

Drivers of Demand for Travel in London: A review of trends in travel demand and their causes



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Executive Summary

Background to the study

London has changed substantially over the past 10 to 15 years, both in terms of transport and in terms of economic and social characteristics. The period from 2000 saw significant improvements in public transport capacity and quality leading to mode shift from private to public transport. Over the same period London has seen rapid and sustained population growth, with higher than historical levels of immigration from the EU and lower levels of out-migration to other areas of the UK.

This review undertaken by TfL Planning attempts to bring together analysis of a range of different travel trends that have been observed in London in recent years, and to understand what has caused them and how they interrelate.

Given that there are so many factors that can influence travel demand, the review does not claim to prove all of the reasons why the trends that have developed over the past two decades have been observed. Rather, it aims to offer a plausible explanation for the trends in travel demand based on a description of some of the major factors that have had an influence.

A series of supplementary reports will be published to explore particular aspects of the topics covered in more detail than can be covered here.

Methods of the review

In attempting to understand the effect of changes in the transport network and the demographics of London, various types of data have been analysed. Since both transport and wider social characteristics have changed in London, sources relating to London's demographics and economy have been used alongside data sources specific to the transport sector to explore explanatory hypotheses for observed travel trends.

The use of both travel-specific and more general data sources means that the review can explore both endogenous and exogenous changes: some trends can be explained by relatively simple supply and demand effects, while others are the result of structural changes in society and the economy, for example changes in attitude toward particular modes.

Importance of understanding how and why trends are developing

Understanding what the recent trends in travel demand are and what has driven them is critical to our ability to forecast and plan for future demand. The transport network is a major factor underlying why London's economy is so productive, and continuing to provide an efficient and modern transport network that caters for the capital's needs will be essential in maintaining prosperity and quality of life as London's population continues to grow over the coming years.

Travel demand is a complicated function of many factors including: population, demographics, economy, incomes, supply of public and private transport, public

and private transport network ‘quality’, and costs of travel in terms of both money and time.

There are two parts to understanding this relationship. First, we need an understanding of how each factor affects demand. There is a large body of evidence and conventional thinking on many aspects of this, linking the factors listed above to travel demand in various ways.

The second stage of this process needs to explore whether the way in which each factor influences demand has changed over time, perhaps because London has entered uncharted territory – such as the widely cited ‘peak car’ hypothesis – or because personal preferences have changed amongst the population. Some trends observed in recent years are consistent with these hypotheses, for example car travel having consistently fallen while London’s population has been growing.

Ensuring we fully understand how the ways in which London has changed and is changing, and how these changes affect the relationship between transport supply and demand, will be critical to making the right decisions for London’s future.

Existing understanding of changing travel in London

London has seen substantial mode shift from private to public transport since 2000, as has been documented in TfL’s series of [Travel in London](#) reports.

Of particular note is the trend in car travel, which has fallen by around 15 per cent from its 1999 peak, even while London’s population has been growing. Since 2000, public transport modes have all seen increases in passenger numbers to varying degrees, with the number of trips on London Underground up by 20 per cent, trips by National Rail in London up over 50 per cent, and bus trips increasing by 70 per cent.

A range of hypotheses linking various economic and social factors to observed travel demand trends have been explored in the process of this review. These hypotheses can be categorised as relating to supply factors, underlying demand factors, and structural changes in the causes of travel.

Supply influences on travel

The supply changes that have influenced travel trends are perhaps the best understood. The investment that has been made in the public transport network, improving both capacity and quality, has led to an increase in demand on these modes. In contrast, capacity for general traffic on London’s road network has declined over the long term, making car travel less appealing again relative to public transport in terms of journey time. In addition, changes to parking policy and regulation introduced in the mid-1990s have continued to have an effect on the total quantity of parking spaces available and restrictions on their use.

There have also been increases in public transport fares during the period of interest. In isolation, these fare increases would be expected to cause a reduction in the quantity of travel by public transport, but with the cost of travel by car increasing similarly while the balance of capacity and service quality has shifted, public transport ridership has continued to increase.

Demand influences on travel

Underlying demand factors such as London's GVA (Gross Value Added) and household incomes have also influenced travel. Income is an important factor, not only because people with higher incomes make more trips, but also because income influences individuals' choices about which modes of transport they use.

The long term trend for increasing incomes was disrupted by the recession, and per capita incomes in London have fallen in real terms in recent years. The influence that income may have had on the observed trends appears stronger again when inner London and outer London residents' incomes are disaggregated.

Inner London saw real incomes increase by 18 per cent from 2003 to their peak in 2009, while in outer London there has surprisingly been no increase since 2003. With the majority of car travel taking place in outer London, this stagnation in incomes may have placed a cap on the amount of car travel, while inner London has benefitted to a greater extent from public transport improvements, and has seen car travel fall despite rising incomes.

The impact of structural changes in London's economy and society

In addition to the supply and demand influences that have been in effect, it appears there have been some structural changes in the drivers of travel demand in recent years.

Changes in attitudes toward car ownership and use, perhaps partly a result of improved public transport services and the increased cost of taking up motoring, mean that London's youngest residents are now much less likely to hold a driving licence than was the case amongst previous cohorts.

Another area of significant change has been in the types and locations of employment that take place in London, with the distinction between blue and white collar workers that was once linked to travel characteristics no longer appearing relevant. Working arrangements have also evolved, with a higher proportion of the population now working part-time – a characteristic associated with higher rates of travel.

London has also seen continued in-migration, including from EU accession states, while the rate of out-migration has slowed, resulting in increasing numbers of families with children living in the capital. The proportion of Londoners born in EU states other than the UK and Ireland rose from 3 per cent in 2001 to 11 per cent in 2011. That many of these migrants are more likely not to own cars and to live in inner London explains part of the phenomenon of increasing population without increasing car use.

A further influence on London-wide travel also relates to the inner and outer London distinction. Over the past 20 years, inner and outer London have seen roughly equal growth in population, despite the fact that outer London is approximately four times the area of inner London. With inner London residents making only half the number of car trips of their outer London counterparts – a pattern that is constant across the spectrum of income bands – the accelerating

densification of inner London relative to outer London has also contributed to sustained mode shift toward walking, cycling and public transport.

