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Traffic accidents and the London congestion charge

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ABSTRACT

In a rare effort to internalize congestion costs, London recently instituted charges for traveling by car to the central city during peak hours. Although the theoretical influence on the number and severity of traffic accidents is ambiguous, we show that the policy generated a substantial reduction in both the number of accidents and in the accident rate. At the same time, the spatial, temporal and vehicle specific nature of the charge may cause unintended substitutions as traffic and accidents shift to other proximate areas, times and to uncharged vehicles. We demonstrate that, to the contrary, the congestion charge reduced accidents and the accident rate in adjacent areas, times and for uncharged vehicles. These results are consistent with the government's objective to use the congestion charge to more broadly promote public transport and change driving habits.

1. Introduction

Early in 2003 London imposed a daily charge for driving on public roads within its central district. Economists hailed the charge as "a triumph of economics," a recognition by policy makers that congestion is a costly externality and that road pricing is an appropriate response (Leape, 2006). While the charge remains flat and so does not vary with distance or time of day, it has been credited with substantial reductions in congestion and increases in travel speed. Less examined is the influence on traffic accidents. While reduced traffic accidents were touted as an additional social benefit, the policy created a series of offsetting behavioral incentives that leave the overall influence on traffic accidents in doubt. Examining this influence requires suitable counterfactuals as the number of London traffic accidents had been trending down prior to the congestion charge.

This paper examines monthly traffic accident counts in central London before and after the congestion charge compared to several sensible controls. We confirm a substantial and robust decline in accidents associated with the advent of the congestion charge. This represents an important public health and social policy finding as resources and lives were saved by diverting travel to safer transport modes and by reducing the aggregate amount of travel. Equally important, we demonstrate that accident rates, the number of accidents per million miles driven, also decline with the advent of the congestion charge. Reduced traffic congestion ameliorated an accident externality (Edlin and Karaca-Mandic, 2006) as the congestion charge went beyond simply reducing miles driven and so accidents. It reduced the probability of drivers being in an accident for a given trip to central London.

As the charge is limited to a specific zone, for specific vehicles and for specific hours of the week, we test for substitution effects. These measure the extent to which the charge may increase accidents in areas outside the zone, the vehicle type or the hours to which it applies. Such increases might be anticipated if travelers continue to travel to Central London but substitute uncharged trips for charged trips. Thus, we examine whether or not traffic accidents increase on weekends and evenings (times not subject to the charge). We examine whether or not accidents increase for motorbikes, bicycles or taxis which are all exempt. Finally, we investigate whether accidents increase in areas immediately adjacent to the charge zone as previous through drivers skirt the charge zone or as drivers travel up to the zone and then cross onto public transport. We find no evidence of long-term accident increases in any of these three dimensions. Indeed, traffic accidents and accident rates decline in adjacent areas, out of charged times and for uncharged vehicles relative to controls. This contradicts earlier evaluations that fail to use suitable controls and examine only a shorter window for policy influences.

We also confirm that the decline in total accidents and accident rates in the charged zone is matched by declines associated with serious

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accidents and with fatalities. These declines also persist in proximate regions and uncharged times. In sum, the evidence suggests that the congestion charge helps in accomplishing the government objective of fundamentally changing behavior regarding the frequency and mode of transit into Central London with beneficial and general reductions in the number of traffic accidents and in accident rates, a point not previously made.

2. Background

Central London has long held a reputation as among the most congested of major Western cities. Over the second half of the twentieth century, traffic speeds decreased and vehicle counts increased. Just prior to imposing the charge, all-day average network travel speeds averaged a sluggish 8.6 mph and more than 1/3 of all travel time was spent simply not moving (Transport for London, 2003). When compared to an uncongested speed of around 20 miles/h, this represented 3.7 min per mile of lost time. Multiplied by the huge number of trips and the value of time, the waste was obviously enormous. Fully ninety percent of all London residents (not just those of Central London) agreed in polls that "there is too much traffic in London" and identified congestion as the "most important problem requiring action" (see survey description and references in Leape, 2006, p. 157).

At least since Pigou (1924), economists have advocated governmental taxes and charges to bring the actual prices that consumers face into alignment with full social costs. The application of this notion to congested roads dates back to at least Walters (1961) and Vickrey (1963) who emphasize that consumers should pay directly for the costs they impose on other travelers as an incentive to use road resources efficiently. If road space is unpriced, traffic volumes will increase until congestion limits further growth with a resulting waste in travel time and reduction in travel reliability. Additional costs associated with congestion include increased air pollution and increased energy dependence (see Parry et al., 2007).

