briefing notes

IFS

LONDON'S CONGESTION CHARGE

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1. Introduction

On 17 February 2003, one of the world's largest and most ambitious plans to tackle urban congestion began, with the introduction of a congestion charge for central London. It is hoped that this £5 daily charge for many vehicles entering the Inner Ring Road charging zone will significantly reduce the level of congestion faced by those travelling into and out of central London both by private and by public transport.

In 2001, almost 1.1 million people entered central London during the morning peak hours of 7.00a.m.–10.00a.m.,[1] of whom around 150,000 (13.7%) used private transport. Whilst the total number of people entering during the morning rush hour has scarcely changed since 1991, there has been a small shift towards public transport: in 1991, 16.8% of people used private transport. Nevertheless, average traffic speeds in central London have fallen slightly over the last decade, with the average morning peak-period traffic speed for 2000–03 just 9.9 mph, compared with a peak of 14.2 mph in 1974–76. During the evening rush hour, average speeds are even slower, at just 9.6 mph.[2] In evidence to the House of Commons Transport Committee,[3] David Begg of the Commission for Integrated Transport argues that around 40% of the total national level of congestion occurs in Greater London.[4] Transport for London suggests that 'there are now no longer any "peaks" or "off-peaks" of traffic volume between 7am – 6.30pm' and states that there are now on average three minutes of delay for every mile that a vehicle travels inside the charging zone.[5]

This Briefing Note aims to provide a guide to the workings of the London congestion charge. We begin in Section 2 by describing the economic case for congestion charging, showing why congestion can be thought of as an urban example of the well-known overuse of common resources to which there is free access (the so-called 'tragedy of the commons'). In Section 3, we move on to look at the details of the proposed charge for London, examining how it fits in with the economic framework we develop and discussing some of the work that has already been carried out to try to predict the likely effects of the charge. Section 4 looks briefly at the issue of what may happen with the

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[1] Source: Transport for London figures on Department for Transport website, http://www.transtat.dft.gov.uk/tables/tsgb02/1/pdf/10502.pdf; note that this figure excludes both taxis and commercial vehicles.

[2] Source: Transport for London figures on Department for Transport website, http://www.transtat.dft.gov.uk/tables/tsgb02/4/pdf/41402.pdf.

[3] http://www.publications.parliament.uk/pa/cm200203/cmselect/cmtran/390/390.pdf.

[4] It should be borne in mind that Greater London is a much larger area than the proposed congestion charge zone for central London.

[5] Transport for London website, http://www.tfl.gov.uk/tfl/cc_fact_sheet_key_stats.shtml.

projected net revenues from the charge, which are legally bound for the first 10 years to be spent on transport within Greater London. In Section 5, we discuss some of the empirical evidence regarding transport in London and present evidence on the potential distributional effects of the congestion charge, since one of the oft-cited criticisms of charging is that it will impact upon the poorest most severely. Section 6 goes on to look at the experience of congestion charging elsewhere around the world.

2. The economics of congestion charging

Congestion is a classic example of the overuse of a common resource – in this case, the London road network – to which there is free access. Unless traffic flow is light, each additional road user slows down other drivers but does not perceive this as a cost since it is not included in his or her own journey costs. This tends to lead to overuse compared with the situation in which motorists do face this cost. This is not a new theory, and neither is the idea of road pricing. Road pricing in Britain was first suggested in the early 1960s, after new vehicle registrations more than doubled between 1958 and 1963. The Smeed Report, published in 1964, suggested that drivers should be charged for the delays they imposed on each other.[6]

Figure 2.1: The cost of motoring

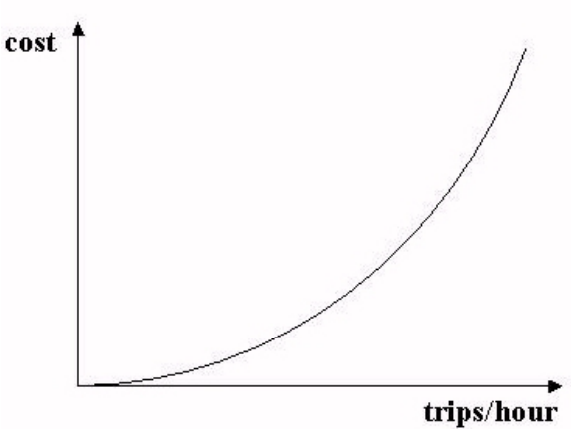

Figure 2.2: Congestion as an externality

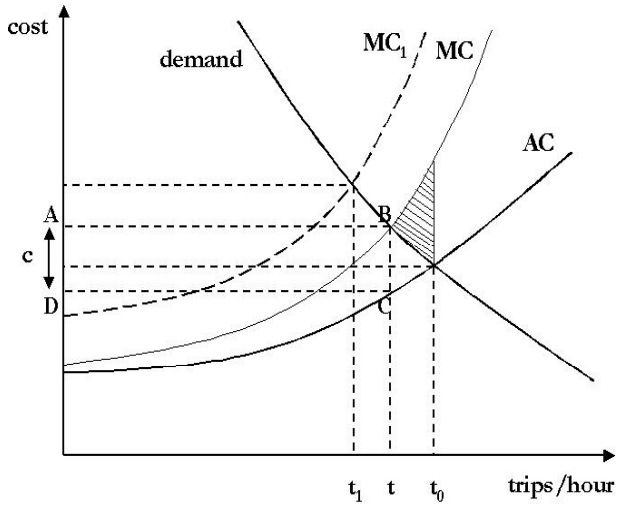

Figure 2.1 illustrates the total private costs to motorists when a certain number of trips per hour are made on a given road. This includes time costs, petrol costs and so on. These total costs rise more than proportionately with the number of trips since, as more cars travel, journey speeds are reduced, increasing costs for a given trip. This translates into the marginal and average trip costs shown on Figure 2.2 by MC and AC respectively. The average cost is the total cost divided by the number of trips, and the marginal cost is the cost of making an additional trip from any particular existing total. Since total costs rise faster

[6] See House of Commons Library Research Paper 99/104 for more details (http://www.parliament.uk/commons/lib/research/rp99/rp99-104.pdf).

than total trips, the marginal cost is always greater than the average cost – each extra trip adds more to total costs than the previous trip.