Findings and next steps

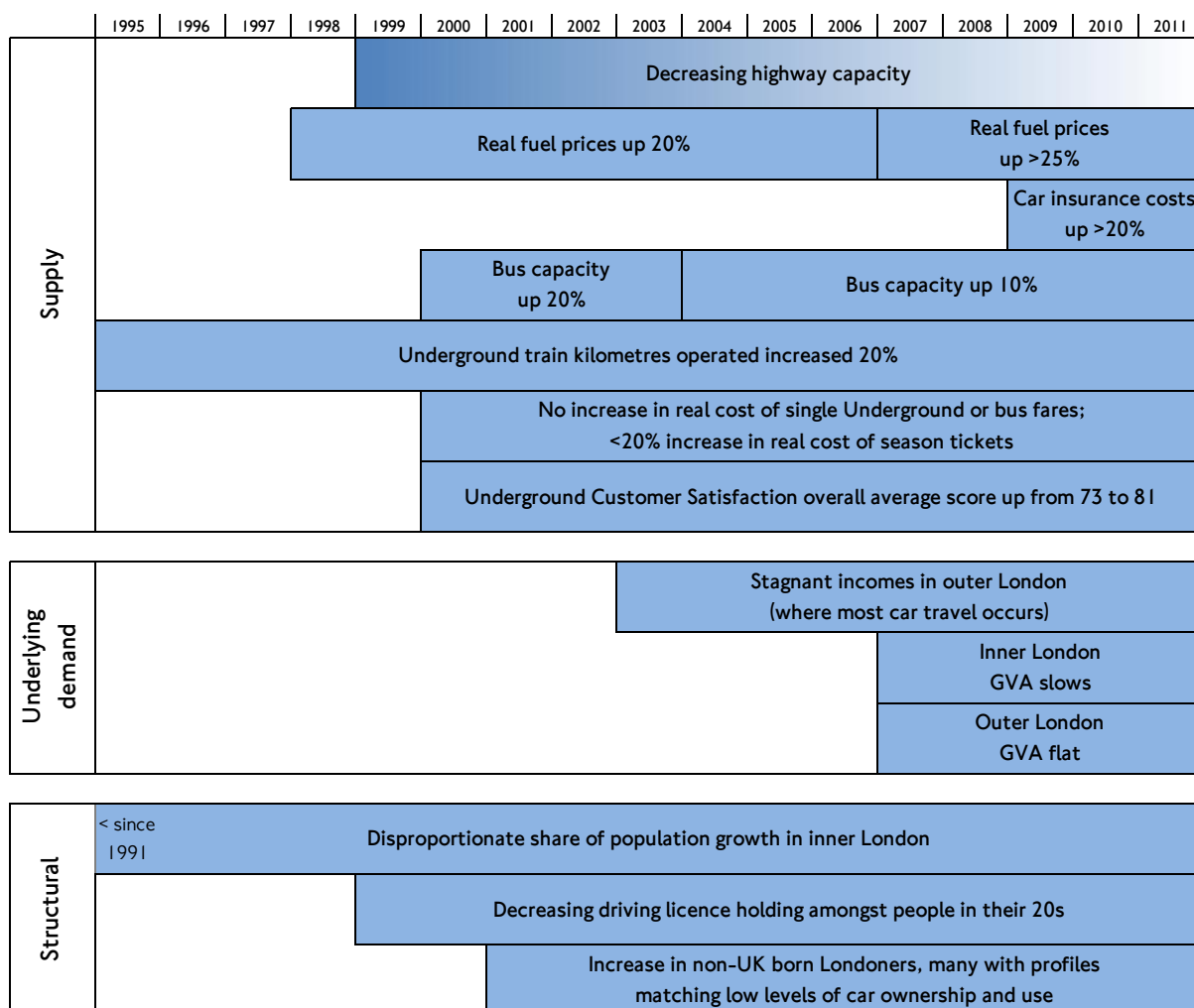
Almost every area explored by the study was found to have seen changes that could influence travel trends towards modal shift away from car travel to public transport, walking and cycling. This means that, while the large amount of investment in London's public transport network has been fundamental to the mode shift that has taken place, other factors also contributed to this phenomenon. Some of the major factors explored are summarised in Figure 1 (a wider range of factors are shown in more detail in Figure 43).

A change or reversal in any of the macroeconomic factors or policies of the past 10 to 15 years – for example a return to increasing household incomes in outer London – could make continued mode shift more challenging in future.

Future demand for transport will depend on how the trends that have been observed continue to develop. Many of the trends of the last two decades may continue, as is expected to be the case with population growth to 2031. The impact of other changes of the last 20 years might now have come to an end, as could be the case with the step change in the proportion of London residents born elsewhere in the EU following the accession of the 12 new member states in 2004 and 2007. It is also possible there will be new and unexpected changes, of the same type as the decrease in driver licence holding amongst the youngest generation of Londoners that would not have been expected 20 years ago.

A series of further supplementary reports associated with this review will be published on the [TfL website](#). These supplementary reports will explore specific aspects of the issues covered here in more detail, with the aim of contributing to the formulation of evidence based transport policy that will support London's continued growth and development. These reports are intended to be of use to policy makers and those looking to gain an understanding of London's changing transport needs over the medium and long term.

Figure 1: Summary of factors contributing to mode shift away from car travel



Why review travel trends?

A changing city

London's population has grown rapidly over the past two decades, from 6.8 million at the time of the 1991 Census to 8.2 million in 2011. With over one million additional residents in the last 10 years, the capital is growing at the fastest rate in its history. But London has not only grown in size over this period: social and economic changes over the past 20 years have also changed the way the city operates, and in particular the demand on its transport system.

Travel demand has risen as London has grown. The amount of travel per person by Londoners has remained relatively constant over the long term, with approximately 1.7 trips per day made by mechanised modes (i.e. by car and public transport). Similarly, the distance travelled per person has not risen, with Londoners on average travelling 10 kilometres per day – having in fact decreased from 1991 levels. The growth in aggregate travel demand that has been observed is therefore largely a function of the population of London growing substantially.

Benefitting economically and socially from a sustainable transport policy

While 20 per cent growth in London's population has led to a roughly proportionate rise in travel demand at the aggregate level, there have been significant changes in travel patterns underlying this overall trend.

The most remarkable of these underlying changes is that even in the context of growth in London's population, the total quantity of car travel has decreased almost 15 per cent from 6.9 million trips per day in 1999 to 5.9 million in 2012. This illustrates London's success in achieving mode shift from car travel to public transport, walking and cycling, with this shift happening at a rate fast enough to accommodate and outstrip the influence of the capital's growth.

'Peak car'

A popular hypothesis amongst transport professionals and commentators, termed 'peak car', is that car travel per capita, having grown for decades, has reached a peak and will see a sustained decline in the long term.

Whether this hypothesis turns out to be true has huge consequences for the future of London's transport network, and attempting to unpick the factors that may contribute to it or act against it is central to our ability to plan and invest for London's long-term future.

The importance of actively planning London's transport network for the future

Attempting to understand the trends in travel in London is not simply a matter of academic interest. Understanding what has caused these trends is critical to our ability to forecast, influence and cater for demand for travel in the future. With London's population projected to grow to 10 million over the next two decades, aggregate travel demand will continue to grow.

