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Hours of service regulations in the United States and the 2013 rule change

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ABSTRACT

This paper studies the revised hours of service regulations for truck drivers in the United States which entered into force in July 2013. It provides a detailed model of the new regulation and presents and a new simulation-based method to assess the impact of the rule change on operational costs and road safety. Unlike previous methodologies, the proposed methodology for assessing the impact of hours of service regulations takes into account that, by optimizing routes and schedules, carriers can minimize the economic impact of stricter regulations. Simulation experiments are conducted indicating that the monetized safety benefit of reducing the daily driving time limits is on the same order of magnitude as the increase in operational costs.

1. Introduction

In July 2013, new hours of service regulations for truck drivers entered into force in the United States (Federal Motor Carrier Safety Administration, 2011). The revised regulations were the outcome of a long dispute concerning the safety impact of previous hours of service regulations. In 2003 the Federal Motor Carrier Safety Administration (FMCSA) increased the previous daily driving time limit from 10 to 11 h and introduced the commonly called '34-h restart' provision (Federal Motor Carrier Safety Administration, 2003). These regulations as well as merely identical rules subsequently published were overturned by the U.S. Court of Appeals for the D.C. Circuit. After another lawsuit was filed (Stone et al., 2009) against the once again identical rules published in 2008 (Federal Motor Carrier Safety Administration, 2008a), the FMCSA signed a settlement agreement and announced that it will reconsider and change the regulations. The now revised regulations restrict the usage of the '34-h restart' provision and introduce a new provision, which requires that drivers must only drive if a period of at least 30 min of off-duty time is taken within the last 8 h. Although the FMCSA considered reducing the daily driving time limit to at most 10 h and also evaluated a driving time limit of 9 h, the agency was not able to show that the improved road safety resulting from reducing the maximum daily driving time is justified by the negative impact on productivity. The FMCSA retained the daily driving time limit of 11 h, but mentioned that it would have favored a lower daily driving time limit. Furthermore, the agency indicated that future research may provide a basis for reconsidering the daily driving limit (Federal Motor Carrier Safety Administration, 2011).

In this paper previous regulatory impact assessments are reviewed and a new methodology for assessing the impact of revised regulations on road safety and productivity is proposed. The main contributions of this paper are the following. First, several shortcomings of the recent regulatory impact assessments conducted by the FMCSA are identified. To overcome these shortcomings a new simulation-based methodology for assessing the impact of regulations on accident risks and productivity is proposed. This methodology is based on a detailed model of the revised regulations and a scheduling procedure capable of automatically generating truck driver schedules complying with the revised regulations. The scheduling procedure can be used by motor carriers to automatically generate and optimize vehicle routes and schedules using computer-based planning approaches. As the method guarantees that drivers are given enough time for regularly taking breaks and rest periods, the method itself can contribute to improved road safety if carriers use planning tools using this method. The regulatory impact assessment based on the proposed methodology indicates that road safety benefits of reducing the daily driving time limit are on the same order of magnitude as the increase in operational costs.

The next section gives a description of the revised regulations. After providing an overview of related work and previous regulatory impact assessments in Section 3, the new methodology to assess the impact of hours of service regulations is presented in Section 4. A detailed model of the revised regulations and a

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method to optimize routes and schedules are described in Section 5. In Section 6, the regulatory impact analysis is given and Section 7 concludes the paper.

2. The revised hours of service regulations

In December 2011, the FMCSA published new hours of service regulations for truck drivers in the United States which entered into force in July 2013. Like the previous regulations, the revised regulations distinguish between *on-duty time* and *off-duty time*. On-duty time refers to all times a driver is working, and includes driving activities as well as other work such as loading and unloading. Off-duty time refers to any time during which a driver is not performing any work.

According to the regulations, a driver must not drive without first taking a period of 10 consecutive hours of off-duty time. In the remainder such a period is referred to as *rest period*. The maximum amount of driving time between two consecutive rest periods is limited to 11 h. The regulation prohibits a driver from driving after 14 h have elapsed since the end of the last rest period. While the above rules are the same as in the previous regulations, the new regulations furthermore introduce additional break constraints which prohibit a driver from driving after 8 h have elapsed since the end of the last off-duty period of at least 30 min. In the remainder such a period is referred to as *break period*.

If the employing motor carrier operates every day of the week, a driver must not drive after 70 h of on-duty time are accumulated within a period of 8 days. Otherwise, a driver must not drive after 60 h of on-duty time are accumulated within a period of 7 days.

If an off-duty period of at least 34 consecutive hours is taken, the driver may restart accumulating on-duty time with respect to the previous provision. According to the revised regulations, this 34 h off-duty period must include two periods from 1 AM to 5 AM. Furthermore, the calculation of the accumulated on-duty time may only be restarted if 168 or more consecutive hours have passed since the beginning of the last 34 h off-duty period.

