Could being in the European Union save lives? An econometric analysis of the 3rd European Road Safety Action Program.

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Abstract: The 2001 White Paper entitled "Time to Decide" and its development in the 3rd European Road Safety Action Program (2003-2010) represent a clear turning point in the history of the European Common Road Safety Policy. Quantitative and measurable targets were included for the first time. After a careful analysis of the main features of this EU policy, the possible determinants of the way accident numbers have evolved in the European Union's 27 member States over the 2000-2009 period are examined using a panel data analysis. We found that the decrease in mortality rates in the EU can be explained by the influence of a variety of variables: exposure risk, better vehicles, improved roads, economic trends, vulnerable population and safety interventions, specifically the limit imposed on alcohol consumption, speed limitations and the existence of penalty-point driver license systems. Our main finding is the negative effect and statistical significance of the *Europeanization* variable (the number of years that a country has been in the EU). The cumulative nature of this variable also allows us to conclude that this process of positive imitation between member countries is not limited to the 2001 White Paper and the 3rd ERSAP, but that its significance could be understood as indirect empirical evidence of the effectiveness of the three ERSAPs executed to date.

I. INTRODUCTION.

Among the adverse road transport-related health externalities –such as air pollution, noise and global warming- the World Health Organization (WHO) highlights road traffic accidents as a major public health problem in the European Region (Racioppi et al., 2004). According to the European Commission (EC) (2010b), more than 35,000 people died and at least 1,500,000 were injured on European Union roads in 2009. And the cost for society was huge, estimated at approximately 130 billion Euros in 2009. But, as can be seen from the Avenoso & Beckmann (2005), ETSC (2006) and Wilmots et al. (2009) studies, this burden is not equally borne throughout the whole of the European Region: low and medium-income countries in the eastern and southern parts are more severely affected than high-income countries in the west.

However, as the WHO itself states, damage caused by traffic accidents can be prevented. The organization goes on to suggest that experience shows that a coordinating authority with sufficient funding, a strategic national/supranational level plan and measurable goals is indispensable for achieving a sustainable answer to the road safety problem (WHO, 2011).

Therefore, road transport and road transport safety have become important issues in common European Union (EU) policies (Threlfall, 2003) and the "Europeanization process" (Knill & Lehmkuhl, 2002), as it appears in official EU Documents on transport, especially since the Maastricht Treaty of 1992 (Bax, 2011). Road safety problems have been addressed by the four European Road Safety Action Programs (ERSAPs) devised to date (Commission of the European Communities, 1993, 1997; EC, 2001, 2003, 2010b): *the 1st ERSAP (1993-1996),* based on the awareness of the problem and the exchange of successful national experiences; *the 2nd ERSAP (1997-2001),* which takes into account the economic cost of accidents; *the 3rd ERSAP (2003-2010),* which pioneered the evaluation of ambitious targets in mortality reduction; and *the 4th ERSAP (2011-2020),* which is currently in force and follows this quantitative strategy with the introduction of the so-called "Vision-Zero". This is the contribution made by the measures included in these plans which may be considered the key factors of the European Common Road Safety Policy (CRSP) (as Table 1 shows for the three already completed).

[INSERT TABLE 1]

In short, the CRSP has moved on from being a subordinated and ambiguous approach to being an autonomous and precise action, and from a centralizing role of the

EC to a shared responsibility of Member States and road users. Thus, the way that the programs have evolved can be described by the following sequence: *Recognition of the problem* (1st ERSAP) - *Quantification of the consequences* (2nd ERSAP) –*Action through prevention, reduction and elimination* (3rd + 4th ERSAPs).

Two thousand and one was clearly an inflection point in this process for the CRSP with the publication of the White Paper entitled "Time to Decide" and its development in the 3rd ERSAP (2003-2010). In line with earlier successful experiences in leader countries, such as Australia, New Zealand, Sweden, the UK and the Netherlands, this document is considered to be a real revolution (Avenoso & Townsend, 2010; Bosetti et al., 2010), proposing quantitative targets with a time limit for the first time: *to halve the number of road fatalities from 54,300 in 2001 to no more than 27,150 by the year 2010*[1] (EC, 2001). The fact that clear and quantitative goals were set for the first time makes it much easier to evaluate the 3rd ERSAP.

For this to be achieved, the 3rd ERSAP comprises a set of measures grouped in different areas: encouraging road users to improve their behavior, making use of technical progress, encouraging the improvement of road infrastructure, safer commercial goods and passenger transport, emergency services and care for road accident victims, collecting accident data and the introduction of the "*European Road Safety Charter"* to obtain an official commitment (EC, 2003). This focus has been continued in the recent White Paper (EC, 2010b) and the 4th ERSAP (2011-2020), which both commit to halving road fatalities by 2020 with the aim of approaching "*zero fatalities"* by 2050 (ETSC, 2011).

Considering the legislative outputs of the first three ERSAPs, Table 1 once again highlights the relevance of the 3rd ERSAP (2001-2010), both with respect to the number of resolutions, directives and regulations developed (49 altogether compared to 7 and 6 in the 1st and 2nd ERSAPs, respectively), and also the breadth of the topics and sub-topics addressed, apart from the mere approval of technical issues.

Despite the relevance of the 3rd ERSAP, and how clearly quantified its targets are, its achievements for the 27 European States have not been developed to the same extent in the scientific literature. Prior to this study, we must highlight the way that researchers such as Allsop et al. (2011), Elvik (2008) and Wong et al. (2006) demonstrate the

[1] The EU safety target is in line with the Bucharest meeting of the ECMT Council of Ministers (2002), (which includes most EU States, Canada, US, Japan, Korea, Australia, New Zealand, and a few others), where the target of a 50% reduction in the number of victims killed in road traffic accidents by 2012 compared to the 2000 baseline was adopted (ECMT, 2002).

positive association between quantitative road safety targets and road fatalities reduction in general terms. However, in the case of the White Paper (2001), published studies limit themselves to the partial impact of specific measures (see Jarašūnienė & Jakubauskas, 2007 for the intelligent vehicle safety system; Strohm et al., 2005 for the effect of automotive short range radar systems; Thomas et al., 2007 on the European Road Safety Observatory).

Evaluations done to date (Bosetti, et al., 2010; EC, 2006; Jost et al., 2011) seem to point to the EU-27 not having achieved its ambitious goal as yet, despite large savings having been made in road fatalities; nonetheless, Loo et al. (2005) state that these studies have been undertaken using a simple before-after statistical comparison. In this regard, Wong & Sze (2010) note the scarcity of studies examining the degree of commitment to road safety targets in the long-term and evaluating the effect on the time-series trend in road fatalities during the time in which the targets were in effect.

In this context, our objective is to examine any factors that might determine the way that the number of road traffic accidents evolved in the 27 European Union member States during the time period of the 3rd ERSAP, which jointly with the White Paper (2001) sets quantitative targets for reductions in road traffic accidents. For this, robust econometric techniques of panel data are used. The effectiveness of different policies to prevent road traffic accidents, such as the maximum amount of alcohol allowed in the blood and of the utility of having a driver license based on a points system, will be tested, and an attempt will be made to measure the importance of certain structural factors, such as the quality of the infrastructure and the education system. An absolutely novel hypothesis will also be tested, that simply being in the European Union, with all that this entails with respect to involvement in large numbers of actions and programs like the ERSAPs, has a positive effect on road traffic accident numbers in member countries, and that the longer a country has been in the EU, the greater this effect should be.

