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The effect of cell phones on international motor vehicle fatality rates: A panel-data analysis

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ABSTRACT

This paper analyzes the effects of cell phone usage and economic freedom on motor vehicle death rates by estimating regression models on data for three years across 38 countries. The models incorporate a representative set of motor vehicle fatality determinants. Results indicate that cell phone use has a statistically significant nonlinear impact on highway death rates and that economic freedom does not appear to have an effect.

1. Introduction

There is considerable variation in motor vehicle death rates across countries and over years. For example, in the year 2004, fatality rates (deaths per 100,000 people) were as high as 30.07 in Botswana and as low as 3.24 in Malta; and in 1999 Botswana had a lower rate (28.46), while Malta had a higher rate (4.05) in 2001 (International Road Federation, 2006). Possible reasons for such variation warrant investigation. This paper analyzes per capita motor vehicle deaths for three years (2000, 2002, and 2004) across 38 countries for which data were available.[1] The analysis accounts for two factors not considered in previous empirical studies of international highway fatalities: cell phone usage and the level of economic freedom within the country.

This study's format is as follows: The first section reviews previous international research on motor vehicle deaths. A model that explains these fatalities is specified in the second section. The third section describes the data set used in the analysis. Regression estimates of the model are reported and discussed in the fourth section. The final section summarizes the paper's findings.

2. Previous international research on motor vehicle fatalities

Prior analyses of international data on motor vehicle deaths vary in terms of the number of countries considered, the data sources utilized, the statistical methods employed, as well as dependent and independent variables chosen. Dependent variables include standardized measures such as per capita injury fatality rates (Hijar et al., 2000) and deaths per motor vehicle (van Beeck et al., 2000). They also include aggregates such as total fatalities (Page, 2001; Noland, 2003, 2005).

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[1] The set of 38 countries used here was chosen based upon two criteria. Data availability across years and variables limited the number of countries. Given that constraint, the countries in this analysis represent a wide cross section of geographic regions, cultures, and economic and political circumstances. While not perfectly representative of all countries in the world, there is considerable diversity.

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Explanatory variables used in previous international studies fall into general categories: economic conditions, driver characteristics, exposure to accidents, driving conditions, medical treatment and technology, and fuel economy. Empirical measures utilized to represent economic conditions typically involve Gross Domestic Product (GDP) (van Beeck et al., 2000; Bester, 2001; Noland, 2003, 2005), but Page (2001) used employed population. Driver characteristics include age information (Page, 2001; Noland, 2003, 2005) and alcohol consumption (Page, 2001; Noland, 2005).

To account for both exposure to accidents and driving conditions, researchers used: passenger car ownership and percentage of vehicles not passenger cars (Bester, 2001); vehicle fleet per capita and percentage of buses and coaches (Page, 2001); and vehicles per capita (Noland, 2003, 2005). Noland (2003, 2005) accounted for medical treatment (physicians per capita) and technology (average acute care days in hospitals). To include fuel economy, Noland (2005) used the average fleet vehicle fuel economy. Specific findings pertaining to the effects of explanatory factors included in these international studies are noted in the next section.

3. Model

Five categories of explanatory factors are explicitly included in the model: economic conditions, driving conditions, driver characteristics, freedom of choice, and medical treatment. The model's general form is:

$$\text{DEATHSPC} = f(\text{GASPRICE}, \text{INCOMEPC}, \text{GDPGROWTH}, \text{POPDEN}, \text{ALCOHOLPC}, \text{CELLPC}, \text{ECFREEDOM}, \text{MEDTREAT}) \quad (1)$$

where DEATHSPC = motor vehicle deaths per capita; GASPRICE = gas price; INCOMEPC = income per capita; GDPGROWTH = economic growth rate; POPDEN = population density; ALCOHOLPC = alcohol consumption per capita; CELLPC = cell phones per capita; ECFREEDOM = economic freedom; MEDTREAT = medical treatment.

The expected relationship between each explanatory factor and the death rate is explained below.

The net impact of gas price on fatalities is uncertain a priori. Higher gas prices should reduce driving and might also encourage slower driving speeds, leading to fewer accidents and fatalities. However, higher prices could encourage the purchase of smaller, more fuel efficient vehicles, which place occupants at greater risk of injury and death. Loeb et al. (1994, p. 19) note that empirical studies reported conflicting results on this issue.[2] Noland (2005) finds statistically insignificant relationships between total motor vehicle fatalities and fuel economy internationally.

Income's effect on motor vehicle deaths is also uncertain a priori. Assuming that safety and driving intensity are normal goods, higher income should increase the demand for both. Because of the offsetting impacts of these two factors, Peltzman (1975) hypothesizes that it is unclear whether fatalities would increase or decrease with income. Loeb et al. (1994, pp. 18–19) indicate that time-series studies support the positive relationship between income and deaths, while cross-sectional and pooled analyses provide counter evidence. The international evidence on the relationship between fatalities and income is also inconclusive (van Beeck et al., 2000; Noland, 2003, 2005).

The amount of driving should correspond directly to the overall level of economic activity. In particular, stronger economic circumstances should lead to greater use of motor vehicles and hence more accidents and deaths. U.S. evidence in support of this conjecture is provided by Evans and Graham (1988). They find a negative relationship between the unemployment rate and highway fatalities. Consistent with this, Page (2001) reports a significant positive relationship between employed population and total fatalities internationally in a pooled cross-section study.

A priori the impact of population density on fatalities is uncertain. As noted by Peltzman (1975), two offsetting forces are at work. On the one hand, the likelihood of accident, and hence death, should increase with density. However, by reducing vehicle speed greater congestion lessens the probability of fatality in the event of an accident. Specifically with respect to population density, Loeb (1988) and Fowles and Loeb (1989) find that this factor has a significant negative relationship with U.S. death measures. In his study of OECD countries, Page (2001) reports a significant negative relationship between the percentage of urban population and the number of motor vehicle fatalities.

The model includes two measures to capture driver characteristics: alcohol consumption and cell phone use.[3] Conventional wisdom maintains that driving while intoxicated increases the likelihood of accidents and deaths. Consistent with this, Loeb et al. (1994, pp. 20–21) report findings of a significant positive association between alcohol usage and highway fatalities in the U.S. Noland (2005) and Page (2001) found analogous results using international data.

None of the international studies mentioned in the previous section controlled for the effect of cell phones. Since using a cell phone while driving creates a distraction, such usage may contribute to highway fatalities. However, having a cell phone may facilitate prompter arrival of emergency medical service after an accident, which could save lives. Estimating a nonlinear model on panel data for the U.S., Fowles et al. (2010) found evidence of both life-taking and life-saving effects of cell phones on motor vehicle fatality rates. The current international study employs their nonlinear approach in its treatment of cell phones. This entails usage of first-, second- and third-order terms for the cell phone variable in the estimated regressions.

[2] Loeb et al. (1994) summarize findings of empirical studies of U.S. motor vehicle fatalities.

[3] International data on alcoholic intoxication while driving and cell phone use while driving are unavailable. Therefore, information on both of these activities for the population in general is utilized in this analysis. The assumption is made here that the behavior of drivers with regards to these activities is highly correlated with that in the general population.