Why review travel trends?

As London's population continues to rise, ensuring its residents and employees can travel efficiently, safely and comfortably will be critical to maintaining London's status as a city with economic opportunities and a quality of life that make it an attractive places to live, work and do business.

Planning the transport network to mitigate the negative effects of increasing demand such as congestion and crowding will be integral to this. Accurately forecasting where and how growth in travel demand will take place is therefore necessary to ensure the transport network continues to allow London's economy to prosper in the long term.

The purpose of the Drivers of Demand review

This report outlines the most significant changes in travel in London that have been observed over the past 10 to 15 years and aims to describe their major causes, with the intention of identifying factors that will continue to influence travel demand in London over the coming decades.

Alongside the strategic overview of the influences of the many factors influencing travel demand presented here, a series of associated reports will be published analysing specific aspects of travel trends and their causes. It is intended that these reports will provide insights to help inform policy makers and transport planners in their decisions about how best to plan and invest for the future of London.

Data sources used

The changes in the nature of travel that have taken place have causes both from within the transport sector, such as increased capacity and improved service quality on public transport, and from beyond the realm of transport. A range of data sources have therefore been drawn upon to explain the observed trends, including travel data from various sources, but also data relating to wider factors such as the economy and demography of London.

Much of the analysis relating to travel activity in this report is based on London Area Transport Survey (LATS) data and the similar London Travel Demand Survey (LTDS) data.

The surveys carried out under the LATS programme were a series of large-scale travel surveys in London which were undertaken every decade until 2001 and were timed to coincide with the Census of Population, data from which was required to 'expand' the survey sample to represent the total population of London. These surveys were undertaken to provide an evidence base to better inform policy decisions. In 1991 LATS achieved a household sample size (within the Greater London area) of 44,700, while in 2001 it was 27,300.

Since 2005/06, LTDS household-based travel surveys in London have been undertaken on a continuous rolling annual basis. These have very similar objectives and content to the previous decennial surveys, albeit with a relatively small annual (financial year) sample of households. By combining three years of surveys, it is possible to derive a synthetic dataset that is broadly representative of conditions in 2011, and also compatible with the historic large-scale LATS surveys.

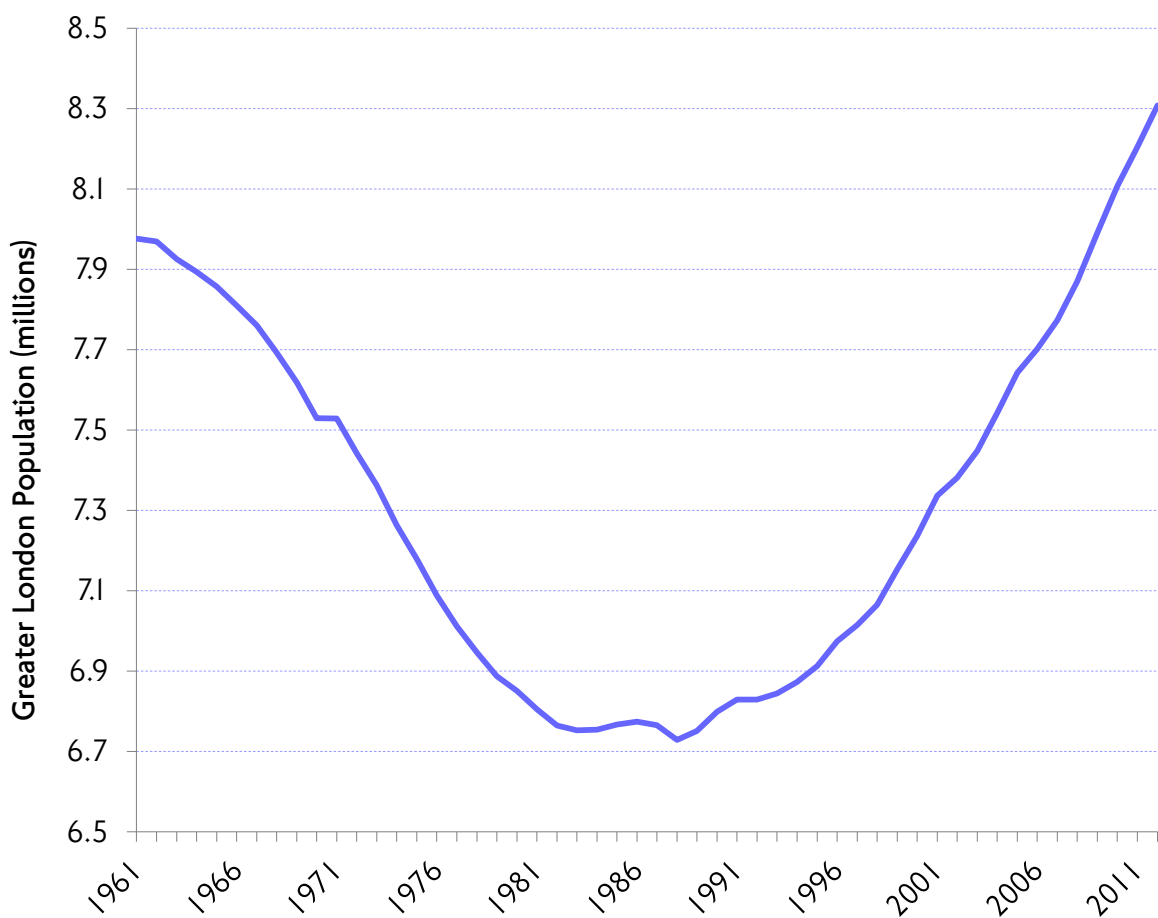
Data has also been drawn from other sources, including statistics published by TfL in its annual Travel in London reports and by the ONS. In all cases, the series used are quoted at least until 2011, and in some cases include later years where available. Since the Census gives the best available account of the population and demographics of London, 2011 is used as the reference point for the 'end' of the trends that this review explores, although these trends continue to develop and will respond to further developments in London's transport network and societal make up.

How has travel changed?

Population size is the primary cause of travel demand

At the aggregate level, the long term trend in the quantity of travel in London has in large part been determined by London's population. While in recent years London's population has been rising rapidly, this was not the case previously, with population falling substantially in the decades following World War II and reaching a low point between 1981 and 1991.