A model has been built to achieve these aims (see Albalate, 2008, for similar specifications) which identifies the determinants of road traffic accidents on the basis of a range of exogenous variables proposed in the literature (e.g. Orsi et al., 2012). The findings will enable us to identify the factors that explain the extraordinary improvements made by countries as unalike as Portugal, Spain, Lithuania, Luxembourg, Sweden, France and Slovenia, with over 50% reductions in fatalities and an average annual fall of over 7.5 %, (EC CARE database, 2012).

The article contains five sections: following this introduction, Section 2 explains the sample studied (the 27 countries that made up the EU when the 2001 White Paper and the 3rd ERSAP were implemented), with specific mention made of their road safety strategies during the 2001-2010 period. Section 3 lays out the variables and the model used, the results of which are discussed in Section 4. The paper ends with the Conclusions and the References sections.

II. DELIMITATION OF THE SAMPLE: A COMPARISON OF NATIONAL INTERVENTIONS.

When the 2001 White Paper was published, the EU was comprised only 15 member States (Belgium, France, Germany, Italy, Luxembourg, the Netherlands, the UK, Ireland, Denmark, Greece, Spain, Portugal, Austria, Finland and Sweden) and it was progressively enlarged until it was composed of 27 countries at the end of the target period, in 2010. For Bosetti et al. (2010), the EU enlargement process has had a major impact, as the new members included between 2001 and 2010 presented poor performance in terms of road safety at the time of their accession. According to Orsi et al. (2012), the same great differences between old and new member States in terms of road fatalities that existed during the 3rd ERSAP implementation have persisted. Great gaps are even found at regional or local levels inside the same country, as revealed by Eskler et al. (2008) and Tolón-Becerra et al. (2009).

Compared to the safest countries, such as the United Kingdom (analyzed by Broughton & Knowles, 2010), the Netherlands (the *"sustainable safety"* approach, considered by Wegman, 2001) and, above all, Sweden (whose *"vision zero"* is evaluated by Loo et al., 2005, *inter alia*), where road safety strategies have been pioneered since the 1990s, at the other extreme we find the countries with the highest death rates, such as Greece (Petridou et al., 1999), and other countries where major political changes have taken place, like Germany (see Clark et al., 2000 for the impact of reunification on road accidents) and other countries that have joined the EU at the end of the target period and which have made great efforts to implement the European road safety acquis in a very short time (Mikulik, 2004), such as the Baltic countries, the Czech Republic, Romania and Bulgaria.

In short, we consider a heterogeneous study sample (27 EU member States) with significant differences in historical, demographic, economic, political, sociological and geographic mobility and cultural conditions which affect their road safety situation

(Bosetti, 2010). The major disparities in road safety across the EU-27 justify classifying member States according to their similar circumstances. Table 2 therefore lists the improvements achieved by the 27 member States during the time span of the 3rd ERSAP, considering the divisions introduced by Avenoso & Beckmann (2005) and the ETSC (2006):

- *SUNflower countries*: Northern members which have developed solid road safety policies with significant improvements and have the highest performance on road safety.
- *SEC Belt countries*: Southern, eastern and central members with higher fatality risk rates and safety indicators below the EU-15 mean. This category can also be sub-divided into 4 groups according to the special features of the countries in the division.
- *OTHER countries:* a heterogeneous group formed by old and new EU members with varying levels of road safety development.

[INSERT TABLE 2]

Using data from the CARE Database (2012), Table 2 shows the percentage change in the numbers of people killed on the road between 2001 and 2010.This is used as an indicator to rank member States and evaluate the extent to which they have complied with the White Paper (2001) + the 3rd ERSAP (2003-2010). This Table agrees with the ETSC (2011) when it indicates, in general terms, that great progress has been achieved across the EU-27, as in 2010 no country recorded figures that exceeded 2001 figures and, as a whole, there was a reduction of 43% in the number of road fatalities. However, only 8 countries reached the EU 2010 target: Latvia, Estonia, Lithuania, Spain, Luxembourg, Sweden, France and Slovenia. One other country, Ireland, fell only just short of the target, with a 49% reduction. The three Baltic countries top the ranking: Estonia and Latvia reduced road deaths by 61% and Lithuania by 58%; they are followed by Spain, with a 55% reduction, Luxembourg and Sweden both with 54%, France with 51% and Slovenia with 50%.

The Netherlands, the UK, Belgium and Portugal achieved major reductions approaching the EU 2010 target and above the EU 43%average, while the remaining countries recorded smaller improvements, and slower progress in the reduction of road fatalities has been made by Romania (3%), Malta (6%), Bulgaria (23%), Poland (29%) and Greece (33%).

From the point-of-view of the different times at which they joined the EU, the countries which originally set the EU target (2001-2010), i.e, EU15, managed a 48% reduction in road fatalities; 42.4% reductions were achieved by the group of countries that joined in 2004 (the Czech Republic, Cyprus, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Slovakia and Slovenia); and finally, the group of countries that joined in 2007 (Bulgaria and Romania) managed an average 13% reduction.

Based on the same CARE (2012) database, the ETSC (2011) estimates that if there had been no EU 2010 target, in other words, if the same number of road deaths as in 2001 had been registered throughout the decade, there would have been 102,000 more deaths in the EU. Based on updated valuations currently used in eight countries using a similar method to evaluate road safety, the ETSC estimates the monetary value to society of the human losses avoided by preventing one fatality to be 1.7 million Euros (at a factor cost adjusted to 2009 prices, purchasing power and GDP/head) (ETSC, 2011). On this basis, the total value to society of road death reductions in EU27 over the 2002-2010 period compared to 2001 is estimated at 176 billion Euros.

If both the principles of subsidiarity and proportionality (Steiner & Bozicevic, 2008) are applied, the adoption of the EU 2010 target is based on the combination of efforts at both national and EU levels (Bosetti et al., 2010). Therefore, following Larsen et al. (2008), a National Road Safety Plan (NRSP) (with measurable long- and medium-term targets, alternative road safety actions and adequate sources of funding[2]) is a must for sustainable improvements to be achieved. In this respect, Table 2 specifies the National Road Safety Plans and Safety Quantitative Targets adopted by the 27 member States with the application of the EU 2010 target.

An examination of Table 2 shows how during the study period all the EU 27 countries (including the so-called Accession Countries that joined in 2004 and 2007) have published an NRSP. With the exception of the UK, France, Germany and Luxembourg (which do not have official national programs), most of the countries report reduction targets similar to the EU 2010 target in terms of road fatalities, while several countries, such as Denmark, Hungary, Italy, Latvia, Lithuania and Malta, also extend the target to injuries.

[2] According to the Larsen et al. (2008) analysis, these documents are usually a product of government interdepartmental committees coordinated by the Ministry of Transport or its equivalent, and with participants or consultants from the road safety research community and other stakeholders.

Targets are usually based on the percentage reduction in road fatalities or injuries from a reference year, although several countries, such as Belgium, Denmark, Estonia, Finland, Poland and the Netherlands, use absolute numbers. Most countries consider 2010 to be the limit for the proposed objectives to be achieved, although some have set later years as their targets, such as 2014-2015 (e.g. Belgium, Estonia, Hungary, Malta), 2012 (Denmark and Spain) or even 2020-2025 (the Netherlands and Finland). Other countries finalize the target period before 2010, including Ireland, Portugal, Slovenia, Sweden, and, more especially, the last countries to join EU 27, Bulgaria and Romania. With respect to the duration of the target period, most countries set a period of ten years, although in some cases, countries such as Cyprus and Portugal have three- or four-year plans. The strategies implemented within these NRSPs have been documented by the ETSC (2011), IRTAD and OECD (2010, 2011).

