

ECONOMIC GROWTH, MOTORIZATION LEVEL, TRAFFIC SAFETY: ARE THEY RELATED (EXPERIENCE OF EU COUNTRIES)

Valentina Peleckiene
Vilnius Gediminas Technical University, Lithuania
E-mail: valentina.peleckiene@vilniutech.lt

Kestutis Peleckis
Vilnius Gediminas Technical University, Lithuania
E-mail: k.peleckis@vilniustech.lt

Aliona Klymchuk
National University of Life and Environmental Sciences of Ukraine, Ukraine
E-mail: alklymchuk@nubip.edu.ua

Inna Tomashuk
Vinnitsia National Agrarian University, Ukraine
E-mail: tomashuk.inna@ukr.net

Iryna Semenyshyna
Podillia State University, Ukraine
E-mail: isemenisina@gmail.com

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ABSTRACT

The purpose of the research paper is to observe and analyze how economic growth of EU countries is accompanied by growth of motorization rate and fatalities during the last decades in terms of inventory number of motor vehicles and accidents in road traffic. Research methodology was statistical analysis from year 2000 to year 2019 of economic growth, motorization rate in the EU countries and the accidents. In the research paper the quantitative analysis and comparison method are applied. Research paper shows that in the EU countries of higher income levels, the rate of increase in motor vehicles is lower than the decline in fatalities per motor vehicle, and in countries of low-income levels the rate of increase in motor vehicles is higher than the decline in fatalities per motor vehicle. Research paper demonstrates that countries with different levels of economic development have different motorization level and there are differences on decline in fatalities per motor vehicle levels. This is the first paper that analyses in different EU countries motorization rate and fatalities during last decades.

Keywords: *Economic growth; Motorization rate; Traffic fatalities; Road traffic safety*

1. INTRODUCTION

Economic growth of countries is accompanied by growth of motorization rate. The growing number of motor vehicles in road traffic presents new challenges to security for road users. According to the World Bank researches the road injuries now rank as the world's eighth-leading cause of death and the number-one killer of young people ages 15 to 24 (World Bank, 2014). These findings impose the need to spread improvements in transport safety.

The compulsory insurance of motor vehicles is an important instrument in providing financial protection against claims for physical damage and injuries resulting from traffic accidents. Motor Insurance Directive (MID) enables to travel within the EU for EU residents with their vehicles based on a single premium. EU residents can travel anywhere without the need to buy additional insurance.

The current Motor Insurance Directive is a consolidation of five earlier Directives. To assess the effectiveness, efficiency and coherence of the motor insurance legislation, the European Commission announced an evaluation of the MID in 2016. The conclusion of the evaluation was that most elements of the Motor Insurance Directive remain fit for purpose, while certain amendments in specific areas would be appropriate.

The Commission announced on possible amendments to enhance the protection of traffic accident victims in cases when insurer is insolvent, in improvement the recognition of claims history statements, risks due to uninsured driving, harmonization of minimum amounts of cover and the scope of the Directive.

The aim of this paper was to overview the conditions of road traffic safety in EU countries and identify problems of MID practice. To obtain the aforementioned aim, the following objectives are set: to analyze the motorization level of EU countries, to identify relationship between economic growth and road traffic accidents victims and to overview the impact of amendments of MID for increasing security of EU road traffic.

Main hypothesis of the research paper is following "In the EU countries of low income levels the rate of increase in motor vehicles is higher than the decline in fatalities per motor vehicle, in the EU countries of higher income levels, the rate of increase in motor vehicles is lower than the decline in fatalities per motor vehicle".

In case if hypothesis will be confirmed by performing statistical analysis of EU countries aggregated by their development levels authors provide an answer to the stated hypothesis as well as provide future research recommendations. In case if hypothesis will not be confirmed by data or the analysis it either will be dismissed or stay on the level of hypothesis for further investigations.