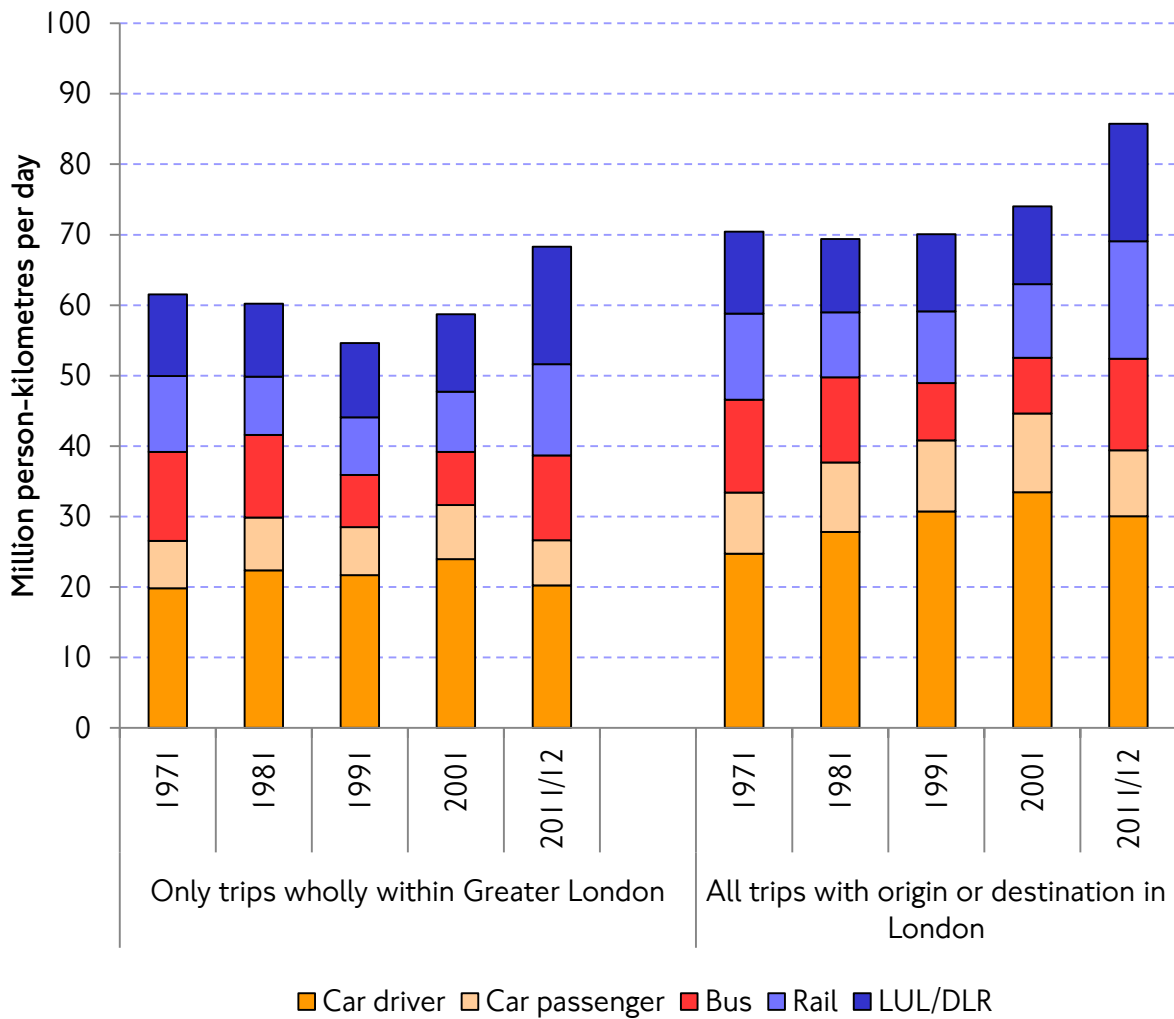
Figure 2: Population of London 1961 - 2012



Source: Greater London Authority

Figure 3 shows that the total volume of travel by Londoners taking place within London has followed the initial decline from, and subsequent growth back towards, the capital's pre-war population peak.

Figure 3: Weekday volume of travel by London residents (motorised travel only)