The improvements achieved by the 27 European Member States during 2001-2010 period, as shown in Table 2, do not seem to identify with the Gitelman et al. (2010) classification into the five country groups based on varying levels of safety performance. We therefore consider that it would be appropriate for further research to be carried out in the line called for by Orsi et al. (2012) to discover the degree to which the EU 2010 target has been reached.

III. THE EMPIRICAL STRATEGY

Several studies have examined the determinants of the road fatalities rate, including several covariates as explanatory variables (Orsi et al., 2012; Page, 2001): proxy variables linked to level of economic progress, to traffic safety policies implemented or related to the development and maintenance of safer roads. In this vein, Albalate (2008) for Europe and Dee (2001) and Eisenberg (2003) for the US, stress the effect of regulations concerning blood alcohol content levels on road safety, Afukaar (2003) for developing countries and Ritchey et al. (2011) for the US, examine the effectiveness of policies related to speed control, while Castillo-Manzano et al. (2010) for Spain and Dionne et al. (2011) for Quebec, among others, focus on the impact of the points-based driving license. Noland (2003) for the US and Albalate & Bel (2011) for Europe stress the role played by the quality of transport infrastructure. Meanwhile, Kopits & Cropper (2005) and Anbarci et al. (2006) focus on the relationship between road traffic deaths and economic development using a sample that includes both developed and developing countries.

In this paper, we follow a similar empirical approach as a result of which our choice of variables and estimation techniques is similar to previous empirical analyses. The main contribution concerns a variable that measures the number of years that a country has been in the European Union. Our main hypothesis is, in fact, that the countries that have most recently joined the European Union will find it more difficult to adapt their road safety policies to the levels marked by the European Commission, especially bearing in mind the time horizon for the goals set by the 2001 White Paper and the 3rd ERSAP (2003-2010). Hence, we expect a negative relationship between the traffic fatality rates and the number of years that a country has been a member of the European Union, (producing a *Europeanization* process, inspired by the harmonization and unification processes broadly described by Borzel & Risse, 2000 and Olsen, 1995), because of the growing priority given to road safety policies by European institutions (Bosetti et al. 2010). Once a country is part of the European Union, governments may have more incentives to be effective in the reduction of traffic fatalities to meet the goals imposed by the European Commission. Certainly, as Bax (2011) reminds us, the road safety targets set for the EU as a whole are not binding for member States, which are not required to meet them (neither do these targets constitute a compulsory condition for the accession process, as pointed out in Mikulik, 2004).

Recent research, such as ETSC (2006) or Orsi et al. (2012), shows that the level of traffic safety performance differs significantly from one member State to another and depends on each State's own socio-political, economic and historical evolution. Nevertheless, when they join, members seem to be encouraged to adopt the overall EU target in their national road safety policies to avoid having their credibility undercut and suffering from the poor public image that derives from becoming a free-rider (see Martin, 1995, for the free-rider problem in EU monetary unification).

Furthermore, there may be an imitation effect that spurs on the road safety policies of recent members of the European Union. The performance of long-standing members (EU-15) was more in line with the targets of the 3rd ERSAP when it came into force in 2003, but new member States (NMS-12) (South European and from the East), presented a more difficult situation (Orsi et al. 2012). However, despite these initial differences between road safety levels, it is logical to think that, following the convergence process of EU unification, existing advances, the "know-how" of the old members and the structures established by European institutions at the level of the various public policies all rub off on countries in transition, as was analyzed by Peev & Mueller (2012) for

democracy and economic freedom, as Baskaran (2009) considered for Macroeconomic performance in the wake of the Treaty of Maastricht, and as Faure (2000) examined for product liability and safety standards, among others.

With respect to the dependent variable in our analysis, it should be noted that the two previous papers that examined empirically road fatality rates in Europe (Albalate, 2008; Albalate & Bel, 2011) only used data for the fifteen-country European Union up to 2003, while our analysis uses data for the twenty-seven-country European Union of the 2000-2009 period.

We develop a two-way fixed effects model that takes the following form for country *i* during period *t*:

$$Y_{it} = \alpha + \beta_k X_{it} + \lambda_k, Z_{it} + \mu_i + \nu_t + \varepsilon_{it} \qquad (1)$$

where Y_{it} is the log of total fatality rate per capita[3], X_{it} contains the vector of economic, institutional and demographic attributes of the country and Z_{it} are variables related to road safety policies. μ_i are country fixed effects that control for time-invariant country-specific omitted variables, ν_t are year dummies that control for national trends and ε_{it} is a mean-zero random error.

The time variation of the policy variables that we consider is low for most of the countries and in some cases there is no variation at all in the period of our analysis. Hence, we apply two different strategies to take into account the country-fixed effects.[4] First we make the estimation using the ordinary least squares method including dummies for countries and years. With this strategy we can include policy variables with low time variability as covariates. Secondly, the data used for estimating the determinants of road traffic fatalities have a data panel structure. Hence, we also estimate a fixed effects model that exploits the within variation of the data. An advantage of the fixed effects model is that it allows any omitted variable to be controlled for which is correlated with the variables of interest and does not change over time. A shortcoming of the fixed effects model is that it may not consider time-constant

[3] Albalate (2008), Albalate & Bel (2011), Dee (2001) and Eisenberg (2003) consider that this is the most appropriate dependent variable for assessing road traffic fatalities, because the interpretation of policy variables is clearer.

[4] Depending on the distribution of the dependent variable, the estimation should be made using a negative binomial distribution (see, for example, Anbarci et al. 2006). In our case, the wide dispersion of our dependent variable and the small number of observations does not allow this method to be used. We have run some regressions using a negative binomial distribution and no variable is statistically significant (results available from the authors upon request).

variables (or those with a very low within variation) as explanatory variables. Thus, the estimation with the fixed effects model does not include either the policy variables or the country dummies[5].

Furthermore, the estimates can present heteroscedasticity and temporal autocorrelation problems in the error term. In this regard, the Wooldridge test for autocorrelation in panel data claims that we may have a problem of serial autocorrelation that must be addressed. Following Bertrand et al. (2004), our standard errors are robust to heteroscedasticity applying the White-Huber correction and are clustered by country to take into account the correlation between observations of the same country.

[INSERT TABLE 3]

As far as the explanatory variables are concerned, Table 3 provides their descriptions, the sources of information and the descriptive statistics (mean and standard deviation). Our main variable of interest, as mentioned above, is the variable of *Europeanization*, which is measured as the number of years that a country has belonged to the European Union; obviously this variable will increase by one unit for each year for each country. We expect a negative relationship between this variable and road traffic fatalities (i.e., following Orsi's et al. 2012 suggestion, the longer a country has been a member of the EU, the smaller the number of road accidents). Our aim is to use this variable to test the effectiveness of European Union programs to save lives in road accidents according to the number of years that each country has been in the EU.