2. METHODOLOGY AND THEORETICAL FRAMEWORK

As the economy of EU member States is growing, the level of motorization of the population is increasing, it affects a growing number of road accidents and causes the number of killed and injured people. The relationship between economic growth, motorization level and their negative consequences was analyzed by many authors (Hua, 2015; Brueckner & Lederman, 2018; Kopits & Cropper 2003; David 2010).

Kopits and Cropper (2003) examined the impact of income growth on the death rate due to traffic fatalities, as well as on fatalities per motor vehicle and on the motorization rate (vehicles/population) using panel data from 1963-99 for 88 countries. Specifically, they estimated fixed effects models for fatalities/population, vehicles/population, and fatalities/vehicles and used these models to project traffic fatalities and the stock of motor vehicles to 2020.

The relationship between motor vehicle fatality rate and per capita income at first increases with per capita income, reaches a peak, and then declines. This is because at low income levels the rate of increase in motor vehicles outpaces the decline in fatalities per motor vehicle. At higher income levels, the reverse occurs.

The income level at which per capita traffic fatalities peaks is approximately \$8,600 in 1985 international dollars. Projections of future traffic fatalities suggest that the global road death toll will grow by approximately 66 percent between 2000 and 2020 (Kopits & Cropper, 2003).

Some studies have shown that there is a U-shaped relationship between road deaths and economic growth. In new research (Hua, 2018) finds that this relationship also holds for non-fatal road injuries in developed countries, but not in countries which are developing.

He writes that an increasingly urban population, more road vehicles, and a greater number of elderly people were all likely to decrease the number of road injuries in developed countries but do the opposite in developing countries. Studies of developed countries showed

an inverted U shape relationship between economic growth and road traffic accidents (Van Beeck, Borsboom, & Mackenbach, 2000).

Various studies have shown that there is an inverted U-shaped relationship, which is known as the Kuznets curve, between road deaths and economic growth: that is, road deaths increase at lower income levels, but decrease once the number has exceeded a certain threshold (Hua, 2018).

3. RESULTS OF THE RESEARCH

The level of economic development has been characterized by real GDP per capita ratio. The indicator is calculated as the ratio of real GDP to the average population of a specific year. GDP measures the value of total final output of goods and services produced by an economy within a certain period. It is a measure of economic activity and is also used as a proxy for the development in a country's material living standards.

As Table 1 shows real GDP per capita varies in Bulgaria from EUR 3.0 thou in 2000 year to EUR 6.6 thou in 2020.

In Luxembourg during this period economic growth was from EUR 72.5 thou to EUR 81.3 thou.

The nine EU member states belong to the group of low economic development. This countries' group distinguishes by lower pace of economic development comparing with other EU countries. On average, real GDP per capita is from EUR 5.9 thou in 2000 to EUR 11.5 thou in 2020 in this group.

Six countries are involved into lower middle group of economic development, where real GDP per capita makes from EUR 14.5 thou to EUR 19.1 during 2000-2017 period; six countries belong to the group of the upper middle economic level with average GDP per capita from EUR 27.7 thou to EUR 31.7 thou; seven countries represent the group of high economic level with average GDP per capita EUR 35.22 thou to EUR 44.72 thou.

Finally, Luxembourg is the EU member state with very high level of economic development which makes approximately EUR 72.5 thou in 2000 to EUR 81.3 thou in 2020.

According to the level of economic development, the authors have grouped the EU countries into five categories (Table 1).