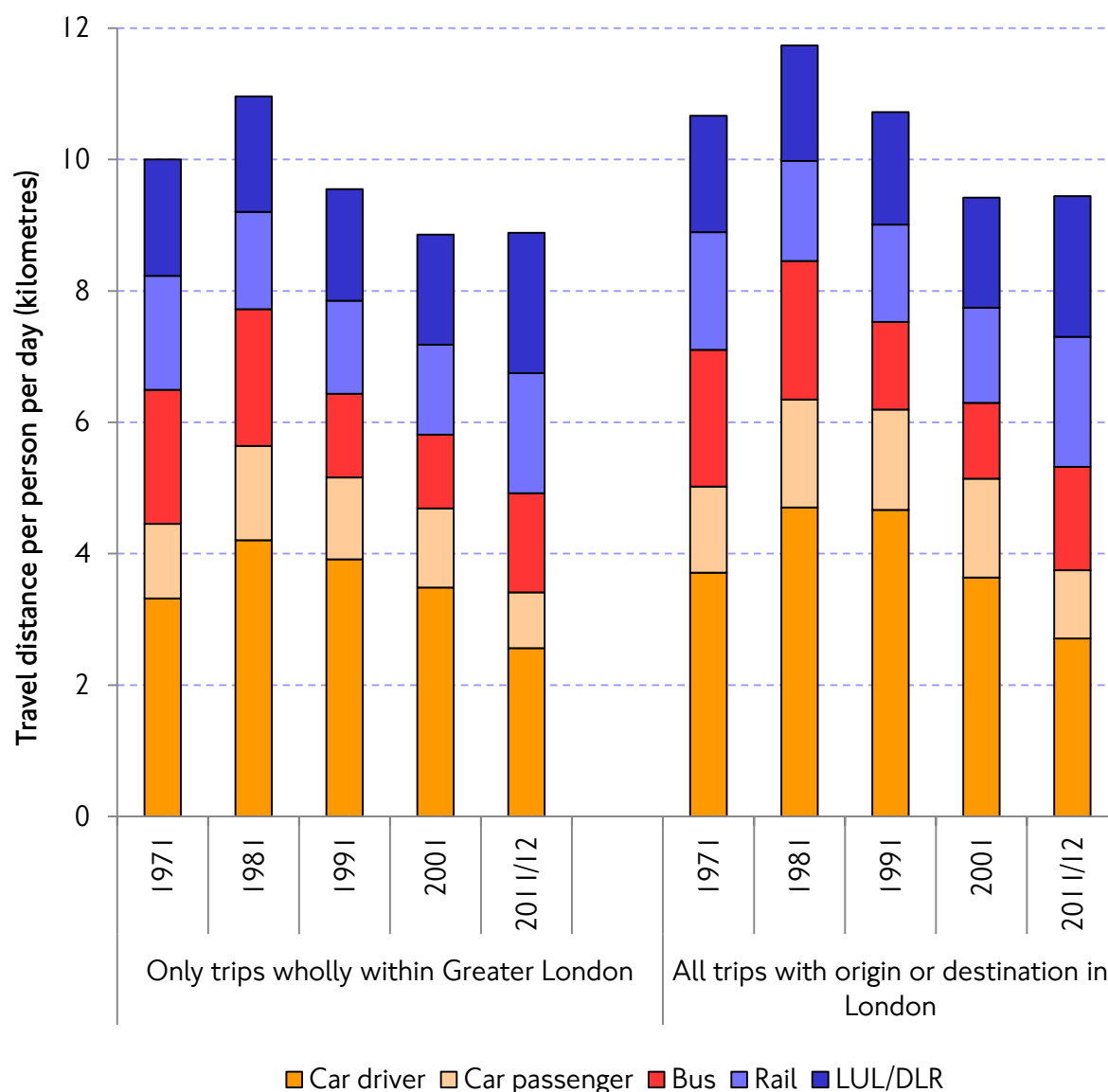


Source: LATS and LTDS

How has travel changed?

Although the aggregate volume of travel in London has increased as population has grown, the average distance travelled per person has decreased slightly from the levels seen in 1981 and 1991 (Figure 4). But while the number of people living in London is the major factor contributing the travel demand, various other travel trends have developed over the past decades that are not explained by this alone.

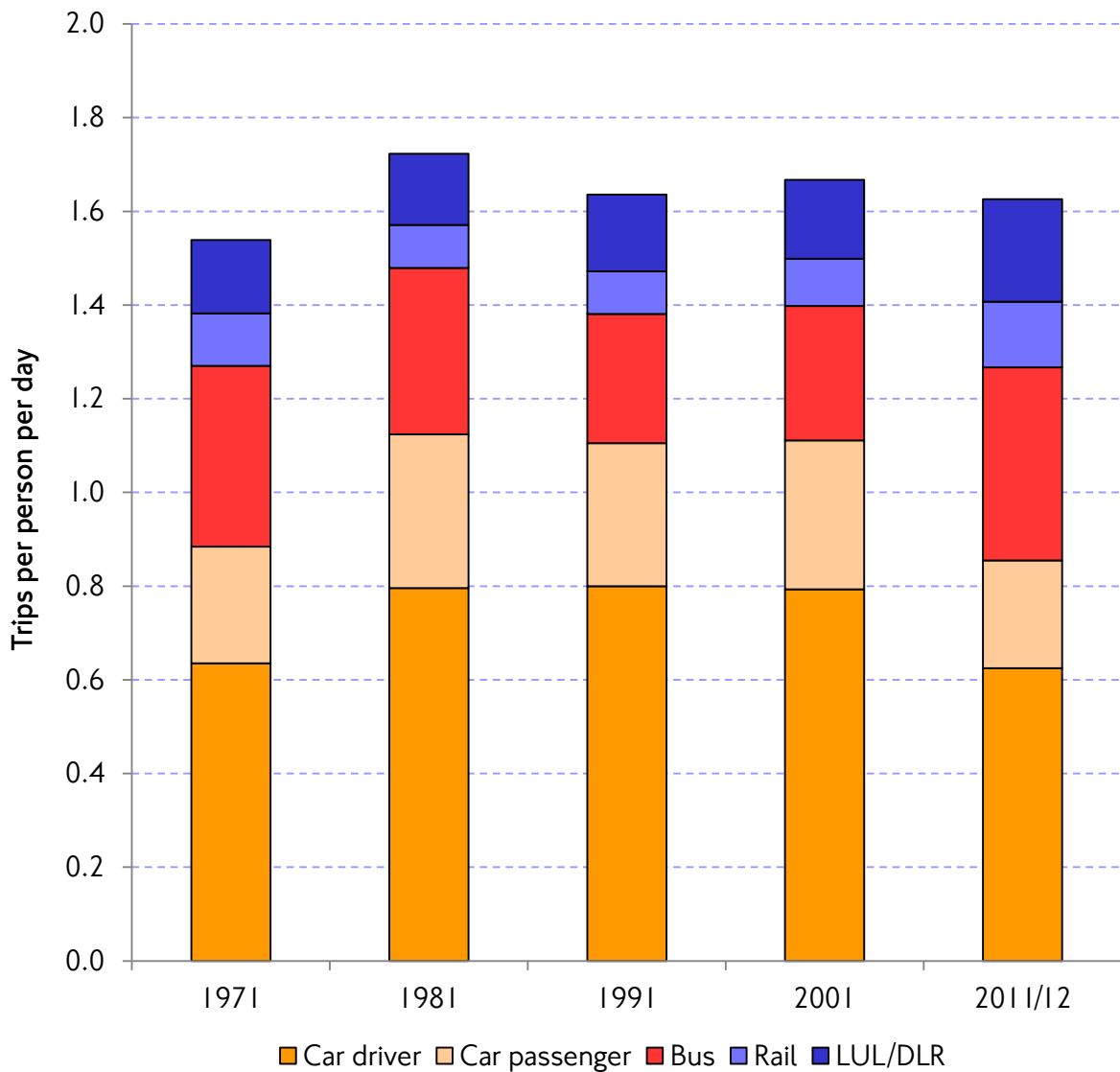
Figure 4: Distance travelled per day by London residents (motorised travel only)



Source: LATS and LTDS

It is apparent from Figure 5 that while the average Londoner continues to make approximately the same number of trips per day as has been the case for decades, the share of modes by which these trips are made has changed substantially. In particular, between 2001 and 2011 the number of car driver trips per person fell back to the level it was at in 1971, having been around 30 per cent higher in the intervening decades.