At any point, the private cost to a motorist of making a trip is the average cost. If this cost is less than the private benefit of the trip, the motorist will go ahead with the journey. So the equilibrium number of trips occurs at the point where average costs equal marginal benefits (as given by the demand curve, where we are assuming, as usual, that demand decreases as price increases) – at point t_0 in Figure 2.2. The socially optimal number of trips would equate marginal benefits with *marginal* costs, leading to a lower total number of trips, t. The optimal number of trips is lower than the private equilibrium because each individual fails to take into account that, by undertaking a journey, they slow down other road users, thereby adding to every user's time and petrol costs – a typical example of an externality. The social cost, or deadweight loss, associated with this inefficient use of resources is shown by the shaded triangle in Figure 2.2. At each point beyond t, the social costs of a trip exceed the benefits, and the deadweight loss is the sum of these differences between t and t_0.

If there are additional external costs, such as road damage costs or pollution costs, then the true marginal social cost may be even higher than MC, such as the curve MC_1 in Figure 2.2. In this case, the optimal traffic volume is even lower, at t_1.

In theory, there are several ways in which the relevant authorities could try to reduce the traffic levels towards a more optimal level. Traffic bans could be imposed within the specified area. Obviously, simply letting people turn up without knowing whether they can enter is not a good idea, but there are other methods – in Athens, for example, cars with odd or even number plates are banned on alternate days. Another option is to use a price mechanism. The congestion problem arises because drivers are not faced with the full costs of their actions, so an obvious solution is to make them pay these external costs. In Figure 2.2, a charge per trip of c would effectively shift the average cost curve up until it intersected the demand curve at t, leading to the efficient number of trips being made. One advantage of using a congestion charge rather than a ban is that a charge ensures that those drivers who value their journey least, or find it least costly to change their behaviour, will forgo their car journey. To achieve a given reduction in traffic in the most efficient way, we want the drivers with the lowest benefit from their journey to alter their behaviour. A congestion charge makes sure that only those drivers with a valuation of their journey (above the private costs already incurred) greater than or equal to the charge continue to travel, whereas a ban based on number plates, say, would not achieve the reduction so efficiently. Another obvious difference between restrictions and charges is that a congestion charge raises revenue – shown by the rectangle ABCD in Figure 2.2. This can be thought of as a straight transfer from motorists to the charging authority, where it will then become part of public spending.

It could be argued that motoring costs are already subject to a large tax burden from high petrol taxes and the annual vehicle excise duty (VED). Some of this tax might already be viewed as an attempt to internalise some of the externalities associated with car use, such as pollution and congestion. Petrol tax increases in recent Budgets have been justified on environmental grounds, and petrol taxes are, indeed, a fairly good proxy for a tax on carbon dioxide emissions. In addition, 'greener' fuels are taxed at a lower rate, and there

is an attempt to differentiate VED according to the polluting and/or road-damaging capacity of the vehicle. However, even if other costs are internalised, this does not mean that congestion costs have been appropriately charged for – the very fact that congestion is a problem suggests that it is not expensive enough to use the congested stretch of road. Petrol taxes increase the general cost of motoring and so could be expected to reduce road use somewhat. A change in motoring costs shifts the curves AC and MC upwards in Figure 2.2, so the intersection of the demand curve with average costs occurs at a lower number of trips. But this shift is not necessarily a simple vertical shift. Combined with the fact that the curvature of the demand curve may be different at this new point, this means it is not necessarily clear that the size of the deadweight triangle will be reduced – there is less congestion, but that which remains is more costly since motoring costs have increased. In any case, general increases in motoring taxation are a very blunt instrument to tackle the problem of congestion since they apply whether or not the driver is in a congested area, i.e. congestion is a localised problem that is not best tackled by an economy-wide tax. Finally, the concept that motoring taxes are designed solely to finance the road system (and possibly cover external costs) disappeared when the Road Fund was suspended in 1955. Petrol tax revenues go into the Consolidated Fund – they are part of general taxation, used to meet the government's budgetary requirements.

The theory of what is best is all very well, but, of course, the practicalities of how a congestion charge might operate are also of great importance. The costs and benefits (i.e. the curves in Figure 2.2) have to be estimated to decide on an appropriate charge. Also, the demand curve in Figure 2.2 could be expected to vary throughout the day, leading to a different optimal charge at different times. This would rarely be practical or even feasible to operate and a simpler system would have to be used. The London congestion charge is a daily payment to enter a given area, set at two levels according to time of day (zero and £5). In addition, the costs of operating the charging system have to be weighed against the benefits. The Conservative government, for example, considered introducing urban road pricing but, following a report into congestion charging in London published in 1995,[7] concluded that there was no accurate or proven technology existing for such a system and as a result decided against it. Unwanted responses seeking to avoid a charge (or ban) must be considered. For example, in response to the Athens ban, it has been suggested that many households bought a second car or switched licence plates according to the day. The cars bought for use on off-days were more likely to be cheap, second-hand vehicles, which were more polluting. Obvious questions arise as to how much traffic will be diverted onto side routes around the charge area, and whether people will attempt to park just outside the charging zone. One aim of the London congestion charge is to encourage people to use alternative, less congesting, forms of transport – a full bus can transport up to 20 times more people than a full car while occupying only three times the road space. But public transport needs to be in place to cope with increased demand.

[7] *Congestion Charging Research Programme: Report*, HMSO, London, 1995.