Table 1: The groups of the EU countries by the level of economic development

Groups of the countries	Real GDP per capita, Euro, 2000	Real GDP per capita, Euro, 2010	Real GDP per capita, Euro, 2020
I. Low economic level			
Bulgaria	5910	9146	11500
Romania	3000	5050	6600
Latvia	4200	6200	8780
Lithuania	5200	8520	12130
Poland	5200	9050	13890
Slovakia	6400	9400	12680
Croatia	7800	12560	15090
Estonia	8190	10520	11500
Hungary	7600	11060	15010
	7900	9960	12640
II. Lower middle economic level			
Malta	14500	18291	19100
Cyprus	13800	16440	20400
Slovenia	20200	23400	23050
Portugal	13980	17750	19720
Greece	16230	16990	17070
Czech	17430	20150	16300
	11230	15020	17340
III. Upper middle economic level			
Spain	27700	30121	31700
Italy	21460	23040	22350
France	27430	26940	24890
Germany	28930	30690	30610
Belgium	29000	31940	34310
Finland	29890	33330	33560
United Kingdom	30500	35080	36070
	26800	29830	-
IV. High economic level	35220	38870	44720
Netherlands	35100	38470	40160
Sweden	33960	39950	42640
Ireland	33300	36700	62980
Denmark	42200	43840	48150
Austria	31700	35390	35390
V. Very high economic level	72530	79160	81290
Luxembourg	72530	79160	81290

Source: authors' calculations based on Eurostat data 2000–2020

According to the European Commission, the average decrease in the annual number of fatalities in Europe between 2000 and 2010 was 6% (European Commission, 2013).

According to the OECD, the total number of people injured in traffic accidents in EU, USA and OECD Member States between 1998 and 2010 decreased by 50%, 31% and 41%, (OECD 2011).

According to the European Automobile Manufacturers' Association (ACEA) in June 2018, passenger car registrations posted a robust increase (+5.2%) across the EU, totalling almost 1.6 million new cars.

Results were too diverse among the five major EU markets. The United Kingdom (-3.5%) and Italy (-7.3%) both posted declines, while demand for cars increased in France (+9.2%), Spain (+8.0%) and Germany (+4.2%). Over the first half of 2018, the European passenger car market grew by 2.9%. The strong performance of the new EU Member States is worth highlighting, as registrations increased by 11.4% so far in 2018 year.

Looking at the major markets, demand went up in Spain (+10.1%), France (+4.7%) and Germany (+2.9%), although sales contracted in the United Kingdom (-6.3%) and in Italy (-1.4%) during the first six months of 2018 year.

Overall, the passenger car fleet in almost all of the EU Member States has grown over the last five years. Comparing the increase of motorization level in the new and old EU member states, we can see different levels of cars per 1000 inhabitants (see Figure 1).

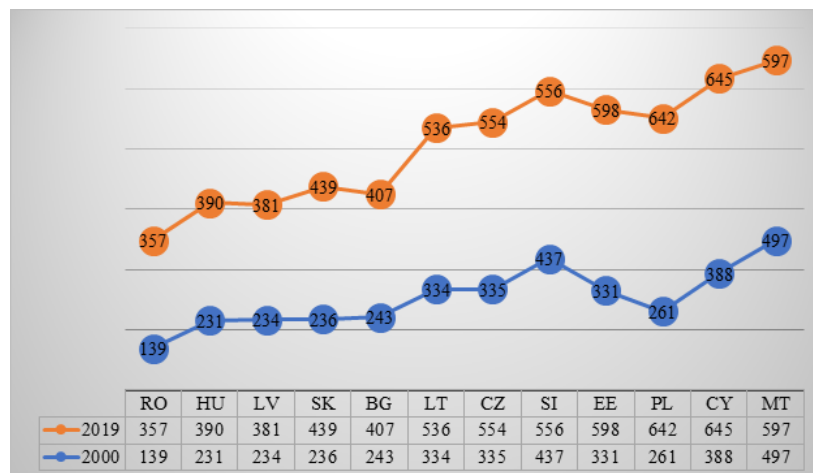


Figure 1: Motorization rate of the new EU Member States in 2000 - 2019 (passenger cars per 1000 inhabitants)
 source: Eurostat data

According to Figure 2, the number of passenger cars in almost all new EU Member States has grown over the last years: the average number of cars per 1000 inhabitants was 531 in 2019. Amongst the new EU Member States with the highest “motorization rates” i.e. passenger cars per 1000 inhabitants, in 2019 was recorded in Cyprus (645), Poland (642) and Estonia (598).