Figure 5: Number of trips per day by London residents (motorised travel only)

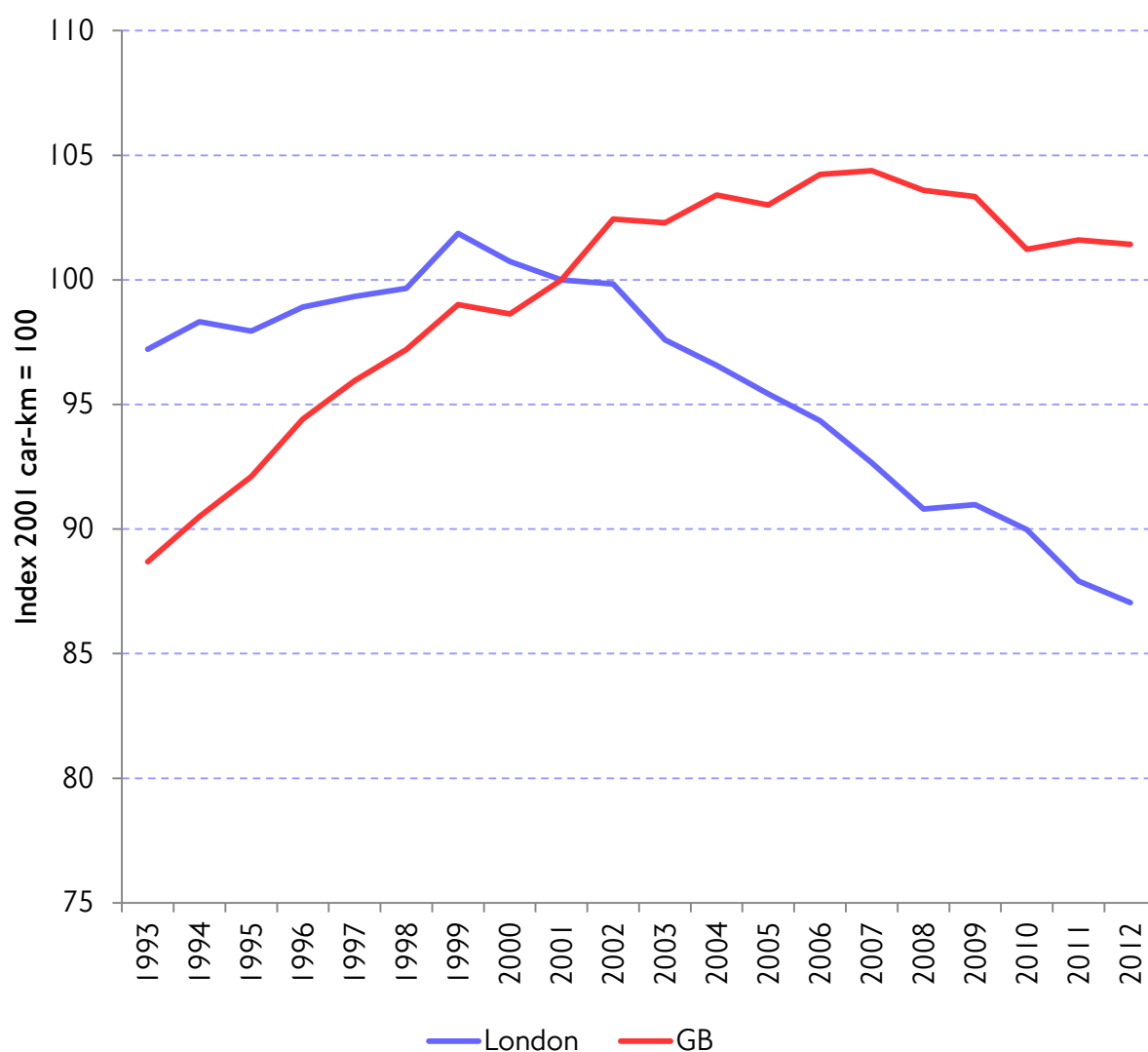


Source: LATS and LTDS

Modal trends have not uniformly followed population growth

Population size is such a major influence on travel demand that without significant outside influences it could be expected that each mode would have seen demand rising steadily while London's population rose increased by 20 per cent between 1991 and 2011. In fact, trends in modal demand have varied hugely over the past two decades, and in the case of car travel total demand has actually declined substantially, against the tide of a growing population (Figure 6).

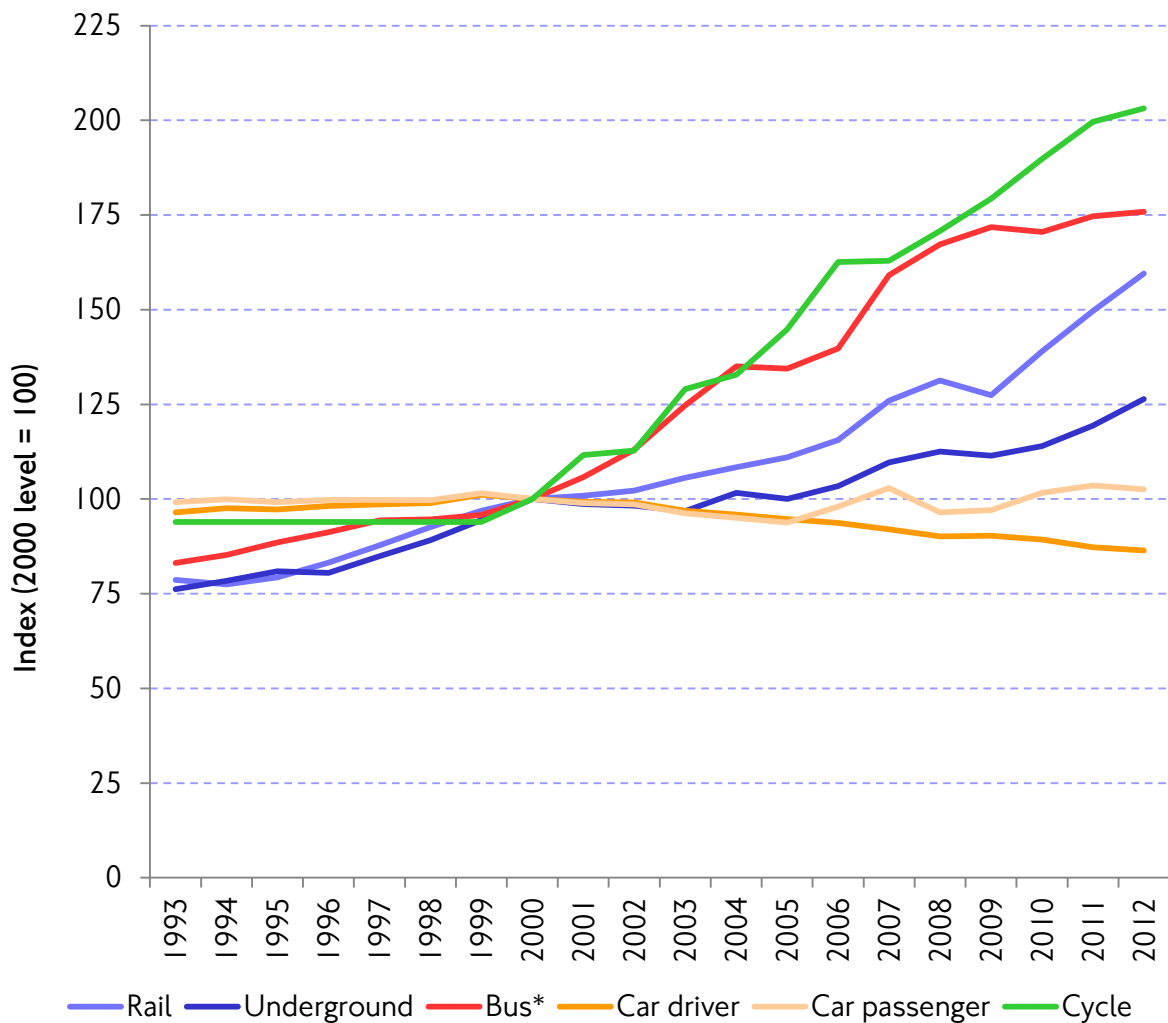
Figure 6: Total car-kilometres travelled (indexed to 2001 = 100)



Source: Department for Transport

Public transport modes have all seen growth in demand at a rate outstripping the growth in London’s population since 2000, with bus seeing the largest increase at 75 per cent growth in journey stages (Figure 7). Cycle demand has grown faster again – reflecting increased investment in policies aimed at cycling – with the number of journey stages doubling between 2000 and 2012 in the context of 13 per cent growth in London’s population.

