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Road pricing in a polycentric urban region: Analysing a pilot project in Belgium

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ABSTRACT

In order to cope with growing car use and congestion, academics often suggest road pricing as a way to reduce car use and internalise external costs (such as congestion and air pollution). However, implementations of road pricing schemes are rather limited and mainly focus on large cities (i.e., cordon charges). Recently, the three regional governments of Belgium – a highly urbanised and polycentric country – have commissioned a pilot project of an area-wide, time- and location-differentiated road pricing scheme, hence differentiating charges according to the time of the day and the type of road used. Results of this project indicate that kilometres travelled by car mainly reduce in urban areas, while car use on motorways only reduces to a limited degree. Furthermore, results indicate that urban residents adapt their travel behaviour more than suburban and rural residents, probably because urban dwellers have more alternatives to travel than driving personal cars only, especially on the short run. In this paper, we will analyse the preliminary outcomes of the conducted pilot project, look into the limitations of this project and suggest an alternative road pricing scheme.

1. Introduction

Although recent studies suggest that car use is ceasing to grow in the developed economies ('peak car use') (Metz, 2013; Newman and Kenworthy, 2011), most western countries have experienced a rapid increase of motor-vehicle-related inconveniences in recent decades, particularly in the form of congestion and associated environmental nuisance, urban liveability problems and hampered economic growth. The high car use can be partly explained by relatively low travel costs. Car users, for instance, only pay for the internal costs of their travel (e.g., purchase of the car, fuel, insurance), but do not pay the costs they cause to third parties. These external costs – such as congestion, air and noise pollution – are paid by all tax payers and not only by those people who cause them (especially car users). Therefore, road pricing policies are being considered and even implemented in various urbanised areas around the world (e.g., Eliasson et al., 2009; Santos, 2005; Tillema et al., 2010a, 2010b; Vonk Noordegraaf et al., 2014). Doing so, external travel-related costs such as time loss and air pollution could be internalised (e.g., Rouwendal and Verhoef, 2006). Such an application of the user-pays or polluter-pays principle is supposed to result in drivers paying full delay and environmental costs, making people more conscious of their travel behaviour (consequences). In the short run, road pricing might lead to changes in travel mode choice and destination choice, and in departure time and route choice in case of a time- and location-differentiated road pricing scheme. Although often neglected by policy makers, road pricing can also have effects on the long run. In the longer term, car ownership may be affected while people may become encouraged to change their residential location or look for a job closer to home (Arentze and Timmermans, 2007; Banister, 2002; Eliasson and Mattsson, 2001; Tillema et al., 2010a, 2010b; van Ommeren et al., 1999).

Today, toll roads, toll tunnels and toll bridges are abundantly present around the world, while in a number of cities (London, Singapore and Stockholm, to name a few) a cordon toll for entering the city centre has been implemented (Börjesson et al., 2012; Goh, 2002; Leape, 2006; Santos, 2005). Road pricing can also take the form of 'value pricing' in which travellers can choose between a free but congested roadway and a priced roadway. High-occupancy toll (HOT) lanes for instance – mainly present in American urban areas – offer an uncongested roadway to people who are willing to pay a time-varying toll (or ride in carpools) on an otherwise free and congested road (Brownstone and Small, 2005; Dahlgren, 2002; Small and Yan, 2001; Sullivan, 2002). People attaching a lot of value to reducing travel time (i.e., people having a high value of time (VOT); mostly related with high incomes) might be more inclined to pay for an uncongested roadway compared to others. Although some regions experimented with VOT-estimates for travellers in regions where road pricing is considered (e.g., the Capital Mega-region, US (Mishra et al., 2014)), or with a charge per

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kilometre travelled (for instance in the state of Oregon, US (McMullen et al., 2010)), a region-wide, time- and location-differentiated kilometre charge scheme – as is proposed in Belgium – has never been applied before. Although this may in significant part be due to the complexity of such as system (Bradley and Kenworthy, 2012; Ubbels, 2006), it is worth mentioning that in the neighbouring Netherlands, a comprehensive road pricing project has been prepared for years, before being cancelled in 2010 because of a lack of public and political support (Ardic et al., 2013).