The highest growth rate was in Poland (245%), Romania (256%), Belgium (167%), Slovakia (186%), Estonia (180%). The lowest growth rate was in Slovenia (78%), Malta (83%), Lithuania (62%), Latvia (61%), Hungary (59%).

In Figure 2 are presented statistics on motorization growth of old Member States. The highest number of registered passenger cars per 1000 inhabitants in 2019 was observed in Luxemburg with 681cars. Thereafter, followed Italy (663) and Finland (642). The lowest number of cars per 1000 inhabitants was in 2019 among Latvia (381), Hungary (390) and Bulgaria (407).

The highest growth rate over the 19 year period from 2000 to 2019 was recorded in Greece (59%), and Finland (64%). Other Member States recorded less growth of motorization in France (4,1 %), Germany (7,7%).

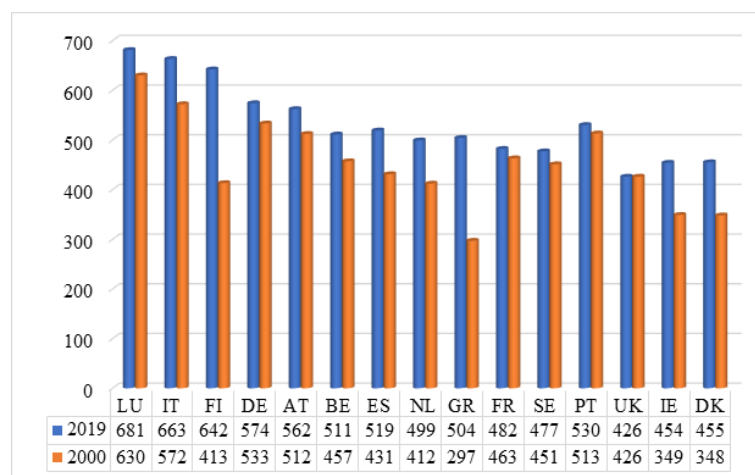


Figure 2: Motorization rate of old EU Member States in 2000 - 2019 (passenger cars per 1000 inhabitants)
 Source: Eurostat

The car market suffer a severe slowdown in 2020: the first registrations of passenger cars fell by 26% compared to 2019, goods transport vehicles by 16%, while the first registrations of motorcycles reduce of -6,4%, total vehicles of -22%.

As a result, the age of the vehicle fleet has further increased. On the motorway network, the annual mileage of vehicles decrease on average by 27.5%; the decrease is greater for light vehicles (- 32.1%) while heavy traffic decrease by 12.4%.

Considering the atypical situation caused by the pandemic and the lockdown periods, so it is clear that 2020 cannot represent a reference year for analyzes and benchmarks for the European 2030 targets (further halving in the number of victims and a 50% reduction in the number of seriously injured).

In order to correctly monitor progress and performance indicators for road safety, the European Commission and the EU countries decided, in fact, to consider 2019 as the baseline

year, or the average for the three-year period 2017-2019 which seems optimal because it smooths the random fluctuations that a single year could suffer from (Istat, 2021).

4. DISCUSSION AND INTERPRETATION OF RESULTS OBTAINED

In 2017, based on Community Road Accident Database (CARE) the European Union sees more than 40,000 fatalities and 1.7 million injuries from road accidents each year, i.e. the average number of people killed per 1 million inhabitants consisted 49. In Lithuania, according to CARE data, 67 people were killed per 1 million inhabitants in 2017.

A higher number of people killed on roads per 1 million inhabitants in 2017 were represented in 6 European countries: in Greece (69 killed/million inhabitants), in Latvia (70 killed/million inhabitants), in Poland (75 killed/million inhabitants), in Croatia (90 killed/million inhabitants), in Bulgaria (96 killed/million inhabitants) and in Romania (98 killed/million inhabitants).