Despite the advantages of taxing congestion, there exists a long history of public and political opposition that has meant there have been relatively few examples (Hårsman and Quigley, 2010). In 2007 Stockholm introduced a tax deductible charge to enter the central city with the proceeds used for road construction. In 2013, following a series of temporary charges and lawsuits, Milan introduced a permanent congestion charge with much of the emphasis being on reducing pollution. A charge to enter lower Manhattan in New York City generated a decade of active debate but no action. Voters soundly defeated proposed congestion charges in Manchester and Edinburgh. The political resistance often coalesces around opposition to a fee seen as largely unrelated to infrastructure cost recovery.[1]

In addition to political resistance, network issues make proper pricing inherently difficult. While pricing a single road between two destinations may be easy, properly pricing a complicated road network like Central London was thought unworkable. Each intersection, road and specific set of combinations contributes to congestion. Moreover, each of these contributes in differing degrees at different times of the day, week or year. Thus, while optimal charges vary by road, intersection and time of day, the creation and enforcement of such charges is likely intractable or infeasible (Newberry, 1990; Shepherd and Sumalee, 2004). Moreover, the proper pricing may interact in complicated ways with the extent and pricing of parking (Fosgerau and de Palma, 2013) and the endogenous choice of speed by drivers (Verhoef and Rouwendal, 2004). Thus, the London congestion charge emerged as a rather blunt instrument. It followed the basic approach "to make private transport relatively less attractive and public transport more attractive" (Newberry, 1990 p. 35). It combined a flat charge for private and commercial vehicles entering the congestion zone, with the revenues from the charge earmarked for reinvestment in London's public transport.

London imposed an initial daily charge in February 2003 of £5 for driving on roads within the congestion zone between 7:00 am and 6:30 pm on weekdays.[2] The congestion zone is pictured in Fig. 1. The original fee has since been increased to £8 in July of 2005, to £10 in 2011 and to £11.50 in 2014. Passes are typically purchased on-line and enforcement relies on a series of video cameras at every entry point to the zone and on mobile units within the zone. A license plate recognition system matches against daily purchases and violators are sent penalty notices for escalating fines that average 20 to 30 times the daily charge. The day pass allows travel in and around the congestion zone of Central London. This eight square mile zone includes tourist sites, the City (London's financial district), Parliament, major government offices and prime business locations.

The charge applies to private and commercial vehicles entering the congestion zone during the charging hours. Importantly, motorcycles, bicycles, buses and taxis are exempt. Also exempt, are vehicles belonging to those who live within the zone but keep their vehicles off the street during the charging hours. When these residents do travel during the charging hours, they pay a highly discounted charge of only 10% of the full charge.

The revenue raised from the charging program has been substantial but so have the administrative costs (Leape, 2006). The net revenue from charges was £97 million in 2004–5 and was supplemented by £70 million in penalties that same year. Such revenues have been largely spent on mass transit improvements with smaller expenditures on road safety and biking/walking initiatives. The earmarking of revenues for such alternative transport is anticipated to continue until at least 2023.

Early indications showed meaningful reductions in distances traveled within the zone. These comparisons of the year immediately before and after the charge showed, for example, that the total distance driven by cars was reduced by an enormous 34% (Leape, 2006). At the same time, the distances driven by bikes, motorcycles, taxis and buses all increased resulting in a more modest overall decline in vehicle distances of 12%. Nonetheless, this was sufficient to reduce the time lost to congestion by nearly 30% (Transport for London, 2005). Thus, the early indication was clear that the charge reduced congestion during the times it was applied, in the zone to which it applied, and for the vehicles to which it applied. This generates substantial social benefits as the values placed by individuals on reduced travel time and improved reliability are typically large (Small et al., 2005).

In addition to reducing congestion and so saving time, a critical by-product of the charge was thought to be reduced traffic accidents. While clearly identified as "an additional social benefit" by Transport for London (2005), the logic implying an overall reduction in accidents and its interpretation seems in doubt. First, Shefer and Rietveld (1997) argue that there should be an inverse relationship between traffic congestion and accidents. The increase in speeds allowed by reduced congestion may increase the number and severity of accidents. Certainly, this balancing of time savings and the increased chance of traffic fatalities is at the heart of setting speed limits (Ashenfelter and Greenstone, 2004). While the evidence seems to depend on the exact circumstances and perhaps even the type of roads being examined (Wang et al., 2009), the possibility exists that the congestion charge increased vehicle speed and at the same time increased the number of bikes and pedestrians with an uncertain net influence on the number and severity of accidents.

Second, even if the congestion charge reduced the number of accidents by reducing the trips by those charged, there are important avenues of substitution. In the empirical estimation we focus on three

[1] Adding to confusion, polices are often misleadingly named. Vancouver voted in April 2015 on a "congestion tax" that was merely a general sales tax dedicated to public transit (Sinoski, 2015).

[2] Beginning in February 2007, the end of the charge time was moved from 6:30 pm to 6:00 pm, a move we account for explicitly in identifying accidents in the treatment.