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Exploring the relationship between truck load capacity and traffic accidents in the European Union

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ABSTRACT

Applying econometric techniques to EU28 panel data and controlling for explanatory variables such as road types, we find that increased truck load capacity does not necessarily aggravate road traffic safety. Specifically, heavy trucks do not seem to be linked with greater numbers of traffic fatalities/accidents, medium trucks appear to be the worst performers in terms of fatalities, and light trucks seem to be the worst for accidents. In summary, our results clarify the complex relationship between truck load capacity and road safety, pointing to the existence of a negative correlation for accidents per capita and an inverse U-shaped curve for fatalities per capita.

1. Introduction

Road freight traffic is a key part of the European common market. However, the external costs associated with motorized transportation have prompted the European Union (EU) to develop a more efficient, sustainable and safer transport system within a framework of liberalization and competition (e.g., Koliousis et al., 2013).

Additionally, as Sanches Rodrigues et al. (2015) explain, certain features of modern European supply chains (i.e., the high concentration of production seeking to exploit economies of scale, and large volumes of freight transported long distances across the continent) have led practitioners to call for an increase in truck dimensions. The fact that road freight transport seems to be a more flexible mode for door-to-door service has contributed to freight consolidation in larger and heavier vehicles (McKinnon, 2008).

However, from a road safety approach, the literature has generated unclear evidence as to the impact of large truck traffic (Carson, 2011). Therefore, the current article explores empirically how different truck configurations impact European road safety, with particular emphasis on the effect of heavy truck traffic compared to other truck categories.

Authors such as Stein and Jones (1988) consider that truck accident involvement may be affected by several factors (i.e., truck operating characteristics, such as load or size; truck driver characteristics, such as age or work conditions; weather and road conditions); while others, such as e.g., Jones et al. (1983) and Vallette et al. (1981), state that vehicle weight and loading variables are essential parameters for vehicle dynamics, roll stability and handling characteristics. Thus, we assess the safety

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differences between three different truck types on the basis of load capacity (i.e., light, medium and heavy trucks) in terms of traffic accidents and fatalities.

In general, the earlier literature has broadly shown that truck road accidents are a significant issue. According to Corsi et al. (2014), due to their economic and social costs, road traffic accidents involving trucks have caught the attention of governments, academicians and society in general. In recent years scientific papers have analyzed a vast array of issues. For example, Britto et al. (2010) and Cantor et al. (2008) have investigated the relationship between motor carrier safety and financial performance; Cantor et al. (2009, 2010), Hickman and Hanowski (2011), Mejza and Corsi (1999) and Mejza et al. (2003) have explored the effect of individual driver attributes, technologies and safety best practices on accident likelihood, while other authors have examined the impact of truck drivers' employment status (Cantor et al., 2013; Corsi et al., 2012). Further studies have tested the influence of external factors, such as infrastructure design (Chang and Chien, 2013); vehicle technologies and maneuvering capabilities (Mooren et al., 2014); environmental conditions (Choi et al., 2014), and specific safety policies (Castillo-Manzano et al., 2015a). Some studies have even analyzed the possibility of internalizing the externalities generated by truck accidents (Anderson and Auffhammer, 2014; Savage, 2011).

Less attention has been paid to research into the effects on traffic safety outcomes of trucks disaggregated by size, weight or configuration. Chang and Mannering (1999) explain that it can be difficult to isolate the significance of these effects due to the presence of confounding factors. In addition, Carson (2011) points out that this literature represents a mixture of statistical papers and institutional reports based on different sources, models and methodologies that provide contradictory conclusions. Moreover, since the well-known TRB study (1990), most of studies on the topic have referred to the U.S. (af Wåhlberg, 2008; Braver et al., 1997; Khorashadi et al., 2005; Welki and Zlatoper, 2009, among many others), or discuss the safety of only one truck size category, mainly large and heavy trucks (Anderson and Auffhammer, 2014; Lemp et al., 2011; Zhu and Srinivasan, 2011).

More precisely, the previous literature shows that the evidence regarding the relationships between load capacity-based truck categories and traffic accidents and their severity is fragmented or even inconclusive. In fact, the af Wåhlberg (2008) meta-analysis, possibly the broadest review published on this topic to date, states that research on this topic has been characterized by a geographic bias (most of the studies take the US as their case study) and detects certain methodological shortcomings that are basically the result of limited exposure data for holding the road type constant. Therefore, the author concludes that this issue has not been conclusively answered.

Our paper therefore attempts to shed light on this still unresolved issue by assessing the safety differences in terms of traffic accidents and fatalities between three different truck types categorized by load capacity (i.e., light, medium and heavy trucks). For this we use a comprehensive database of a large number of heterogeneous EU countries and for a broad recent timeframe, the 1999–2012 period. While the main variables of the empirical analysis are for different categories of truck load capacity, we control for several explanatory factors of safety outcomes, such as country attributes, proxies for the type of roads used by trucks and specific road safety policies. All this enables us to offer robust results on this relevant topic.

Specifically, our research aims to answer the following questions: How does truck weight – gauged by load capacity – affect European traffic safety? What differences in safety are there among different truck load capacity categories in the EU? Which truck load capacity category is the most hazardous for EU traffic safety? Are people more likely to be involved in fatal accidents in the EU as truck load capacity increases?

The main contribution of our investigation is that it is the first to examine EU road safety issues in relation to this specific breakdown of truck types using a broad set of control variables. We believe that our findings may serve as a starting point for the analysis of different truck types circulating on other geographic levels and in other areas; and, in a practical context, they may also be helpful to governments and policy makers by adding safety issues to the perspectives of sustainability and logistics to orient both logistics and road safety strategies. In this regard, our results could also serve as a guide to adapt technology efforts, regulation and enforcement strategies to different truck configurations.

The timeliness of our research is justified by recent EU and individual government initiatives to extend the use of higher capacity freight vehicles (see e.g., Bergqvist and Behrends, 2011; ITF, 2010; McKinnon, 2008; Sanches Rodrigues et al., 2015 for a more in depth analysis). The body of EU legislation that addresses standard regulations on maximum weights and dimensions for heavy goods vehicles, buses and coaches mainly conforms to Directive 96/53/EC (see http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:31996L0053). This norm ensures the unhindered movement in Member States[1] of vehicles within these limits. It also places restrictions on the cross-border movement of vehicles that are heavier, longer or higher than these standards, the so-called *Mega Trucks*, *Long and Heavy Vehicles (LHVs)*, and *EuroCombis* or *Gigaliners*.[2] The European Commission (EC) has attempted to legalize cross-border mega trucks traffic during recent years, but the initial Directive has recently been amended by Directive (EU) 2015/719 (accessible at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2015.115.01.0001.01.ENG), which provides for derogations from the maximum lengths to improve the safety and environmental emissions of heavy goods vehicles (through improved aerodynamic performance) and also recommends that no modifications should be made to Directive 96/53/EC's

[1] Today different EU countries have different national regulations regarding maximum dimensions. According to this Directive, the maximum permitted length is 16.50 m for semitrailers and 18.75 m for road trains with a total combined weight of 40 tonnes (the so-called Heavy Goods Vehicles, HGVs).

[2] Up to 25 m in length and 60 tonnes in weight.