3. Details of the London scheme

In his manifesto for election to the post of London Mayor in 2000, Ken Livingstone pledged to reduce traffic congestion by 15% by 2010, partly by consulting 'widely about the best possible congestion charge scheme to discourage unnecessary car journeys in a small zone of central London … with all monies devoted to improving transport'.[8] As part of the devolution process in the Greater London Authority Act 1999, the elected Mayor was required to produce a Transport Strategy 'for the promotion and encouragement of safe, integrated, efficient and economic transport facilities and services to, from and within Greater London'.[9] *The Mayor's Transport Strategy* was published in July 2001[10] and, based largely on work done by the Review of Charging Options for London (ROCOL) working group,[11] it included proposals for a congestion charge for central London. After a further consultation period, the final order allowing congestion charging was made in February 2002,[12] with the charge itself beginning on 17 February 2003.

This section attempts to describe the main features of the congestion charge for London – how it operates, who does and does not have to pay, how payments can be made, etc. It also looks at some of the background work done by various groups on congestion charging, and attempts to highlight some of the possible advantages and disadvantages of the scheme as it has been proposed, and to what extent it fits in with the economic framework we developed in Section 2. We examine some of the projections made for the benefits of the scheme in terms of both reducing congestion and raising revenue (ways in which this revenue may be spent are discussed in the next section) and the possible implications both for public transport and for the road network outside the charging zone.

How does the congestion charge operate?

Details of the scheme

The congestion charge (or 'road user charge') is a £5 daily fee to drive into central London. The charging zone is bounded by the Inner Ring Road and covers an area of 8 square miles (21 sq. km).[13] The charge is an 'area licence' in that the fee effectively buys for the purchaser the right to drive into and out of the charging zone as many times as desired throughout the day, with charges applicable between 7.00a.m. and 6.30p.m.[14] on weekdays (except public holidays). The cost is the same for all eligible vehicles entering

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[8] http://www.livingstoneforlondon.org.uk/lonagenda/newmanifesto/transport.htm.

[9] Greater London Authority Act 1999, sections 141 and 142. See http://www.legislation.hmso.gov.uk/acts/acts1999/90029--i.htm#141.

[10] See http://www.london.gov.uk/approot/mayor/strategies/transport/index.jsp.

[11] *Road Charging Options for London: A Technical Assessment*, March 2000. Available at http://www.go-london.gov.uk/localregionalgov/rocol.asp.

[12] http://www.london.gov.uk/approot/mayor/congest/rtf/conf_ord.rtf.

[13] A map of the zone can be found at http://www.london.gov.uk/approot/mayor/congest/pdf/zone_map.pdf.

[14] The original proposal for the congestion charge envisaged a 7.00p.m. finishing time; however, the decision was taken to end charges at 6.30p.m. to bring them into line with parking restrictions.

the zone from outside. People resident within the zone receive a 90% discount on the daily charge. The charge applies to vehicles parked or driven on public roads within the zone, but residents whose vehicles are parked off-street or in a resident's parking bay throughout the congestion charge operation period for one day do not have to pay the charge for that day.

Drivers entering the charging zone have their vehicle number plate read by cameras using automatic number plate recognition (ANPR) technology. The vehicle registration number is then stored in a database that is compared at midnight each night against a database of those who have paid the charge for that day. If it is found that eligible vehicles have entered the zone without paying, their details are passed on to the DVLA, who will supply Transport for London (TfL) with the details of the registered owner, who will then receive an £80 fine (reduced to £40 for payment within two weeks, but increased to £120 if no payment is received after 28 days). Persistent offenders may have their vehicle seized.

Who is eligible to pay?

TfL estimates that around 150,000 drivers will be eligible to make the payment each day. These include commercial heavy and light goods vehicles and private motorists. However, public transport vehicles are exempt (buses with more than nine seats registered for use in London, taxis registered in London), as are motorcycles and bicycles. People registered as disabled will not have to pay, and there are exemptions for a variety of other vehicles, such as emergency vehicles, breakdown vehicles, certain vehicles using alternative fuels and vehicles used by certain NHS staff and firefighters for operational reasons.

Payment can be made either in advance (by purchase of a daily, weekly, monthly or annual pass much like current Travelcards, although there is no discount applied for prepayment) or on the day of the journey, although payment must be received by midnight and any payments made after 10.00p.m. are subject to a £10 charge rather than the usual £5. Payment can be made by telephone, over the Internet, at certain retail outlets (though not Post Offices) or by post. Text message payments are also possible.

How was the scheme developed?

Prior to the first elections to the Greater London Authority in May 2000, the ROCOL report[15] highlighted a number of ways in which a congestion charging scheme could be implemented in London, including a paper-based system and an extension of workplace parking levies. The authors suggested that a paper-based system may be too cumbersome to administer and enforce, and based much of their illustrative work on an ANPR system which they described as 'an intermediate technology system which … could be implemented in Central London within the Mayor's first term … [and could] afford a migratory route to a more advanced electronic system with in-vehicle units'. This more advanced system would see a charge automatically deducted from a prepaid unit within

[15] http://www.go-london.gov.uk/localregionalgov/rocol.asp.

the car, similar to schemes currently operating in places such as Singapore and Melbourne (see Section 6), which would have lower administration costs and would be less inconvenient in terms of having to purchase area licences regularly. Certainly, the legal provisions of the Greater London Authority Act allow for any congestion charging to be differentiated across time or location.

The ROCOL report also looked at the possibility of a workplace parking levy of £3,000 per annum to be paid by those providing spaces that could conceivably be passed on to employees. This figure was arrived at on the basis of off-street parking charges in central London in the range of £12–£15 per day. However, it was felt that this scheme would not have the same effect in reducing congestion, as it would not deter traffic driving through central London without stopping.