Figure 7: Trends in number of journey stages by mode (indexed to 2000 = 100)



Source: TfL Planning, Strategic Analysis

*A new estimation method was introduced for bus in 2007/08

The remainder of this report explores the reasons for the diverging trends in modal growth, with the intention of identifying the main factors that have driven the observed changes in order to inform our understanding of the quantity of demand for transport London will see in the coming years and decades.

What has caused the trends?

What has caused the trends?

Many influences on transport demand are already well documented. Bodies of evidence exist relating various economic, social and demographic factors as well as supply and cost of transport to travel demand. Models of transport demand take many of these factors into account as inputs and use these established relationships to predict the volume and type of demand the transport network is likely to experience in future.

It appears, though, as if some of the traditional theories relating these factors to travel demand may no longer apply in London. Examples of this include the fact, explored above in Chapter 2, that car use has seen a sustained decline in London while the economy has been performing well. A number of further examples are set out in Figure 8.

The reason why not all of the theories linking individual factors to travel demand appear to hold is because they are all part of a bigger, less clear picture with many interlinked influences of varying degrees of importance determining the scale of demand seen on the different modes of transport.

To help explore the many influences on travel demand in recent years, the various factors have been grouped into three categories to be treated in turn: supply factors; underlying demand factors; and structural changes. The following chapters present evidence of these factors and their influences on travel demand over the past 10 to 20 years.

Supply factors are changes that have altered the appeal and/or affordability of travel, or of specific modes, such as:

- Transport capacity increases;
- Improvements in quality of transport provision;
- Changes in monetary or time costs of use of particular modes of transport

Underlying demand factors are the macro-level trends that determine the population's desire to travel:

- Size of London's population;
- The performance of London's economy;
- Incomes and personal economic circumstances

Structural changes in the relationship between the macro-level trends that influence demand and the quantity and type of travel that takes place, for example:

- Changing attitudes to car ownership and use;
- Evolving working arrangements;
- Change in personal preferences amongst the population as a consequence of a change in demographics

Figure 8: Apparent divergences from theory that have been observed in London

Traditional conventional thinking	Observations in London
Volume of car traffic increases as a city grows	Car travel in London decreased by 12 per cent between 2001 and 2011 while the population grew by one million
Car ownership and use increased while it was becoming 'normal' in society through the second half of the 20 th century before reaching a plateau, after which it should remain constant	Car use grew to 1999, since when it has been in decline. Car ownership rates decreased between 2001 and 2011. Driver licence holding rates also peaked before falling
Car ownership rate increases as incomes rise	Inner London has seen the greatest income growth in the UK and car ownership has fallen
People switch to 'more desirable' modes as their incomes increase, typically from bus to rail modes and from rail modes to car	Since 2000 bus use has grown by more than use of rail modes, and use of rail modes has grown by more than car use (which has fallen)
Demand decreases when fares increase	Rail travel in London has grown by 50 per cent in spite of fares rising 15 to 20 per cent
People travel more as incomes rise	People with higher household incomes travel more than those with lower incomes, but the distance travelled per person has not increased over a number of decades

Supply factors

Of the three categories identified, the supply factors that have contributed to the observed changes in transport behaviour in London are perhaps the most recognised and best understood.

The formation of the Greater London Authority and the subsequent creation of Transport for London in 2000 brought a change in the way in which transport investment decisions for London were made and planned for.

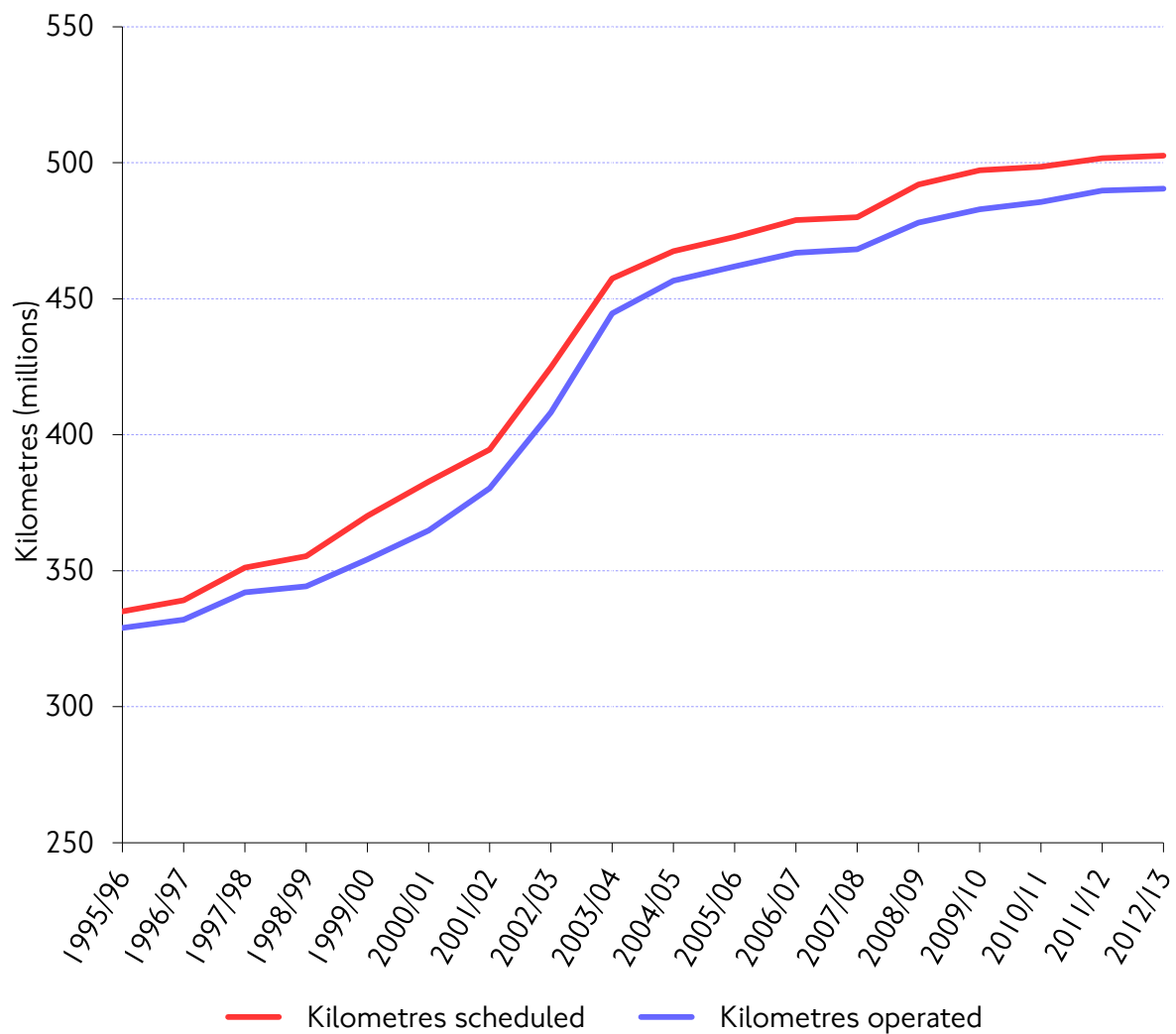
As an integrated transport authority TfL had the ability to make decisions to improve the public transport network as a whole recognising that, in contrast to car trips, public transport trips are often made up of multiple stages by different modes. Since 2000, London's public transport network has not only seen substantial investment in its individual elements as evidenced below, but also improvements in overall customer experience, for example through integrated interchanges and better provision of information.

