (Nilsson, 2004). If the speed limit decreases, the crash risk is reduced as well as the level of injury severity. As summarized by Cameron and Elvik (2010: 1908), "(i)ncreases in fatal crashes are related to the 4th power of the increase in speed mean, increases in serious casualty crashes (those involving death or serious injuries) according to the 3rd power, and increases in casualty crashes (those involving death or any injury) according to the 2nd power".

[3] Data on traffic injuries are published in the ONISR annual report and can be found online at www.ladocumentationfrancaise.fr (last accessed 30 July 2012). Data on vehicles are available online at: http://www.unionroutiere.fr/wp-content/uploads/2012/04/chapitre-2_vehicules-faits-et-chiffres-2011.pdf (last accessed 17 April 2012).