The leading country between the EU Member States in 2017 was Sweden, where 25 people were killed per 1 million inhabitants. Since 2011 Lithuania was seeking to achieve an ambitious target of the National Road Safety Development Program for 2011–2017 to get between 10 European Union states showing the best results or to reduce the number of the killed per 1 million inhabitants to 60.

But it didn't managed to achieve this target: the number of people killed per 1 million inhabitants in Lithuania reached 67 in 2017 year and according to this indicator Lithuania took only 20 position among European Union countries. Since the start of the National Road Safety Development Program for 2011–2017 the number of fatalities per 1 million of population in Lithuania decreased by 27 %. In 2017, on the roads and streets of Lithuania 3192 injury accidents took place where 192 people were killed and 3752 were injured.

Compared to 2016 the number of road accidents and people injured were almost the same – number of accidents decreased by 0,3 % and number of injured people increased by 0,1 % , the number of road fatalities remained unchanged (Statistics of fatal and injury road accidents in Lithuania, 2011–2017, Vilnius 2018).

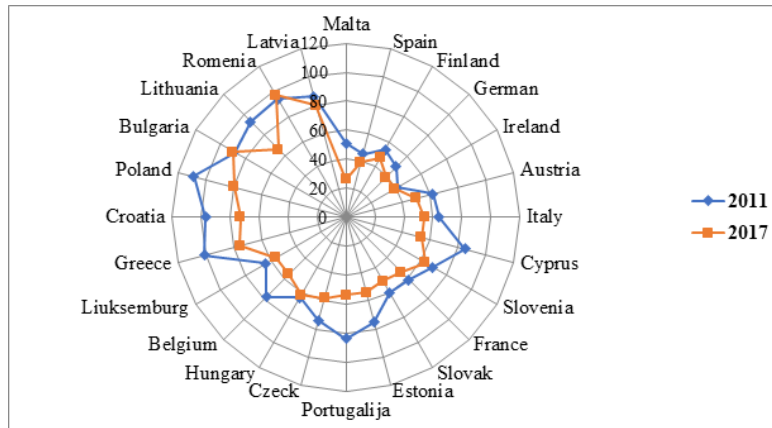


Figure 3: Road fatalities per million of population in EU
 Source: CARE, 2017

Over a long time, a clear downward trend can be observed in all Member States except Malta. In particular, the number of road traffic victims has been cut by two-thirds or more in Portugal (from 2 730 in 1996 to 563 in 2016, or -79.4%), Latvia (-73.4%), Lithuania (-71.8%), Spain (-67.0%), Greece (-66.7%) and Slovenia (-66.6%). Overall, in the EU, the number of road traffic victims more than halved (-57.4%) between 1996 and 2016 (Eurostat, 2016).

European roads remain the safest in the world: the EU counted 49 road fatalities per one million inhabitants, against 174 deaths per million globally in 2017. According to data from the World Health Organization about 1.3 million people die each year on the world's roads, of which 25.300 lost their lives in the EU last year. Thanks to decisive action at local, national and EU level, the EU has made impressive progress over the past decades.

However, the progress rate has lately slowed down. After two years of stagnation (2014 and 2015), the number of road fatalities was reduced by 2% in 2016, and by another 2% in 2017. While the last two years give rise to some optimism, it will be very challenging for the EU to reach its ambitious target of halving the number of road deaths between 2010 and 2020. For every person killed in traffic crashes, about five more suffer serious injuries with life-changing consequences. Serious injuries are common and often more costly to the society because of long-time rehabilitation and healthcare needs.

The Commission estimates that 135.000 people are seriously injured on Europe' roads every year. As an overall trend, the performance gap between EU Member States has been narrowing year after year. Following a pronounced discrepancy in Member States' road safety records in the 1970s and 1990s, a clear convergence began in 2000. In 2017 year, only two EU Member States recorded a fatality rate higher than 80 deaths per million against eight in 2011. In

2017, most of the Member States had a road fatality rate below 60 deaths per million inhabitants, and eight of them stood below 40 deaths per million inhabitants.