TfL defines congestion in the same manner as the Department for Transport, considering it as 'the average amount of time spent stationary in traffic queues by vehicle occupants'.[16] This is not the only way in which congestion can be defined – we may think of it as the excess time spent making a journey compared with a situation where the traffic is free-flowing.

How does the scheme compare with the economics of congestion charging?

In Section 2, we argued that an optimal congestion charge would equate social costs and benefits and internalise the externalities imposed by road users slowing down everyone else. Clearly, an estimate of these externalities is difficult, but it is intuitive that a £5 blanket charge for driving into central London is not entirely efficient. Ideally, the charge would be differentiated both by the specific route taken and by the time of day, to reflect different levels of congestion in both a geographic and a time-specific sense. However, such differentiation is difficult with ANPR technology, as it would require much more monitoring of the movement of vehicles (leading to greater set-up and administration costs) and a more complex calculation of the total charge to be levied. It may be that in the future the technology will be put in place to allow more differentiation using an in-vehicle unit, as in Singapore, without unduly increasing costs. On the other hand, the level of congestion across the charging zone is unlikely to be very heterogeneous, especially during the morning and evening peak hours, so that a uniform levy might not be a bad approximation.

Of course, it will be difficult to judge for some time whether £5 is an appropriate charge. The Transport Select Committee's Report on Urban Charging Schemes[17] raised concern that the Mayor plans to evaluate whether congestion charging is working after just two months – the report suggests that it will take at least six months to make a proper judgement, and a preliminary evaluation is due to be published in Autumn 2003 by TfL. It is not altogether clear how the effectiveness of the charge will be judged. If congestion is reduced much more than anticipated (or if the increased demands on public transport

[16] Quoted by Derek Turner, Director of Street Management at TfL, in the House of Commons Transport Committee Report (http://www.publications.parliament.uk/pa/cm200203/cmselect/cmtran/390/390.pdf).

[17] http://www.publications.parliament.uk/pa/cm200203/cmselect/cmtran/390/390.pdf.

or the traffic level increases outside the zone are above expectations), it could be argued that the charge is too high; equally, if congestion is barely affected, it may not be evidence of the failure of congestion charging, merely that the charge is too low to internalise the costs of congestion. The London Assembly Transport Committee argues that judgements on the effectiveness of the charge must be based on 'real and sustainable' reductions in congestion, the generation of revenue and an absence of adverse effects for business, the environment and (particularly low-income) people in London.[18]

There have been concerns raised over the efficacy of the ANPR system in recognising plates accurately, and over whether the DVLA database is up-to-date enough to ensure accurate identification of offenders. It remains to be seen how effective the system will be at catching people attempting to evade the charge, and this will be one of the central parts of any initial evaluations of the scheme.

Further, the real value of the charge will clearly diminish over time, as both prices and incomes rise. Thus the 'bite' of the charge will become less stringent. At present, it is not clear what, if any, plans are in place to increase the level of the congestion charge in the future in order to maintain its potency. Questions have also been raised as to whether a charge explicitly for central London is appropriate – average traffic speeds have been falling throughout Greater London at peak hours (from 15.1 mph in inner London in 1968–70 to 12.0 mph in 1997–2000; and from 20.5 mph to 18.2 mph in outer London over the same period).[19] However, in central London outside peak hours, traffic speeds are no greater (indeed, even slightly lower) than during peak times; whereas outside central London, off-peak speeds are significantly higher. There may therefore be scope in the future to introduce charges for the rest of Greater London, particularly at peak times.

What are the anticipated effects of the scheme?

Traffic levels, congestion and speed

Both the ROCOL report and a report by TfL on the Mayor's initial congestion charging proposals[20] attempted to predict the effects of congestion charging in a number of dimensions. These included the impact on traffic levels, congestion levels and revenues, the costs of running the scheme, the benefits in terms of reduced pollution and faster journey times, the effect on public transport and the degree to which traffic would be diverted along alternative routes.

The estimated impacts are derived from various computer modelling techniques which attempt to assess the extent to which charges would deter drivers from making their journeys, and from detailed models of the London transport network. Estimates of the monetary costs and benefits of the scheme are derived by various assumptions made about the value of time, the value of lower pollution and reduced accident rates and so

[18] http://www.london.gov.uk/approot/assembly/reports/transport/congestion_charging.pdf.

[19] Source: Transport for London figures on Department for Transport website, http://www.transtat.dft.gov.uk/tables/tsgb02/4/pdf/41402.pdf.

[20] http://www.go-london.gov.uk/localregionalgov/rocol.asp and http://www.tfl.gov.uk/tfl/cc_report_mayor.shtml.

on. Details of the ROCOL modelling procedures can be found in the annexes to its report.[21] We focus here on the more up-to-date estimates in the TfL forecasts.

Based on various models and assumptions about the sensitivity of drivers to charges, TfL's predicted effects of the congestion charge on total traffic levels, congestion and average speeds are summarised in Table 3.1.

Table 3.1: Transport for London forecast effects of congestion charge

Area	Traffic volume	Congestion	Average speed
Charging zone	down 12–17%	down 18–26%	up 8–12%
Inner Ring Road	up 8–9%	?	down 7–10%
Annulus	down 1–2%	down 4–7%	up 2–3%

Notes: The ranges reflect various assumptions about the sensitivity of drivers to the charge. Figures are modelled using the London Transportation Studies (LTS) model and are for the morning peak hours of 7a.m.–10a.m. only; similar effects are expected for the evening peak hours. The annulus is the area between the Inner Ring Road and the North and South Circular Roads.

The main benefits are felt inside the charging zone itself, with some smaller benefits in outer London as a result of fewer people driving from those areas. The overall effects are somewhat mitigated by the predicted increase in traffic on the Inner Ring Road itself.

