

# Chapter 13

## The External Costs of Road Transport: A Case Study of Turkey

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### **ABSTRACT**

*This chapter focuses on the estimation of marginal and total external costs of road transportation in Turkey in terms of accidents, air pollution, climate change, noise, and traffic congestion. The study estimates marginal external costs for cars, light commercial vehicles (LCVs), heavy duty vehicles (HDVs), busses, and motorcycles, which comprise total vehicle fleet stock of the Turkish road transport sector. The researchers reviewed the literature of both local and international studies for the quantification and monetisation of the specified external costs of road transport. This will provide a base for the future studies on Turkish transport research and transport policy appraisal guidelines. The authors conclude that accidents are the most important externality of road use and that local air pollution and congestion appear to be more important than noise and climate change. This implies that priority should be given to road accidents, air pollution, and congestion alongside noise and global warming.*

### **INTRODUCTION**

Although transportation sector has a significant share in the national income accounts, it generates side effects, through its negative impacts on public health and on the environmental resources. These effects are known as external effects, such as congestion, road crashes, air pollution, noise, impacts on climate change and water resources; and the costs associated with these are called 'external costs'. Externalities are effects arising from a purchase or use decision by one set of parties that fall on people other than the purchaser or the user (Verhoef, 1994; Boundreaux and Meiners, 2019). Therefore, users are not aware

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of the impacts of their activities on the society and do not channel this into their purchasing patterns or behavioral decisions. According to the welfare theory, internalisation of external costs through the use of market-based instruments may result in a more efficient use of transport infrastructure, reduce the negative impacts of transport activity on the society and environment, and enhance equity between transport users.

There is abundant literature on the subject, in which negative externalities have drawn the most attention (Mayeres et al., 1996; Griffiths et al., 2019). Regarding road transport externalities, Newbery (1994) pointed to travel delays stemming from road congestion, road damage and accidents as the most relevant externalities covered by the literature. The bulk of literature focusing on travel delays has examined road congestion mainly from economic point of view. Among the studies that focused on models of road pricing in relation to congestion, we can refer to Stopher (2004), Small and Verhoef (2007), Croci (2016), and de Dios Ortuzar et al. (2021). A comprehensive review on road congestion theory and practice can be found in Emmerink et al. (1995), Levinson (2010), Beaudoin et al. (2015) and Gu et al. (2018). Differently, Vitaliano and Held (1990), and Hau (1995) examined road damage externalities through developing theoretical models and searching for policy implications. However, there are more studies researching on accident externalities and relevant policy tools needed to control of externalities. Some examples include: Edlin and Karaca-Mandic (2006), Saito et al. (2010), Dementyeva et al. (2015) and Muehlenbachs et al. (2021).

Other externalities of road transportation include air and noise pollution, climate change, aesthetic impact and barrier effects, among others. Most importantly, there is overwhelming body of evidence that air pollution has significant impacts on the environment and health worldwide (Bel and Holst, 2018; Liu et al., 2020). It has been accepted that road transport is one of the key contributors to the rising levels of greenhouse gases and air pollutants contributing to worsening air quality (Commission of the European Communities, 1990; Duffy et al., 2017). In order to assess potential exposure and estimate long-term impacts on the public health, transport and population exposure models need to be explored. Transport models, in a standard way, predict traffic flows and average speed on the road network can be used to estimate vehicle emissions of air pollutants and noise (Rizzi and De La Maza, 2017). Population exposure can be modelled in several ways from using simple measures (Buzzelli and Jerrett, 2003; Carrier et al., 2014), regression models (Liu et al, 2016) and spatial analysis (Shekarrizfard et al., 2016) to more complex models of atmospheric dispersion (Namdeo et al., 2019), integrated emission (Tang et al., 2018) and hybrid models (Michanowicz, 2016). Though significant, community severance, also known as the barrier effect, has been relatively neglected by the researchers and transport planners. The barrier effects refer to the impact of transport infrastructure or road traffic levels or speeds as a physical or physiological barrier separating people from facilities, services and social networks within a community (Anciaes et al., 2014). Similarly, the studies on aesthetic impact valuation are scarce as the subject impacts have been generally ignored or underestimated in planning and policy making (Kapper, 2004). Examples of studies that included barrier effects and aesthetic impact valuation are INFRAS/IWW (2004); Jiang and Kang (2016); and Evangelinos and Tscharaktschiew (2021).

In economic analysis, it is important to know the monetary values of the transport-related health and environmental impacts born by the society in order to assess the efficacy of both new and existing transport network. These effects of air and noise pollution, congestion, and accidents have been quantified by various studies where a monetary value has been assigned to assess the policy measures planned or implemented. Considering that market prices for the experienced damages are generally unavailable, non-market valuation methods are used to value the external costs (EC, 2019). This is in contrast to

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