In 2017 can be distinguished the following trends: the average level of motorization was 500 cars per 1000 inhabitants, and the average death rate per 1 million population was approximately 50, given, that the highest real GDP per capita was in Luxemburg (80.3 thou euro per capita) with the higher motorization rate (662 cars per 1000 inhabitants). In this country the number of fatalities was 56 per 1 million inhabitants in comparison with 159 in 2000 year.

From other hand in Bulgaria the real GDP euro per capita was 6.3 thou euro per capita, motorization rate 443 cars per 1000 inhabitants with fatalities of 99 per 1 million inhabitants.

The international MAIS trauma scale (Maximum Abbreviated Injury Score) has been used for the EU definition of serious road traffic injuries as from 2014. The scale 3 and more (MAIS3+) is the one applying to seriously injured.

In Table 1 the EU countries have been grouped into five categories, such as:

- 1) very high economic level,
- 2) high economic level,
- 3) upper middle economic level,
- 4) lower middle and
- 5) low economic level.

Thereafter, the relationship between motorization rate growth and decrease of fatalities among these countries' groups has been examined.

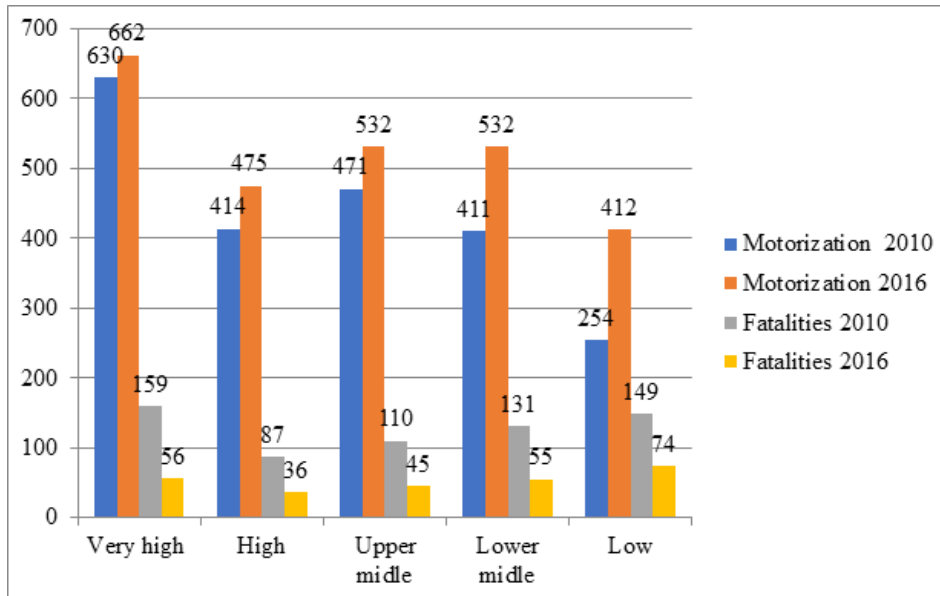


Figure 4: Relationship between income growth, motorization and amounts of fatalities in countries with different economic level

Source: Eurostat

Figure 4 shows the relationship between motorization growth rate and decline of fatalities in countries of different economic growth level.

In Luxemburg, which is country of Very high economic level, the growth of motorization level during the period 2000-2016 consist of 5 percent, as the number of fatalities decreased by 35 percent.

In the EU countries with High economic level (Netherlands, Sweden, Ireland, Denmark, and Austria) motorization rate grew by 15 percent and the number of fatalities – decreased by 59 percent.

In the countries of Upper middle economic level motorization rete grew by 13 percent, while fatalities – drop by 58 percent.

In the Lower middle economic level countries, the growth of vehicles number was 29 percent and fatalities – drop by 57 percent.