3. Related work

Different methodologies to analyze how a rule change impacts productivity and road safety have been used in the past. If statistical data for periods before and after a regulatory change are available, the impact of the change can be assessed by comparing the respective data sets. The study by McCartt et al. (2008) used survey based data for the periods before and after the rule change of 2003 came into effect. According to the survey, one out of six truck drivers admits to having dozed at the wheel in the month prior to the survey. This value has significantly increased since the 2003 rule came into effect. The survey also revealed that less than one out of two truck drivers reported that delivery schedules are always realistic. Truck drivers who reported that they are sometimes or often given unrealistic delivery schedules are approximately three times as likely to violate the work rules compared to drivers who rarely or never have to deal with unrealistic delivery schedules. Hanowski et al. (2007) conducted a naturalistic driving study based on data collection using sensors and video to analyze the impact of the 2003 rule change on the duration of sleep and involvement in critical incidents. They found that prior to a critical incident, drivers received less sleep, and that, compared to the amount of sleep identified in previous research by Mitler et al. (1997), drivers may be getting more sleep after the rule change. In another study Hanowski et al. (2009) analyzed the impact of the 2003 rule change focusing on the increased daily driving time limit. Based on the occurrence of critical incidents as a function of driving hours since the last rest period, Hanowski et al. (2009) found no evidence that accident risks are increased by changing the daily driving time limit from 10 to 11 h. Whether the increase in the driving time limit has an impact on accident risks on subsequent days was not assessed.

Obviously, approaches similar to the ones above can only be conducted after a rule change has been implemented. In 2008, the FMCSA conducted a regulatory impact analysis (RIA) using a simulation-based approach (Federal Motor Carrier Safety Administration, 2008b). A truck driver performing full truckload operations is simulated assuming that whenever the driver delivers a load, a new pickup and delivery request is selected from a pool of potential requests. A rule-based approach for scheduling duty and rest periods is used in the simulation. The scheduling approach is not based on a detailed model of the regulation and assumes that drivers take voluntary breaks although they are not required by the regulation. In the last few years significant progress has been made in developing detailed models of hours of service regulations worldwide (Archetti and Savelsbergh, 2009; Goel, 2010; Kok et al., 2010; Prescott-Gagnon et al., 2010; Goel and Kok, 2012; Goel and Rousseau, 2012; Goel et al., 2012; Rancourt et al., 2012). These detailed models and the scheduling methods presented in these papers could be used to replace the rule-based approach used in the 2008 RIA.

The 2008 RIA analyzes all truck driver schedules generated within the simulation-based approach with respect to operating costs and accident risks. To assess accident risks of work plans the SAFTE/FAST model is used, which together with other biomathematical models for human performance and fatigue is surveyed in Mallis et al. (2004). As the SAFTE model does not include the effects of workload, the crash risk after a given number of hours of driving is estimated using a function derived from the analysis by Campbell (2005). The results of both models are then combined to assess the overall impact of the regulations considered on accident risks. In 2006, the Health and Safety Executive in the United Kingdom published a different approach to assess the accident risk associated to work plans of shift workers (Spencer et al., 2006; Health and Safety Executive, 2006). This approach considers the cumulative impact of sleep deprivation, the circadian rhythm as well as the duration of breaks during a work shift. With this integrated tool it is not required to use and combine the results of different models as was done in the RIA of 2008.

For the recently revised regulations the FMCSA conducted a new RIA (Federal Motor Carrier Safety Administration, 2010). In the new RIA, typical operating patterns of truck drivers are analyzed and drivers are categorized according to their average weekly work time. Based on this classification of drivers and their share in the industry, estimates are given on how a change in hours of service regulations impacts schedules of truck drivers with respect to productivity, accident risks, and occupational health. All impacts are monetized and the net benefit for different alternative sets of rules is calculated. The RIA evaluates and compares four different regulatory options. The first option is to retain the regulations which came into effect with the 2003 rule change. The other options are the new regulations which entered into force in July 2013, and two variants of the new regulations in which the daily driving time limit is reduced to 10 h or 9 h. As all of the latter options impose stricter limits, the RIA uses the regulations implemented in 2003 as a baseline and tries to estimate how often a driver will not be able to perform the same driving tasks if stricter rules are in place. The RIA calculates how much driving time is lost in any shift and, based on their judgments, the RIA assumes that some of this lost driving time can be transferred to another day. Whether or not the lost time can be transferred to another driver is not assessed and the FMCSA assumes that any productivity loss of a driver is a societal cost.