We also consider typical variables used for road traffic fatalities in the empirical literature related to the country's economic and social conditions:

1) Gross domestic product per capita as an indicator of the country's economic development. In this regard, Kopits & Cropper (2005) and Anbarci et al. (2006) find evidence of a non-linear relationship between road fatalities and economic development using samples that include developed and developing countries from all round the world. Indeed, fatality rates may increase with economic development in very poor countries because of increased exposure to road traffic accidents. However, the relationship between economic development and traffic fatality rates may become flat or even decrease after reaching a certain wealth threshold, as Bishai et al. (2006) specify

[5] The Hausman test shows that systematic differences are found between the random and fixed effects and thus the fixed effects model should be preferred to the random effects model.

for rich countries. In our context, we should expect a negative relationship between the GDP per capita variable and traffic fatalities.

2) The level of motorization in the country which is also related to the economic development of the country and the development of private transportation in particular. It is not clear what relationship with road traffic fatalities should be expected. On the one hand, higher levels of motorization may imply higher exposure to road traffic accidents (as for example Clark et al. 2000 found in East Germany after German unification). On the other hand, more developed countries may enjoy better infrastructure and vehicles, better policies and better social attitudes towards road safety (confirming the so-called Smeed's law of 1949 regarding how countries with lower levels of road mortality rates are among those with the highest levels of motorization).

3) The number of passengers-kilometer weighted by the population of the country. This variable seeks to capture the intensity of traffic on the roads. In this regard, we could expect a positive relationship between the amount of traffic and road fatalities since, as Page (2001) states, the total amount of driving is an indication of the population's exposure to road accident risks. However, following the findings of Li et al. (2012), such a relationship could be dependent upon congestion levels.

4) The density of motorways as an indicator of the quality of transport infrastructure. We may expect a negative relationship between the quality of transport infrastructure and road traffic fatality rates (Noland, 2003; Albalate & Bel, 2011).

5) We also consider the educational background of the population from 15 to 64 years of age. As Page (2001) suggests, travelers' educational background may influence both their risk behavior and also the intensity of use of private cars. Thus, its relationship with road traffic fatalities is not clear, confirming Lourens et al. (1999).

6) We also take into account the percentage of vulnerable population in the country depending on age. In this regard, we consider the percentage of population that is 20-34 years old and the percentage of population of over 60 years old. Young people may be less risk-averse, while the mortality rate could be higher in accidents where older travelers are involved. In this regard, Anbarci et al. (2006) and McCarthy (1994, 2005) find evidence of a positive relationship between traffic fatalities and the percentage of vulnerable population in the country.

We also consider additional variables which are related to road safety policies:

1) A dummy variable that takes a value of one for countries and periods where the maximum blood alcohol concentration rate allowed is lower than 0.5. Several papers

have shown the effectiveness of setting this limit at 0.8 (Dee, 2001; Eisenberg, 2003) or 0.5 (Albalate, 2008). In our context, most of the countries have set the limit at 0.5 or lower, so we are able to test whether blood alcohol concentration rates lower than 0.5 are also effective in reducing road traffic fatalities.

2) A dummy variable that takes a value of one for countries and periods with points-based driving licenses. With this variable, we can test the effectiveness of this policy in reducing road traffic fatalities (see Castillo-Manzano & Castro-Nuño, 2012 for a recent meta-analysis).

3) A variable that shows the maximum speed limit allowed on motorways. We may expect a positive relationship between the speed limit (and its subsequent enforcement) and road traffic fatalities (Elvik, 2012; McCarthy, 1994).

IV. RESULTS AND DISCUSSION.

Table 4 gives the results of the estimates of the equation for the determinants of road traffic fatalities. We find no substantial differences in the results whichever estimation technique is used.

The GDP per capita variable is not statistically significant. A possible explanation of this result is that the variability for this variable is not high enough in our sample. However, we find lower road fatality rates in countries with higher levels of motorization. It should be remembered that the motorization variable correlates with the economic development of the country. Road traffic fatalities seem to be lower in countries with a higher level of transport development, where infrastructure and vehicles may be safer and greater priority is given to road safety policies. Albalate (2008) and Albalate & Bel (2011) also find a negative relationship between traffic fatalities and the level of motorization in analyses of a sample of European countries.

The variable of vehicles-kilometer driven is positive and statistically significant. As expected, more traffic on the roads implies higher fatality rates. In this regard, we confirm the result for this variable found in Albalate & Bel (2011), Dee (2001), Eisenberg (2003) and McCarthy (1994, 2005). To the contrary, the motorway density variable is negative and statistically significant. This confirms that the quality of transport infrastructure has a significant effect on road safety, as analyzed in Albalate & Bel (2011) and Noland (2003).

We do not find that the population's educational background has a clear effect on road fatality rates, as found in Lourens et al. (1999). With respect to the vulnerable

population-related variables, we find a positive relationship between fatality rates and the percentage of population of over 60 years old. We do not find evidence of higher traffic fatality rates when the percentage of the younger population is higher. These findings are consistent with the idea that risk exposure is higher for a younger population, although the impact of the accidents means that morbidity and mortality are higher for an older population (see Yee et al. 2006).

All road safety policies examined in this paper seem to be effective in reducing traffic fatalities. The variables linked to the maximum blood alcohol concentration rate and the points-based driving license are negative and statistically significant, as was to be expected according to prior findings in Albalate (2008) and Castillo-Manzano & Castro-Nuño (2012), respectively, while the maximum speed limit variable is positive and statistically significant, corroborating the findings of Afukaar (2003).

Finally, the Europeanization variable is negative and statistically significant. Controlling for several explanatory factors, we find econometric evidence that a country's road traffic fatalities decrease as the number of years that the country has been a member of the European Union increases. This leads us to confirm the initial hypothesis that the EU draws member countries closer together on road safety policy through joint involvement in all its institutions and programs, such as the ERSAPs. The transnationalization of policy norms and practices (see Peck and Theodore, 2010 on the transnationalization of policies concept) is thus speeded up, making it easier for newcomers (the SEC-Belt countries, for example) to have the opportunity to see and be advised directly on other members' successful policies and experiences. In many cases the longest-standing European members have had the greatest success in road safety worldwide (the SUNFlower countries).

In the same way as happens with the Economic Theory of Military Alliances (e.g. Hendrickson, 1999 and Kramer, 2002 describe the enlargement of NATO with the Baltic States), benefits exceed accession costs for new members, and "the club" continues to expand. The great national efforts made by new members, such as Portugal, Spain, Latvia and The Czech Republic (Gitelman et al. 2010) have benefited from the successful road safety policies developed over many decades by the old European countries, such as Sweden, the Netherlands, Germany and the United Kingdom (Loo et al. 2005), that were destined to become international leaders in road safety.

Notwithstanding, as Yannis (2003) suggests, it should not be forgotten that although the achievement of EU road safety targets depends directly on the performance of NSM-12, the role of EU institutions is regarded as necessary by the literature for introducing compulsory and quantified traffic safety procedures according to the EC Treaty's principle of subsidiarity (see Van den Bergh, 2000, for the attribution of powers that comes from this principle).

V. CONCLUSIONS.

The 2001 publication of the White Paper entitled "Time to Decide" and its development in the 3rd ERSAP (2003-2010) represents a clear inflection point in the history of the European Common Road Safety Policy. For the first time, the quantitative and measurable target of halving the number of road fatalities by 2010 was included as a shared target, and at last the issue of road safety seemed to play a crucial role in European policy. Nevertheless, there were huge differences in member States' levels of safety performance and the target was only a non-binding commitment for them. According to Eurostat data for 2001, compared to the EU-15 (longest-standing members) average of 105 deaths per million inhabitants, SEC-Belt countries presented mortality rates of 236 for Latvia, 202 for Lithuania, 136 for Spain and 130 for the Czech Republic, while the safest countries in the world (the SUNFlower countries) recorded rates of 61 for UK, 62 for the Netherlands and 66 for Sweden. However, at the end of the target period, the CARE database (ETSC, 2011) found that since 2001 road deaths had been cut by 43% in the EU-27 and by 48% in the EU-15.