In total, TfL argues that congestion in London will be reduced by 10–15 million person hours per year. The Mayor has said that he expects a reduction in total traffic inside the charging zone (over the full day) of 10–15%, with an increase in traffic speeds of 10–15% and a reduction in congestion of 20–30%.[22]

Public transport

Between 1998 and 2001, the total number of people entering central London in the morning peak period (7.00a.m.–10.00a.m.) by public transport rose from 892,000 to 936,000.[23] TfL estimates that the total increase in the demand for public transport as a result of congestion charging would be in the region of 1–2%, or around 20,000 extra passengers during the morning peak. It suggests that capacity constraints on the rail and Tube networks mean that the net increase here would be around 5,000 – or 0.5% on existing levels. The bulk of additional passengers – 14,000 – would be on the bus network, with 7,000 of these between 8.00a.m. and 9.00a.m.

Another TfL report[24] suggests that the public transport system would be well-placed to cope with these increases, with 11,000 bus spaces being introduced between February 2002 and February 2003 in the morning peak hour, although if the predicted increase in demand is too low there may be some problems (and bus usage has grown by almost

[21] http://www.go-london.gov.uk/localregionalgov/rocol/anxs.pdf.

[22] http://www.london.gov.uk/approot/assembly/reports/transport/congestion_charging.pdf, page 8.

[23] Source: Transport for London figures on Department for Transport website, http://www.transtat.dft.gov.uk/tables/tsgb02/1/pdf/10502.pdf.

[24] *TfL Report to the Mayor on the Readiness of Public Transport for Central London Congestion Charging*, September 2002. Available at http://www.tfl.gov.uk/tfl/pdfdocs/readiness-full.pdf.

20% between 1998 and 2001). The House of Commons Transport Select Committee[25] has expressed some caution over the optimistic forecasts for public transport, suggesting that commuters from outside London are unlikely to use bus networks, but instead will switch to trains, placing extra pressure on an already overcrowded network which could have knock-on implications for people using trains within Greater London. Clearly, however, if congestion is reduced as a result of the charge, the reliability of buses will increase, which could further entice people to use them.

It is thought unlikely that there will be much effect from people taking advantage of lower congestion by switching from using trains to using cars.[26]

Financial implications

TfL suggests that net revenues will be around £130 million per year (excluding net penalty charges) on a most cautious estimate, and perhaps £150 million more optimistically. Revenue raising and congestion reduction as 'aims' of a congestion charge are not compatible, since the more congestion is reduced by deterring traffic coming into the charging zone, the lower the revenue that will be accrued. The House of Commons Select Committee argues that congestion reduction must be considered the overriding target.

TfL presents its forecast budget for the congestion charge over a 10-year horizon up to 2012–13, and suggests a total net present value (NPV) (based on an assumed 6% interest rate) of start-up costs of around £175 million and running costs of some £543 million. The NPV of total revenues over this period is forecast at almost £1.5 billion, giving an NPV net revenue of around £780 million.[27] The bulk of the running costs will be the database management scheme contracted out to Capita. By 2003–04 – the first full year of operation – it is forecast that net revenues will be positive, after a net revenue of around –£81 million in 2002–03 (of course, the charge will only be operating for the last two months of this financial year and set-up costs will be considerable).

TfL also attempts a social cost–benefit analysis of the scheme, taking into account such factors as time savings for people journeying into London, reduced accident rates, the reduced environmental impact of congestion and so forth. It suggests the NPV of the total costs to be around £884 million between 2002–03 and 2012–13, which is higher than the financial cost outlined above because it includes things such as the impact of additional costs in maintaining public transport, additional traffic management costs (for the Inner Ring Road), losses of fuel tax revenue and the disutility suffered by people having to use a mode of transport other than their preferred private car. The NPV of the total benefits is forecast to be between £937 million and £1.3 billion; thus net benefits

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[25] http://www.publications.parliament.uk/pa/cm200203/cmselect/cmtran/390/390.pdf, paragraph 76, page 27.

[26] Source: http://www.go-london.gov.uk/localregionalgov/rocol/chap5l.pdf.

[27] Note that this differs from the £130 million per annum assumed net revenue because this latter figure is simply the average in real terms of the total benefits less the total costs of the scheme, not including the fact that revenues and costs in the future are discounted at the 6% assumed in the NPV figures. In real terms, the total costs are forecast to be just over £1 billion and total revenues just less than £2.3 billion, giving net revenue of around £1.3 billion, or £130 million per annum over 10 years.

are forecast to be anywhere between £53 million and £435 million over the next 10 years, or a benefit-to-cost ratio of between 1.1 and 1.5. Of course, arguments over the validity of these figures are commonplace, since placing financial values on such things as accidents and time is difficult, and arguments over what is and is not included can often be justified. Nevertheless, the figures provide a useful alternative means of assessing the costs and benefits rather than the simple comparison of operating and start-up costs versus revenues raised.

4. How might the revenue from the congestion charge be spent?

The legislation that allowed Transport for London to introduce road user charging also stipulated that the net proceeds of the scheme should be spent on 'relevant transport purposes' by the Greater London Authority (GLA), TfL or a London borough council for a period of 10 years.[28] The allocation of revenues to specific purposes is a process known as hypothecation. Some people are opposed to hypothecation, for two main reasons. First, in general, there is usually no reason why it is optimal for spending in a particular area (e.g. the NHS) to vary with revenue from another tax (e.g. tobacco tax). Secondly, it is difficult to know whether any allocated revenue really is additional unless one knows what spending plans were before the hypothecation. One argument often used in favour of hypothecation is that people are more willing to pay a tax if they know where the money is being spent. But if one cannot tell whether spending really is additional, this may be viewed as a deceitful way of gaining support for the tax.

Although it is true that optimal spending on transport in London may not coincide with the level of revenue collected from the congestion charge, we do not know the optimal level of spending on transport. It is probably fair to say that the London electorate believe that the current level is suboptimal and so any additional spending would be welcome.