In the countries of Low economical level motorization level grew by 62 percent, as number of fatalities decreased by 50 percent.

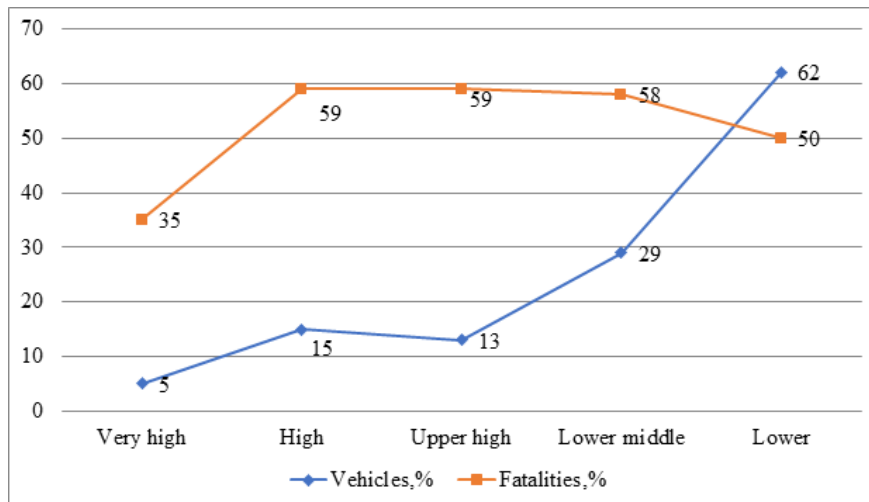


Figure 5: The rate of increase in motor vehicles and number of fatalities per motor vehicle, %
 Source: compiled by the authors

The results in Figure 5 confirm hypothesis that in the countries of higher income level, the rate of increase in motor vehicles is lower than the decline in fatalities per motor vehicle, and in countries of low-income levels the rate of increase in motor vehicles is higher than the decline in fatalities per motor vehicle.

The key findings will be translated into objectives, which consequently lead to measures around arrangements on Motor Third Party Liability insurance regulations development and improvements in transport safety.

5. CONCLUSIONS

- 1) Economic growth of countries is accompanied by growth of motorization rate, which results in an increase of road traffic injuries. Although the EU guarantees the free movement of persons, the member states differ in terms of economic growth, motorization growth rates, and fatalities on the roads. Scientists are trying to find the relationship between economic growth and road traffic accidents by creating models to project traffic fatalities and the stock of motor vehicles in future.
- 2) The insurance of motor third party liability (MTPL) serves as powerful instrument for regulation problems arising after accidents. Insurance companies must take into account the accident rate and deaths in road accidents when calculating insurance premiums. However, these variables vary greatly in separate EU member states.
- 3) The Commission announced on possible amendments to enhance the protection of traffic accident victims in cases when insurer is insolvent, in improvement the recognition of

claims history statements, risks due to uninsured driving, harmonization of minimum amounts of cover and the scope of the Directive. To obtain the aforementioned aim, the following objectives are set: to analyze the motorization level of the EU countries, to identify relationship between economic growth and road traffic accidents victims.

- 4) EU countries have been grouped into five categories, such as: very high economic level, high economic level, upper middle economic level, lower middle and low economic level thereafter, the relationship between motorization rate growth and decrease of fatalities among these countries' groups has been examined.
- 5) The number of passenger cars in almost all new EU Member States has grown over the last years: the average number of cars per 1000 inhabitants was 531 in 2019 in EU. Amongst the new EU Member States with the highest "motorization rates" i.e. passenger cars per 1000 inhabitants, in 2019 was recorded in Cyprus (645), Poland (642) and Estonia (598).
- 6) Results of research on the relationship between motorization rate growth and decrease of fatalities among these countries' groups confirmed hypothesis as in the EU countries of higher income levels, the rate of increase in motor vehicles is lower than the decline in fatalities per motor vehicle, and in countries of low income levels the rate of increase in motor vehicles is higher than the decline in fatalities per motor vehicle.
- 7) The key findings will be translated into objectives, which consequently lead to measures in the area of arrangements of Motor Third Party Liability Insurance regulation development and improvements in transport safety.