The purpose of our study was to analyze the factors that explain the fall in road traffic accidents during the 3rd ERSAP. We conducted a panel data analysis and found that the fall in mortality rates in the EU as a whole can be explained by the influence of different variables: exposure risk, better vehicles, improved roads, economic trends, vulnerable population and safety interventions, specifically the limit imposed on alcohol consumption, speed limitations and the existence of penalty-point driver license systems.

However, the most important finding of our research is more far-reaching. The *Europeanization* variable (measured as the number of years that a country has been a member of the EU) is negative and statistically significant at 1%, which shows that a converging process on road safety emerges after the accession process to the EU. When a new member State completes accession, road traffic issues increase in national policy,

and the country has the opportunity to have access to other members' successful experiences and benefit from the EU acquis, taking advantage of EU legislation, EU funding and the motivation provided by contributing to the EU shared target.

The cumulative nature of this variable also allows us to conclude that this process of positive imitation between member countries is not limited to the 2001White Paper and the 3rd ERSAP, but that its significance could be understood as indirect empirical evidence of the effectiveness of the three ERSAPs executed to date, as the implication is that the higher the value of this variable for a country, the greater the number of these programs is that it has taken part in.

These findings should not surprise us as European integration offers citizens greater transparency regarding the relative value of its main socio-economic variables, including those linked to road safety, and this translates into great pressure on governments to close any gaps that exist compared to the EU average for said variables. Compared to the difficulties that this entails in strictly economic variables, such as unemployment and inflation, a priori this should not be so complex for traffic safety policy, thanks to all the experiences and recommendations (compulsory seat-belt use, reductions in alcohol limits allowed in the blood and improved communication and advertising strategies, among many others) generally with affordable implementation costs. Furthermore, these efforts by States to reduce this gap in road safety seem to receive solid social support, as according to the results offered by the Eurobarometer survey (EC, 2010a), European citizens agree with the efforts made in this field in recent years, and even call for governments to do more to combat the problem.

In other respects, the benefits of the Europeanization process that have been calculated could also be considered as clear empirical evidence in favor of the principle of subsidiarity, as set out in the EU Treaty, in certain areas, such as road safety. And all this within the ongoing debate between the champions of the principle of subsidiarity and those who advocate greater amounts of decentralization in managing national public policy (for more on this debate, see Díaz-Serrano & Rodríguez-Pose, 2012; Van der Bergh, 2000).

Finally, although the European Common Road Safety Policy still has a long way to go (harmonizing alcohol consumption and speed limits or extending the target to injuries with a standard definition), as demonstrated by the current text of the 4th ERSAP, and although some of the measures adopted in SEC-Belt countries will require plenty of time to achieve their full potential impact on road safety (ETSC, 2006), we

understand that this paper's findings are especially useful in the context of difficulties found in European integration going forward. Our findings show an area where belonging to the European Union clearly provides positive benefits and demonstrates that it is much more than an economic and monetary union. In the words of Avenoso & Townsend (2010): "…EU road safety legislation has an added value for all Member States…".

REFERENCES

Afukaar, F.K. (2003). Speed control in developing countries: issues, challenges and opportunities in reducing road traffic injuries, *Injury Control and Safety Promotion.* 10: 77–81.

Albalate, D. (2008). Lowering Blood Alcohol Content Levels to Save Lives: The European Experience, *Journal of Policy Analysis and Management.* 27: 20–39.

Albalate, D., Bel, G. (forthcoming). Motorways, tolls, and road safety: Evidence from Europe. SERIEs: *Journal of the Spanish Economic Association*. DOI: 10.1007/s13209-011-0071-6.

Allsop, R.E., Sze, N.N., Wong, S.C. (2011). An update on the association between setting quantified road safety targets and road fatality reduction, *Accident Analysis and Prevention.* 43: 1279-1283.

Anbarci, N., Escaleras, M., Register, C. (2006). Traffic Fatalities and Public Sector Corruption, *Kyklos.* 59: 327-344.

Avenoso, A., Beckmann, J. (2005). *The safety of vulnerable road users in the Southern, Eastern and Central European Countries (The "SEC belt").* European Transport Safety Council (ETSC). Brussels.

Avenoso, A., Townsend, E. (2010). *Future road safety in the EU at stake? ETSC Response to the EC Communication "Towards a European Road Safety Area: Policy orientations on road safety 2011-2020"*. European Transport Safety Council (ETSC). Brussels.

Baskaran, T. (2009). Did the Maastricht treaty matter for macroeconomic performance? A difference-in-difference investigation. *Kyklos*, 62: 331–358.

Bax, Ch. (2011). *Policy instruments for managing EU road safety targets: carrots, sticks or sermons? An analysis and suggestions for the USA*. SWOV Institute for Road Safety Research, publication R-2011-15. The Netherlands.

Bertrand, M., Duflo, E., Mullainathan, I. (2003). How much should we trust differences-in-differences estimates?, *The Quarterly Journal of Economics*. 119: 249-275.

Bishai, D., Quresh, A., James, P., Ghaffar, A. (2006). National road casualties and economic development, *Health Economics:* 15, 65–81.

Borzel, T.A., Risse, T. (2000). *When Europe Hits Home: Europeanization and Domestic Change*. European Integration Online Papers 4/15.

Bosetti, S., Corrias, C., Scatamacchia, R., Sitran A. Delhaye, E. (2010). Ex-post evaluation of the RSAP. Final Report. Volume I.N Specific contract, DG TREN A2/143-2007. *The preparation of the European Road Safety Action Program 2011-2020*. Transport & Mobility LEUVEN, Belgium.

Broughton, J., Knowles, J. (2010). Providing the numerical context for British casualty reduction targets, *Safety Science:* 48, 1134-1141.

Castillo-Manzano, Castro-Nuño, M., Pedregal, D.J (2010). An econometric analysis of the effects of the penalty points system driver's license in Spain, *Accident Analysis and Prevention*, 42: 1310-1319.

Castillo-Manzano, Castro-Nuño, M. (2012). Driving licenses based on points systems: Efficient road safety strategy or latest fashion in global transport policy? A world wide meta-analysis, *Transport Policy:* 21, 191–201.

Clark, D.E., Wildner, M., Bergmann, K.E. (2000). Injury mortality in East Germany, *American Journal of Public Health*, 90: 1761-1764.

Commission of the European Communities (1993). *Communication from the Commission to the Council for an action Program on road safety*. COM(93) 246 final. Brussels.

Commission of the European Communities (1997). *Promoting Road Safety in the EU. The Program for 1997-2001*. Communication COM (97) 131 final, from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions. Brussels.

Dee, T.S. (2001). Does setting limits *save lives? The case of 0.08 BAC laws, Journal* of Policy Analysis and Management: 20,111-118.

Díaz-Serrano, L., Rodríguez-Pose, A. (2012). Decentralization, Subjective Well-Being, and the Perception of Institutions, *Kyklos:* 65, 179–193.

Dionne, G., Pinquet,J., Maurice,M., Vanasse,Ch. (2011). Incentive mechanisms for safe driving: a comparative analysis with dynamic data, *The review of Economics and Statistics*, 93: 218–227.