The congestion charge is projected to raise £121 million of net revenue.[29] This must be spent on measures that support the Mayor's Transport Strategy. The question is how easy it will be to monitor whether spending on transport-related purposes really is additional spending. In the Mayor's Annual Report 2002, planned spending by TfL was just under £1.3 billion in 2001–02 and just under £1.7 billion in 2002–03. The breakdown of the plans is shown in Table 4.1.

In the Mayor's Final Draft Budget 2003/4,[30] a preliminary outline of how net revenues will be applied to transport is available. There are two broad areas of spending – improving public transport and safer streets. An 'indicative attribution' to various initiatives is contained in Table 4.2.

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[28] See the Greater London Authority Act 1999, Schedule 23, http://www.hmso.gov.uk/acts/acts1999/90029-bl.htm#sch23.

[29] See http://www.london.gov.uk/approot/gla/budget/03-04/fin-draft-budgetv2.pdf, page 16. This is the figure used in the draft budget, and is very similar to the conservative £130 million net revenue forecast of TfL.

[30] http://www.london.gov.uk/approot/gla/budget/03-04/fin-draft-budgetv2.pdf, Annex A, A12, page 55.

Table 4.1: GLA Group spending plans for Transport for London

Spending plans	2001–02 £m	2002–03 £m
Highways and road traffic	447.7	566.2
Bus services	649.6	871.3
Docklands Light Railway	87.3	85.0
Other services	77.9	134.4
Total TfL	**1,262.5**	**1,656.9**

Note: Currently, the GLA does not set the budget for the Tube.

Source: The Mayor's Annual Report 2002, http://www.london.gov.uk/approot/mayor/annual_report/pdf/2002/full_report_2002.pdf.

Table 4.2: Application of net congestion charging revenue for 2003–04

Initiative	Spending £m
Bus network improvements	81
Increasing late-night public transport	3
Safety and security improvement schemes (e.g. expansion of CCTV on buses)	4
Total improving public transport	88
Safer routes to schools	6
Road Safety Plan	36
Total safer streets	42
Total expenditure	130
Congestion net income	121

Notes: Funds from the transport grant would make up the difference between the total costs of the improvements and the congestion charging net income.

Source: http://www.london.gov.uk/approot/gla/budget/03-04/fin-draft-budgetv2.pdf, Annex A, A12, page 55.

The largest planned item of spending that uses congestion charging revenue is bus network improvements.[31] This £81 million represents an increase of around 9% in spending on bus services between 2002–03 and 2003–04. However, it can be seen from Table 4.1 that between 2001–02 and 2002–03, there was an increase in spending on bus services of around 34%. This raises the question of whether spending on buses would have been increased by 9% even without the existence of the congestion charging revenue. In order to identify whether the congestion charging revenue really represents additional spending, spending plans would need to have been set out for the next 10 years and been made prior to the knowledge that a congestion charge was going to come into effect. Since this has not happened, we cannot be sure that revenue allocated to transport really does represent additional spending – particularly in the long term.

5. Empirical evidence

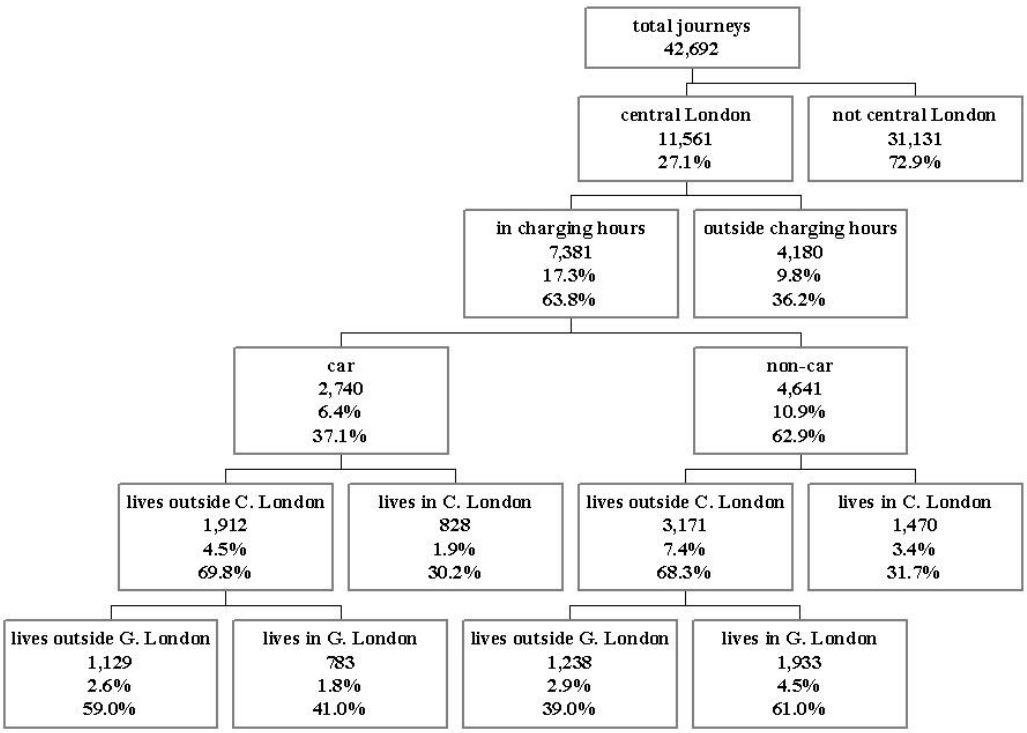
In this section, we use data from the National Travel Survey (NTS) to look at some of the characteristics of journeys made into London during the hours in which the congestion charge will operate. (Transport Statistics for London[32] also contains

[31] It should be noted that some of this spending has been taking place in 2002–03.