REFERENCES

- Brueckner, M., & Lederman, D. (2018). Inequality and economic growth: the role of initial income. **Journal of Economic Growth**, 23(3), 341–366.
- Bayar, Y., Gavriletea, M., & Danuletiu, D. C. (2021). Does the insurance sector really matter for economic growth? Evidence from Central and Eastern European countries. **Journal of Business Economics and Management**, 22(3), 695–713.
- David, W. J. (2010). **Mass Motorization and Mass Transit: An American History and Policy Analysis**. Indiana University Press.
- Ernits, E., Antov, D., & Kott, A. (2017). Assessment of the precision of data collected about the traffic accidents with property damage only in claim handling process by insurance companies. **Transport**, 32(2), 160–166. DOI: <https://doi.org/10.3846/16484142.2014.914571>.

European Commission (2017a). **Road Safety**: What is behind the figures? Brussels, 10 April 2018.

European Commission (2017b) **Fact sheet, road safety statistics**: What is behind the figures? Brussels, 10 April 2018.

Hua, L. T. (2015). Factors associated with the relationship between non-fatal road injuries and economic growth? **Transport Policy**, 42(C), 166–172.
DOI: 10.1016/j.tranpol.2015.06.004

Hua, L. T. (2018). **Economic growth means more road injuries in less developed countries, but fewer in those which are highly developed**. LSE Phelan US Centre. Available in: <https://blogs.lse.ac.uk/usappblog/2015/10/12/economic-growth-means-more-road-injuries-in-less-developed-countries-but-fewer-in-those-which-are-highly-developed/>. Access in: 02/28/2022

International Transport Forum (2017). **Road Safety Annual Report**. Paris, France. Retrieved from: <http://www.sipotra.it/wp-content/uploads/2017/10/Road-Safety-Annual-Report-2017.pdf>. Accessed: December 02, 2021.

Istat (2021, July 22). **Automobile Club d'Italia. Road accidents 2020**. Retrieved from: https://www.istat.it/it/files//2021/07/Road-accidents_2020_EN.pdf. Accessed: December 06, 2021.

Kopits, E., & Cropper, M. L. (2003). Traffic Fatalities and Economic Growth. **Open Knowledge Repository**. DOI: 10.1596/1813-9450-3035

Lithuanian MTPL Law (14 June 2001) **No. IX-378**. Retrieved from: <https://www.cab.lt/web/en/law-on-compulsory-insurance>. Accessed: December 02, 2021.

OECD (2017). **World Development Indicators**. Organization for Economic Cooperation and Development. Retrieved from: <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators> Access: 23 September 2021.

Saurabh, V. (2013). **CARE Database: CaDaS – Common Accident Data Set**. Version 3.2. European Commission, Directorate General for Mobility and Transport. 133 p. Retrieved from: http://ec.europa.eu/transport/road_safety/pdf/statistics/cadas_glossary.pdf. Accessed: December 04, 2021.

Van Beeck, E. F., Borsboom, G. J., & Mackenbach, J. P. (2000). Economic development and traffic accident mortality in the industrialized world, 1962–1990. **International journal of epidemiology**, 29(3), 503-509.

Vilnius (2018). **Statistics of fatal and injury road accidents in Lithuania, 2014–2017**. Retrieved from: https://lakd.lrv.lt/uploads/lakd/documents/files/eismo_saugumas/statistika/en/2018/statistics_2014%20%80%932017.pdf. Accessed: December 09, 2021.

World Health Organisation. (2017). **Violence and Injury Prevention**. Road traffic injuries. Report. Retrieved from: http://www.who.int/violence_injury_prevention/road_traffic/en/. Accessed: December 09, 2021.