Elvik, R. (2008). Road safety management by objectives: a critical analysis of the Norwegian approach, *Accident Analysis and Prevention*. 40: 1115-1122.

Elvik, R. (2012). Speed limits, enforcement and health consequences, *Annual Review of Public Health*: 33, 225-238.

Eisenberg, D. (2003). Evaluating the effectiveness of policies related to drunk driving, *Journal of Policy Analysis and Management.* 22: 249-274

European Conference of Ministers of Transport (ECMT) (2002). *ECMT Key Recommendations on Road Safety*. Council of Ministers of Transport, Bucharest, 2930.

European Commission (EC) (2001). European Transport Policy for 2010: Time to Decide, White Paper, COM (2001) 370, Brussels.

European Commission (EC) (2003). *Programa de Acción Europeo de seguridad vial. Reducir a la mitad el número de víctimas de accidentes de tráfico en la UE de aquí a 2010: una responsabilidad compartida.* Comunicación de la Comisión COM(2003) 311 FINAL. Brussels.

European Commission (EC) (2010a). Flash Eurobarometer, No 301. *Road safety. Analytical report*. The Gallup Organization upon the request of Directorate-General Mobility and Transport. Hungary.

European Commission (EC) (2010b). *Towards a European road safety area: policy orientations on road safety 2011-2020*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2010) 389 final, Brussels.

European Commission (EC) CARE Database (2012): *National data of EU road fatalities*. Annual evolution since 2001. Directorate General for Mobility and Transport. Brussels.

European Transport Safety Council (ETSC) (2006). *A methodological approach to national road safety policies*. Brussels.

European Transport Safety Council (ETSC) (2011). *Roadmap to a single European Transport Area- Towards a competitive and resource efficient transport system*. ETSC Response to the European Commission White Paper. Brussels.

Faure, M.G. (2000). Product Liability and Product Safety in Europe: Harmonization or Differentiation?, *Kyklos* 53: 467–508.

Gitelman, V., Doveh, E., Hakkert, S. (2010). Designing a composite indicator for road safety, Safety Science. 48: 1212-1224.

Hendrickson, R.C. (1999). The enlargement of NATO: The theory and politics of alliance expansion. *European Security*. 8: 84-99.

Jarašūnienė, A., Jakubauskas, G. (2007). Improvement of road safety using passive and active intelligent vehicle safety systems. *Transport,* XXII (4): 284–289.

Jost G., Allsop, R., Steriu, M., Popolizio, M. (2011): *5th Road Safety PIN Report: 2010 Road Safety Target Outcome: 100,000 fewer deaths since 2001*. European Transport Safety Council (ETSC), Brussels.

Kramer, M. (2002). NATO, the Baltic States and Russia: a framework for sustainable enlargement. *International Affairs.* 78: 731-756.

Knill, C., Lehmkhul, D. (2002). The national impact of European Union regulatory policy: Three Europeanization mechanisms. *European Journal of Political Research.* 41: 255–280.

Kopits, E., Cropper, M. (2005). Traffic fatalities and economic growth. *Accident analysis and Prevention*. 37: 169-178

Larsen, L., Vavakos, V., Zaidel, D. (2008): *Comparison and analysis of traffic enforcement chains across EU Member States and in relation to EU policies*. Police Enforcement Policy and Programs on European Roads (PEPPER). DTU, University of Denmark.

Li, H., Graham, D.J., Majumdar, A. (2012). The effects of congestion charging on road traffic casualties: A causal analysis using difference-in-difference estimation, *Accident Analysis and Prevention*. 49: 366-377.

Loo, B.P.Y., Hung, W.T., Lo, H.K., Wong, S.C. (2005). Road safety strategies: a comparative framework and case studies. *Transport Reviews*, 25: 613-619.

Lourens, P. Vissers, J., Jessurun, M. (1999). Annual mileage, driving violations, and accident involvement in relation to drivers' sex, age, and level of education. *Accident Analysis and Prevention*. 31: 593–597.

Martin, P. (1995). Free-riding, convergence and two-speed monetary unification in Europe. *European Economic Review*. 39: 1345-1364.

McCarthy, P. (1994). An empirical analysis of the direct and indirect effects of relaxed interstate speed limits on highway safety. *Journal of Urban Economics*. 36: 353-364.

McCarthy, P. (2005). Alcohol, public policy and highway crashes. *Journal of Transport Economics and Policy*. 39: 109-125.

Mikulik, J. (2004). *Road safety in an enlarged Europe: challenges and opportunities for the 25 EU member states*. The 6th European Transport Safety Lecture. ETSL.

Noland, R. (2003). Traffic fatalities and injuries: The effect of changes in infrastructure trends. *Accident Analysis and Prevention*. 35: 599-611.

Olsen, J.P. (1995). *European Challenges to the Nation-State*. ARENA, Working Paper No. 14, University of Oslo.

Orsi, Ch., Bertuccio, P., Morandi, A., Levi, F., Bosetti, C., La Vecchia, C. (2012). Trends in motor vehicle crash mortality in Europe, 1980-2007. *Safety Science*, 50: 1009-1018.

Page, Y. (2001). A statistical model to compare road mortality in OECD countries. *Accident Analysis and Prevention*. 33: 371-385.

Peck, J., Theodore, N., (2010). Mobilizing policy: models, methods and mutations. *Geoforum*. 41: 169–174.

Peev, E., Mueller, D.C. (2012). Democracy, Economic Freedom and Growth in Transition Economies. *Kyklos*, 65: 371–407.

Petridou, E., Trichopoulos, D., Stappa, M., Tsoufis, Y., Skalkidou, A. (1999). Effectiveness of a comprehensive multisector campaign to increase seat belt use in the Greater Athens Area, Greece. *American Journal of Public Health.* 89: 1861-1863.

Racioppi, F., Eriksson, L., Tingvall, C., Villaveces, A. (2004). *Preventing road traffic injury: a public health perspective for Europe.* World Health Organization (WHO) Regional Office for Europe. Denmark.

Ritchey, M., Nicholson-Crotty, S. (2011). Deterrence Theory and the Implementation of Speed Limits in the American States, *Policy Studies Journal.* 39: 329-346.

Smeed, E.W. (1949). Some statistical aspects of road safety research, *Journal of the Royal Statistical Society*. 1: 1-23.

Steiner, S., Bozicevic, J., (2008). *Subsidiarity in strategic transport planning*, international conference: Transportation and Land Use Interaction, University Politehnica of Bucharest.

Strohm, K.M., Bloecher, H.-L., Schneider, R., Wenger, J., (2005). *Development of future short range radar technology*. European Radar Conference, EURAD 2005, 165-168, doi: 10.1109/EURAD.2005.1605591.

Thomas, P., Morris, A., Yannis, G., Lejeune, P., Wesemann, P., Vallet, G., Vanlaar, W. (2007). Designing the European road safety observatory, *International Journal of Injury Control and Safety Promotion.* 12: 251-253.

Threlfall, M. (2003). European Social Integration: Harmonization, Convergence and Single Social Areas. *Journal of European Social Policy.* 13: 121-139.

Tolón-Becerra, A., Lastra-Bravo, X., Bienvenido-Bárcena, F. (2009). Proposal for territorial distribution of the 2010 EU road safety target. *Accident Analysis and Prevention.* 41: 1008-1015.