[32] http://www.tfl.gov.uk/tfl/pdfdocs/stats2001.pdf.

information on London travel that may be of interest.) The NTS is an annual survey of around 3,000 households in which respondents keep a detailed diary of every journey they make over a one-week period. In addition, some information about the households and individuals, and the vehicles they own or have access to, is also collected. The NTS is released in three-year sets. We have used data from 1996–98, the latest years available that specify whether the destination or origin of a journey was central London. Out of this initial sample, we took all households that either lived in the Greater London area or made a journey into or out of central London during their diary week. This left us with 1,464 households, of which 316 (or nearly 22%) were not resident in Greater London. The total number of journeys made by these households was 42,692. Of these, 11,561 (or 27%) either started or ended in central London (we will call them central London journeys). Unfortunately, it is not possible to ascertain whether a journey that did *not* originate or terminate in central London passed *through* central London, so any estimates we make about the congestion charge will be conservative. Of the central London journeys, 7,381 (64%) were made during the congestion charging times, and, of these, 2,740 (37%) were made by car or van (we will refer to these as car journeys for shorthand from now on). We can further split these into journeys that were made by people who are resident in central London (who receive a 90% discount on the congestion charge) and those who live outside central London. These figures are given in more detail in Figure 5.1, in which the first percentage figure gives the percentage out of all journeys and the second gives the percentage out of the relevant subgroup.

Figure 5.1: Breakdown of journeys by time and mode



Note: The first percentage figure gives the percentage out of all journeys and the second gives the percentage out of the relevant subgroup.

Source: Authors' calculations from National Travel Survey.

In Table 5.1, we divide the journeys starting or ending in central London into those made by car and those made by other modes, and, within these groups, into those made by households resident in central London and those made by households resident outside central London. We then look at the purposes of these journeys. The numbers refer to journeys by person, not by vehicle – two people from the same household may be travelling in the same car, but this is difficult to group over the household because the travel diary is kept individually. For non-car journeys, by far the largest group is work journeys. Work is also an important purpose for car journeys, but shopping and other personal business is also a large group for non-residents and is the largest group for residents. The 'school run' is also important, forming 11.5% of non-resident car journeys and 23.0% of resident car journeys.

Table 5.1: Breakdown of journeys starting or ending in central London during congestion charging hours by purpose, mode and residency

Purpose	**Type**					
	Car			**Non-car**		
	Non-resident	*Resident*	*Total*	*Non-resident*	*Resident*	*Total*
Work	38.6	29.7	36.0	65.2	39.9	57.2
Education	11.5	23.0	15.0	6.2	21.7	11.1
Shopping/personal	29.4	35.0	31.1	15.2	23.0	17.7
Social/sport	13.9	9.2	12.5	9.0	11.4	9.7
Holiday	3.6	1.6	3.0	1.9	0.4	1.4
Other	3.0	1.6	2.6	2.5	3.6	2.9
Total no. of journeys	*1,912*	*828*	*2,740*	*3,171*	*1,470*	*4,641*

In Table 5.2, we break down the mode of transport for non-car journeys made during congestion charging hours in more detail. For non-residents, travel by rail and underground forms over two-thirds of total journeys, with bus journeys and walking equally split between most of the remaining third (remember that this is not just travel into and out of central London, but also journeys made during the day once in central London, e.g. going out for lunch by foot). For residents, walking and travel by bus and by underground form roughly equal groups and, together, account for almost 90% of all journeys.

Table 5.2: Breakdown of non-car journeys starting or ending in central London during congestion charging hours by detailed mode and residency

Main mode	**Non-resident**	**Resident**
Walk	13.9	28.9
Bicycle	1.7	0.7
Motorcycle/moped	0.9	0.9
Bus	13.9	31.0
Underground	26.3	28.4
Surface rail	40.7	5.1
Taxi/minicab	2.6	5.0

Of the 5,083 journeys made during congestion charging hours by people resident outside central London, almost 47% were made by people living outside Greater London.

However, when looking at the car journeys (1,912 out of the 5,083, or 38%), 59% were made by people living outside Greater London. Of the 1,912 car journeys, 12% were made in vehicles that parked in a workplace car park or other private car park, and 28% were made in vehicles that were either company cars or had some work-related costs paid.

We now present some distributional analysis of the impact of the congestion charge. We want to look at how the congestion charge, as a proportion of income, varies across households as they become better off. A tax or charge is defined as regressive if the payment as a proportion of total income decreases as income increases. Unlike income tax, say, where people with similar incomes pay similar taxes, a particular household with a low income might face a high burden from the congestion charge even though, on average, households with this level of income do not face a high burden. In looking at the distributional impacts of the congestion charge, we want to know what the burden looks like on average. We arrange the 1,464 households in our sample into quintiles of equivalised household income. That is, we equivalise household income to account for different needs of different families (e.g. we would not want to say that a two-adult household with an income of £15,000 was as well off as a single-adult household with an income of £15,000), arrange households in order of their equivalised income and divide them into five equally sized groups. We then count whether a household vehicle is in the congestion charge zone between 7.00a.m. and 6.30p.m. on a weekday and add up the resulting total congestion charge payable across the whole week for each income quintile, allowing for the discount applied to central London residents. We then divide this figure by the number of households in the quintile to give the average payment per household for each quintile.

The income data in the NTS are banded, and, whilst we must use them to place households in income quintiles, we do not wish to calculate the average income by quintile from these data. Instead, we take this figure from the equivalent sample in the Family Resources Survey 1997. We then divide the average household congestion charge payment by average (unequivalised) household income for each income quintile to give us the average burden of the congestion charge as a proportion of income.

Another way of looking at the proportional effects of the charge would be to calculate the charge as a proportion of income for each household, and then average these proportions by quintile. But we do not consider the income data in the NTS to be sufficiently reliable to do this. Indeed, because of the quality of the income data, the figures presented in Table 5.3 should only be taken as an indication of the possible effects. In addition, it should be recalled that we cannot include people who travel through central London without stopping and noted that we are not attempting to model changes in behaviour in response to the congestion charge.