Previous examples indicate that road pricing – and cordon charge in particular – can affect people's travel behaviour. In 1998, Singapore replaced an area licensing scheme – already restricting traffic flows in Singapore to a certain extent between 1975 and 1998 – by a time-differentiated electronic road pricing system to track vehicles entering Singapore's central area. This system uses on-board units, smart cards and overhead gantries to detect incoming vehicles. After the introduction in April 1998, a significant drop of approximately 15% (Olszewski and Xie, 2005; santos, 2005) to 24% (Seik, 2000) was observed in the daily traffic flows in the central area. Since traffic volumes dropped below the expected level, the rates were reduced by 20% in November 1998. However, traffic flows only increased to a limited extent compared to traffic flows in the period April 1998 – October 1998. In general, the road pricing experience in Singapore turns out to be an effective method of controlling congestion, as average travel speeds in the restricted zone improved from approximately 30–35 km/h to 40–45 km/h (Goh, 2002; Olszewski and Xie, 2005; Santos, 2005; Seik, 2000). In 2003, London imposed a £5 daily charge (increased to £8 in July 2005) for entering the congestion charging zone between 7:00 a.m. and 6:30 p.m., excluding weekends and public holidays. Charges have to be paid in advance, for instance through retail outlets and payment by Internet. Automatic number plate recognition technology at every entry point and in mobile units is used for enforcement. The traffic flow of cars, trucks and vans coming into central London dropped approximately 18% (Santos, 2005; Santos and Fraser, 2006; Santos et al., 2008) to 27% (Leape, 2006) while inbound car traffic reduced with 33% (Leape, 2006). Around half of these trips are being replaced by public transport trips, while people also avoid the charging zone, travel by taxi or bicycle or shift their trip outside charging hours. As a result, average travel speeds in the charging zone increased from 14.3 km/h to 16.7 km/h (Leape, 2006; Santos, 2005; Santos and Fraser, 2006; Santos et al., 2008). In Stockholm, a time-differentiated cordon charge – permanently introduced in 2007 – reduced the number of passages across the cordon significantly. Commuting trips by car reduced by 24%, mostly in favour of public transport trips. Non-mandatory trips reduced with 22%, mostly due to changes in destination choice and decreasing trip frequencies. Finally, commercial traffic (freight traffic, deliveries, business trips, etc.) decreased by 15%. These traffic reductions resulted in substantial decreases in congestion and travel time (variability) (Börjesson et al., 2012; Eliasson, 2008). To the best of our knowledge, favourable outcomes (i.e., reductions in kilometres travelled by car and improved travel times) from other types of road pricing (e.g., charge per kilometre travelled) are not available.

In this paper we will analyse preliminary results from an area-wide, time- and location-differentiated road pricing scheme in Belgium which was conducted from January till April 2014. The remainder of this paper is organised as follows. In Section 2 we give an overview of the Belgian context regarding the land use pattern and general daily travel patterns and give background information on the road pricing pilot project. Primary results of this project are provided and examined in Section 3, while Section 4 discusses the main limitations of the project. In Section 5 we analyse possible alternatives for the applied road pricing scheme. Finally, the conclusion is provided in Section 6.

2. The Belgian road pricing project

2.1. The Belgian context

As in other prosperous regions and countries in the world, car use in Belgium has rapidly increased throughout the post-war period, despite a slight ripple in the growth curve at the time of the oil crisis. In 2014, the yearly amount of vehicle kilometres travelled by car had tripled since 1970, doubled since 1980 and increased by 50% since 1990. However, from 2007 the car use growth rate in Belgium slows down. Today, car use per capita seems to be stabilising, an observation that supports peak car use hypotheses (http://www.statbel.fgov.be). However, some regional differences are still observable. In Flanders (i.e., the northern region of Belgium) car use is still slightly increasing, while in Wallonia (i.e., the southern region) car use seems to stabilise. Interestingly, in the Brussels capital region, which is the largest and fastest growing urban area in Belgium, car use is actually decreasing, even in absolute terms (http://www.statbel.fgov.be). Despite these flattening growth curves, in Belgium, the private motor vehicle is by far the most used travel mode (i.e., 65% of all the trips in Belgium are car trips), especially – but not exclusively – in non-urban areas (http://www.beldam.be). Congestion and significant travel time losses are the obvious consequences of such an important rate of car dependency, which is mainly manifest near and in the cities of Brussels and Antwerp. However, inter-urban congestion is also present. In Belgium, the ratio of average free flow speed is low and the average delay per kilometre is high in comparison with other countries in Europe (European Commission, 2012). Especially in Flanders, which is the home region of many employees working in Brussels and where the logistics industry is an important economic actor, time losses due to congestion are considered a threat to the growth of the economy. In Brussels, policy objectives aim at reducing vehicle kilometres travelled within the capital region, in the light of making the city more attractive as a living environment. Finally, Wallonia is the least populated region where congestion levels – and other undesired car use externalities – are mostly acceptable. As a result, this region would probably benefit less from a road pricing regime than Flanders and Brussels.

The high car use in Belgium is related with the Belgian land use pattern. Improvements in transport technology since the end of the nineteenth century – reducing travel costs – in combination with limited spatial planning regulations have resulted in urban sprawl. During the Industrial Revolution, Belgium constructed (starting in 1835) the most densified network of trams and trains of all Industrial countries. In combination with cheap public transport passes (since 1869) this enabled labourers to work in the city but live on the countryside. This resulted in a first wave of decentralisation; cities spread outwards generating sub-centres around public transport nodes (De Block and Polasky, 2011; De Decker, 2011; De Vos, 2015; De Vos and Witlox, 2013). After the Second World War, urban sprawl accelerated even further. The car, first produced before the Second World War, becomes the dominant travel mode after the war. As the car made it easier to reside almost everywhere on the countryside – even in places which were difficult to access by train – it became the transport mode that shapes the land. Suburban, low-density neighbourhoods with good car accessibility emerged scattered around Belgium. People were no longer forced to live either near their place of employment or a public transport stop to transport them there (e.g., De Decker, 2011; De Vos and Witlox, 2013).

Spatial planning regulations did not hinder the geographical distribution of facilities. The limited amount of spatial plans (especially the so-called ‘regional plans’ in the 1970s) did not cluster destinations (e.g., residential area, industrial area) in urban