Van der Bergh, R. (2000). Towards an Institutional Legal Framework for Regulatory Competition in Europe, *Kyklos.* 53: 435–466.

Wegman, F. (2001). *Sharing responsibility- central and local government partnership*. Contribution to the Road Safety Conference of the European Transport Safety Council, 12 September 2000 (Brussels), SWOV Institute for Road Safety Research, The Netherlands.

Wilmots, B., Hermans, E., Brijs, T., Wets, G. (2009). *Analyzing Road Safety Indicator Data across Europe: Describing, Explaining and Comparing*. Hasselt University Transportation Research Institute – IMOB. Belgium. 4th IRTAD Conference: "Road safety data: collection and analysis for target setting and monitoring performances and progress", 16-17 September, 2009, Seoul, Korea.

Wong, S.C., Sze, N.N., Yip, H.F., Loo, B.P.Y., Hung, W.T., Lo, H.K. (2006). Association between setting quantified road safety targets and road fatality reduction. *Accident Analysis and Prevention*, 38: 997-1005.

Wong, S.C., Sze, N.N. (2010). Is the effect of quantified road safety targets sustainable? *Safety Science*, 48: 1182-1188.

World Health Organization (WHO) (2011). *The Decade of Action for Road Safety 2011-2020.* Available at http://www.who.int/roadsafety/decade_of_action/.

Yannis, G. (2003). *The challenges for Southern Europe and the New Member States. European Transport Safety Council Best in Europe Conference*. "Targeted Road Safety Programs in the EU". Brussels, 10 June, 2003.

Yee, W.Y., Cameron, P.A., Bailey, M.J. (2006). Road traffic injuries in the elderly, *Emergency Medicine Journal.* 23: 42-46.

TABLE 1. COMPILATION OF THE ROAD SAFETY ACQUIS DEVELOPED WITHIN THE FIRST 3 ERSAPs.

TOPICS / Sub-topic		Number of legislative texts [a] / YEAR OF ADOPTION			
		1ST ERSAP (1993-1996)	2ND ERSAP (1997-2001)	3RD ERSAP (2003-2010)	TOTAL for TOPICS
VEHICLES	**Type approval**			1 (2007) 1 (2009)	**2**
	Registration		1 (1998) 1 (1999)	1 (2003)	**3**
	Technical control and roadworthiness inspection		1 (2000)	1 (2003) 1 (2009) 2 (2010)	**5**
	Front protection of vulnerable users			1 (2003) 1 (2005) 2 (2009)	**4**
	Safety belts and other vulnerable user restraints systems (children)			1 (2003) 1 (2005) 1 (2009)	**3**
	Tires			1 (2008)	**1**
	Daytime running lights			1 (2008)	**1**
	Blind spot mirrors			1 (2003) 1 (2005) 1 (2007)	**3**
	Conspicuousness			1 (2007) 1 (2009)	**2**
	Speed limitation devices			1 (2002)	**1**
	Weights and dimensions	1 (1996)		1 (2002)	**2**
	TOTAL FOR EACH ERSAP	**1**	**3**	**23**	**-**
BEHAVIOR	**Driving license**	1 (1994) 1 (1996)	1 (1997) 1 (2000)	1 (2006) 2 (2008) 1 (2009)	**8**
	Alcohol, drugs and medicines			1 (2003)	**1**
	Professional drivers (training)			1 (2003)	**1**
	Professional drivers (working conditions)			1 (2002) 1 (2006)	**2**
	Professional drivers (tachograph)	1 (1998)		1 (2002) 1 (2004) 1 (2009)	**4**
	Professional drivers (check of working conditions)			1 (2006) 2 (2009)	**3**
	TOTAL FOR EACH ERSAP	**3**	**2**	**14**	**-**

INFRASTRUCTURE	**Safety requirements for tunnels in the Trans-European Road Network**			1 (2004)	**1**
	Road safety management			1 (2008)	**1**
	TOTAL FOR EACH ERSAP			**2**	**-**
ENFORCEMENT	**Mutual recognition of financial penalties**			1 (2003) 1 (2005)	**2**
	Facilitating cross-border enforcement			1 (2008)	**1**
	TOTAL FOR EACH ERSAP			**3**	**-**
DANGEROUS GOODS	**Weights and dimensions (transportable pressure equipment)**	1 (1999)			**1**
	Harmonization of procedures for checks	1 (1995)	1 (2001)	1 (2004)	**3**
	Inland transport			1 (2008) 1 (2009)	**2**
	TOTAL FOR EACH ERSAP	**2**	**1**	**3**	**-**
OTHER FIELDS	**Accident data collection**	1 (1993)			**1**
	Emergency calls			1 (2002) 1 (2003)	**2**
	Third country driver attestation			1 (2002)	**1**
	Approximation of units of measurement			1 (2009)	**1**
	TOTAL FOR EACH ERSAP	**1**		**4**	**-**

[a] We consider REGULATIONS + DIRECTIVES + DECISIONS+ RESOLUTIONS from the European Commission and the European Council.

Source: Prepared by authors based on European Commission website (http://ec.europa.eu/transport/road_safety; Mobility, transport and road safety section).

TABLE 2. COUNTRY-BY-COUNTRY PROGRESS IN EUROPEAN ROAD SAFETY IN THE FRAMEWORK OF THE 3RD ERSAP.

GROUPS OF EU COUNTRIES*		EU COUNTRY	ROAD FATALITIES EVOLUTION 2001-2010		IS THERE A NATIONAL ROAD SAFETY PLAN?	QUANTITATIVE SAFETY TARGETS
			CHANGE	ANNUAL AVERAGE		
SEC BELT COUNTRIES*	GROUP I*	Estonia	-61%	- 10%	• Program for (2003-15).	• No more than 100 fatalities by 2015 compared to 2003.
		Latvia	-61%	- 10%	• Program for (2001-07).	• - 70% deaths by 2013 in comparison with 2001. • -20% injured persons by 2010.
		Lithuania	-58%	-9%	• Program for (2002-04). • Road Safety Strategy for (2005-10).	• -50% fatalities and -20% injury accidents.
	GROUP II*	Czech Republic	-40%	-5%	• Road Safety Strategy for (2004-10).	• -50% in fatalities by 2010 compared to 2002.
		Hungary	-40%	-6%	• Action Program for (2006-10/15).	• -50% fatalities and injury accidents by 2015 from 2001.
		Poland	-29%	-4%	• GAMBIT 2000. • Updated GAMBIT 2005 (following EU accession).	• To reduce the number of fatalities to no more than 4 000 per year by 2010. • -50% the number of road deaths in the 2003-2013 period to no more than 2,800.
		Slovakia	-40%	-7%	• 1st Slovak Road Safety Plan in 2005.	• -50% fatalities by 2010 compared to 2002.
		Slovenia	-50%	-5%	• National Plan for (2002-06). • National Plan for (2007-11).	• -50% fatalities by 2005 compared to 1995. • Target was not reached. New target in the line of EU target.
	GROUP III*	Cyprus	-39%	-5%	• 1st Strategic Plan for (2002-06) • 2nd Strategic Plan for (2005-10)	• -50% fatalities by 2010 compared to 1999-2003.
		Malta	-6%	-1%	• National Environmental Health Action Plan (NEHAP) for (2006-10)	• -50% fatalities and -50% injury accidents by 2014 compared to 2004.