Table 5.3: Impact of the congestion charge as a proportion of household income, and vehicle ownership rates, by equivalised income quintile

Income quintile	Average cost / average income (%)	Car ownership rate (%)
1 (poorest)	0.59	35
2	0.92	56
3	0.93	73
4	0.87	88
5 (richest)	0.64	90

The results do not indicate that the impact of the congestion charge is regressive. The lowest average burden falls in the poorest income quintile. This is not that surprising, since a higher proportion of poorer households than richer households do not own a car – this shows up in the NTS data, as seen by the ownership rates given in Table 5.3. The burden of the congestion charge peaks in the middle of the distribution, then falls off again. This hump shape is broadly in line with the findings of Crawford (2000),[33] who used the 1991 London Area Transport Survey.

6. The international experience of congestion charging

London will not be the first world city to implement a scheme of congestion charging, though it will certainly be the largest to do so so far. This section briefly discusses the charges operating in other areas around the world.

Singapore

The Singaporean scheme of congestion charging is perhaps the most widely known. Singapore began a system of congestion charging in 1975 which was largely paper-based. In 1998, it replaced this with an electronic toll collection (ETC) scheme. All cars are fitted with an in-vehicle unit (IU) and drivers have a prepaid cash card which fits into the IU. As cars drive under various gantries in the charging zone (which is much smaller than London's), an amount is automatically deducted from their cash card; this amount varies by both the area and the time of day, with the highest prices being at the 8.30a.m.–9.00a.m. peak traffic time. The Singaporean scheme operates from 7.30a.m.–7.00p.m. in the Central Business District, but ends at 9.30a.m. in the outer ring road area. The Singaporean Land Transport Authority website[34] argues that the electronic road pricing (ERP) system makes motorists 'more aware of the true cost of driving' and is fair in the sense that 'those who contribute more to the congestion, pay more'. Prices are changed when the speeds in some 'basket' of roads in the Central Business District fall above or below certain thresholds; if the average speed rises above the threshold, the price is decreased. Recently, the system has changed to one of graduated payments to stop people attempting to speed up if they are approaching gantries just as the price is about to increase (or indeed slowing down if it is about to fall).

Unlike London, charges are paid each and every time a vehicle passes under a gantry (recall that the London system is an area licence in which one payment gives unlimited

[33] http://www.ifs.org.uk/consume/gla.pdf.

[34] http://www.gov.sg/lta.

access to the zone for one day). Further, buses and taxis are not exempt from payments. Fines are levied on people who do not have IUs or who have insufficient credit on their cash cards, which can be easily topped up at ATMs, petrol stations, etc.

A study by Chin (2002)[35] found that traffic volume in the Central Business District fell by 10–15% as a result of the ERP scheme when compared with the old paper-based scheme, although the old scheme was, like London's, an area licence system. Thus the switch to ERP had a big impact on those who made multiple trips into and out of the zone, which accounted for about a quarter of all trips under the old scheme.

Trondheim

The Norwegian city of Trondheim began a charging scheme for driving into the city in 1991, although it was designed as a means to fund the construction of ring roads rather than explicitly as a congestion charge (although, of course, these roads would help reduce congestion in the city centre). Drivers entering the 4km by 6km charging zone have the cost deducted automatically at electronic tolling booths from a unit mounted on the windscreen. Again, therefore, like the Singapore system, this is not an area licence but rather a toll paid for every journey into the zone. The number of daily charges that can be made is, however, capped. The toll is higher at peak times (giving the scheme a congestion element). The Trondheim scheme is due to end in 2005 when the ring roads have been constructed. Transport for London reports that peak rush-hour traffic fell by 10% upon introduction of the charge, with public opinion turning steadily in favour of it, such that five years into the scheme, the percentage saying they were opposed halved from 72% to 36%.[36]

Melbourne

The Melbourne system, called 'CityLink', opened in January 2000. It links three major freeways in Melbourne via a 22km-long toll road, again operated electronically by deducting payments from a prepaid in-car unit. In 2001–02, more than 600,000 payments were made each weekday on average. The scheme has helped reduce congestion on the toll road itself, but with some evidence that it has led to more congestion on alternative routes,[37] akin to the fears of increased traffic along the Inner Ring Road in London.

Durham

Durham became the first UK city to introduce an explicit congestion charge, in 2002. Its scheme is, however, on a much smaller scale than London's – it operates essentially along one street in the older part of the city, and is a £2 charge payable between 10.00a.m. and 4.00p.m., Monday to Saturday. The aim had been to reduce the traffic levels within the

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[35] http://www.imprint-eu.org/public/Papers/IMPRINT3_chin.pdf.

[36] http://www.tfl.gov.uk/tfl/cc_fact_sheet_other_schemes.shtml.

[37] For example, the newspaper *The Age* (http://www.theage.com.au/articles/2002/05/04/1019441447276.html) looked at the impact 18 months after the completion of CityLink and suggested that the road was not being used to its full capacity. It was argued that differentiating between peak and off-peak tolls would help reduce the avoidance issue.

charging zone from 2,000 vehicles per day to 1,000; in fact, the drop was 90%, to just 200. This, of course, had the effect of reducing the revenue from the scheme, highlighting the incompatibility of the revenue-raising and traffic-reducing aims of congestion charges on whatever scale.

More information on these and other schemes can be found on the Transport for London website at http://www.tfl.gov.uk/tfl/cc_fact_sheet_other_schemes.shtml and on the BBC website – which also considers possible further congestion charges in the UK – at http://www.bbc.co.uk/london/congestion/cities.shtml. It should be clear from these that whilst congestion charging has operated in other cities – and in some cases for a considerable time, and usually with significant benefits in terms of reduced congestion – the London scheme in terms of size and scope is on a scale unparalleled elsewhere.