	GROUP IV*	Belgium	-45%	-6%	• A road safety action plan was adopted in 2002.	• -50% fatalities by 2010 compared to 1998-2000 (about 750) or a maximum of 7 fatalities per 100,000 inhabitants. • A new target of 500 deaths by 2015 was proposed.
		France	-51%	-8%	• There is no a plan with pre-defined targets to be reached within a time period. The approach is a sliding (annual) action plan issued and monitored by the Inter-ministerial Committee for Road Safety (CISR).	• -50% by 2010 compared to 2001.
		Greece	-33%	-4%	• The 1st strategic plan for (2001-05) and the 2nd plan for (2006-10).	• -50% by 2010 compared to 2001.
		Italy	-42%	-6%	• The2002 national plan is revised every 2 years and defines how regions, provinces and municipalities can apply for co-financing of regional or local plans and initiatives.	• - 40 % in the number of fatalities by 2010. • - 20 % in the number of injuries by 2010.
		Portugal	-44%	-6%	• National plan for the prevention of road accidents (NPPRA) (2003-10). • National Road Safety Strategy (NRSS) for (2008-15).	• -50% fatalities by 2010 compared to 1998-2000. Several sub-targets.
		Spain	-55%	-9%	• A key strategic road safety plan for (2005-08)	• -40% fatalities by 2008 compared to 2003. • -50% by 2012.
AVERAGE SEC BELT		**TOTAL**	**-43%**	**-6%**	-	-
		GROUP I	**-60%**	**-10%**	-	-
		GROUP II	**-40%**	**-5%**	-	-
		GROUP III	**-23%**	**-3%**	-	-

		GROUP IV	**-45%**	**-7%**	-	-
SUN-FLOWER COUNTRIES*		Netherlands	-46%	-7%	• A concept of *sustainable safety* was implemented in 2 phases: (1997-02) and (2003-10).	• Fewer than 580 fatalities by 2020. Several sub-targets.
		Sweden	-54%	-8%	• No safety plan in a traditional sense but the *Vision Zero Program* for (2002-07).	• -50% fatalities by 2007 compared to 1996.
		United Kingdom	-47%	-7%	• The *Tomorrow's Roads – Safer for Everyone* road safety strategy was published in 2000 and ran to 2010	• No national target.
AVERAGE SUN-FLOWER		**TOTAL**	**-49%**	**-7%**	-	-
OTHERS	**OLD MEMBERS**	Austria	-42%	-6%	• *Austrian Road Safety Program (2002-10): strategies for Improved Road Safety*.	• -50% fatalities by 2010 compared to 1998-2000.
		Denmark	-41%	-6%	• Road safety strategy for (2001-12) is: *Every accident is one too many*.	• -40% fatalities and seriously injured by 2012 compared to 1998, no more than 300 fatalities.
		Finland	-37%	-5%	• Road Safety Program for (2001-05) and (2006-10).	• Less than 250 fatalities by 2010. • Less than 100 fatalities by 2025.
		Germany	-41%	-6%	• *Program for more safety in road transport*, dates from 2001.	• It does not have fixed numerical targets or a target year. • No national targets but states sometimes do (e.g., North Rhine Westphalia, -50% fatalities by 2015).
		Ireland	-49%	-7%	• *Road Safety Strategy* for (2004-06). • Follows the previous *The Road to Safety* strategy for (1998-02).	• -25% fatalities by 2006 compared to 1998-2003. Several sub-targets.

		Luxembourg	-54%	-8%	• No formal road safety action plan. • Improvement of road safety and reduction of number of victims are underlined in the Government Program.	• No specific targets. • The strategy constitutes a medium-term road safety plan, and road safety improvements are envisaged to be achieved both by prevention and enforcement.
	NEW MEMBERS	Bulgaria	-23%	-3%	• The National Road Safety Plan for (2006-10).	• -50% fatalities by 2010 compared to 1991-2004. • -20% fatalities by 2006.
		Romania	-3%	0%	• Romania instituted a progressive road safety program in 1999, but the Romanian Road Safety Plan was implemented in 2011, after the 3rd ERSAP end-date.	• -50% fatalities by 2012 compared to 2002.
AVERAGE OTHERS		**TOTAL**	**-36%**	**-5%**	-	-
		OLD MEMBERS	**-44%**	**-6%**	-	-
		NEW MEMBERS	**-13%**	**-2%**	-	-
AVERAGE EU		**27**	**-43%**	**-6%**	-	-

* Groups from ETSC (2006): definitions based on similar historical, social and economic environments.

Source: Prepared by authors based on Eurostat data, IRTAD (OECD) annual reports and countries' National Road Safety Plans

.TABLE 3. VARIABLES: DEFINITIONS AND DESCRIPTIVE STATISTICS

Variables	Description	Source	Mean	Standard Deviation
Fatalities per capita	Fatality rates per million inhabitants (Fatalities: any person who was killed outright or who died within 30 days as a result of a road accident)	CARE (EU road accidents database)	110.61	45.32
GDP per capita	Gross domestic product per capita in International Comparable Prices (US$ at 2005 prices and PPP)	UNECE Statistical Division Database, compiled from official national and international (CIS, EUROSTAT, IMF, OECD) sources	25211	11738
Motorization	Number of registered vehicles per 1000 inhabitants	UNECE transport division, Eurostat, World Bank and national databases	424.27	113.57
Vehicles-km driven	Number of passenger-cars-km expressed in 1000 million km and weighted by national population	European Commission (Directorate General for mobility and transport)	8.28	2.89
Density of motorways	Number km of motorways divided by square km of the country	EUROSTAT and UNECE	1.68	1.74
Upper secondary Education	% population between 14-65 years old with upper secondary education	WORLD BANK	46.72	14.41
Young	% population between 20-34 years old	UNECE	21.39	2.05
Old	% population over 60 years old	UNECE	19.65	2.32
Europeanization	Number of years that the country has been in the European Union	European Commission	18.17	18.61
BAC_05	Dummy variable that takes a value of 1 for countries and periods where the maximum blood alcohol concentration rate allowed is lower than 0.5	European Commission Road Safety Website	0.25	0.43
PPS	Dummy variable that takes a value of 1 for countries and	SWOV and National	0.74	0.43

	periods with a points-based driving license	legislations		
Speed limits	Maximum speed limits (km/hour)	European Commission Road Safety Website	121.18	13.66

TABLE 4. Results of estimates: Fatality rates per capita

Independent variables	Fixed effects (within estimator)	Ordinary Least Squares
GDP per capita	0.000012 (0.000011)	0.000012 (0.000011)
Motorization	-0.0013 (0.0005)**	-0.0012 (0.0005)**
Vehicles-Km driven	0.05 (0.02)**	0.05 (0.02)**
Density of motorways	-0.14 (0.04)***	-0.14 (0.05)**
Upper secondary Education	0.007 (0.05)	0.007 (0.005)
Young	0.003 (0.015)	0.003 (0.01)
Old	0.07 (0.02)**	0.08 (0.03)**
Europeanization	-0.07 (0.02)***	-0.07 (0.02)***
BAC_05	-	-2.38 (1.10)**
PPS	-	-0.90 (0.23)***
Speed limits	-	0.05 (0.02)**
Constant term	4.01 (1.13)***	-1.11 (1.52)
Country fixed effects	NO	YES
Time fixed effects	YES	YES
R-Sq.	0.77	0.95
Number observations	258	258

Note 1: Standard errors are given in brackets (robust to heteroscedasticity and clustered by country)

Note 2: Statistical significance at 1% (***), 5% (**), 10% (*)