Network capacity has developed differently for different modes

In the years immediately following the formation of TfL the coverage of London's bus network was increased dramatically, with an increase of 20 per cent in bus-kilometres from 2000 to 2003 (Figure 9), partly as a mitigation measure in preparation for the introduction of the Congestion Charge. Capacity has continued to increase at a slower but consistent rate, with a further 10 per cent additional bus-km added since 2003.

The substantial investment in bus capacity has meant both that a greater proportion of Londoners have easy access to bus services (95% of households in London are within 400m of a bus stop) and that there is sufficient capacity to carry the growing number of passengers in the busiest corridors.

Figure 9: Scheduled and operated bus kilometres



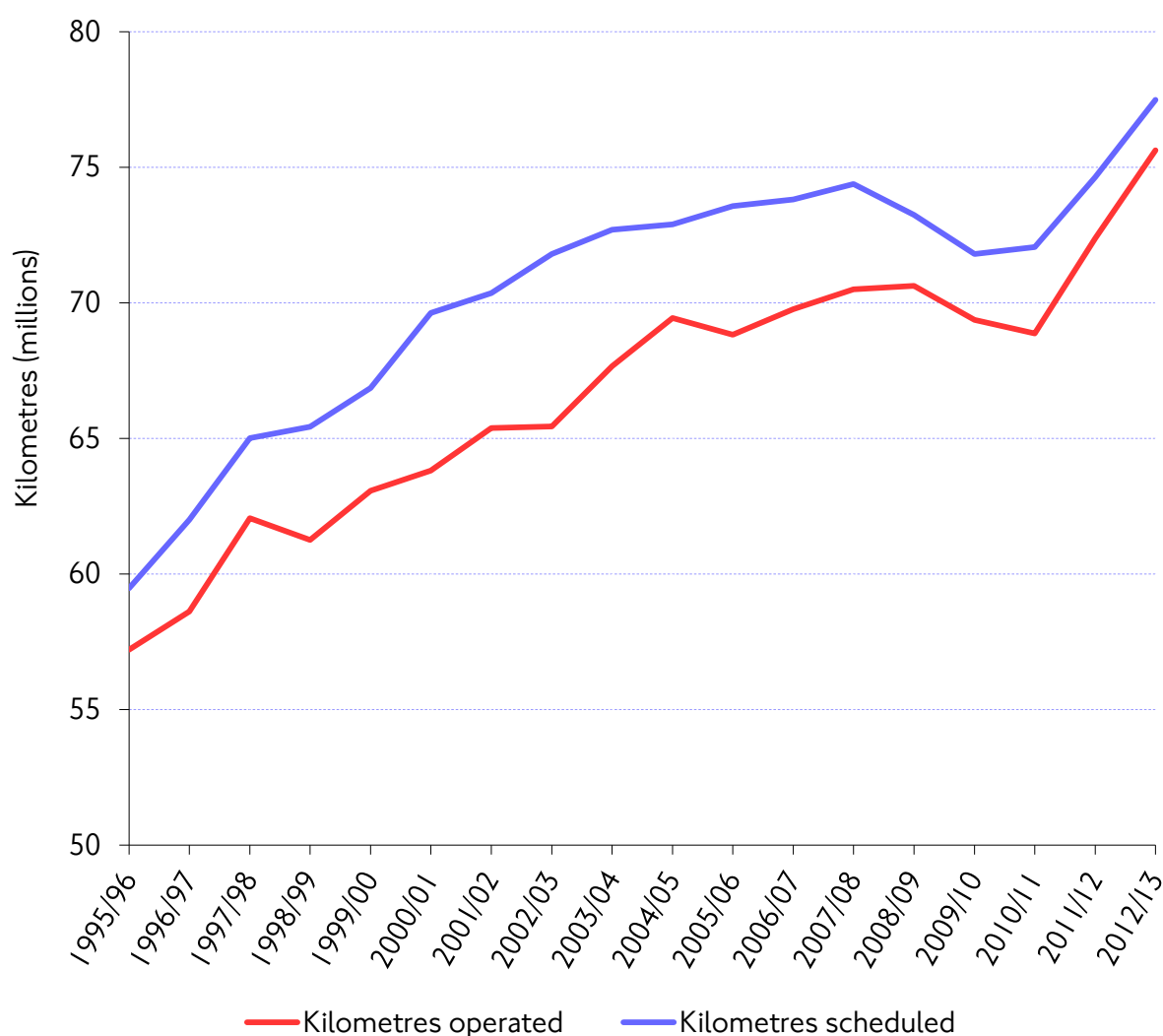
Source: London Buses

Supply factors

The Underground has also seen an increase in capacity (Figure 10), with the volume of train kilometres operated up by 19 per cent since 2000.

In comparison to the growth seen in bus capacity, the increase in Underground capacity has been sustained at a relatively constant level over around 20 years, albeit with a slight decline in the years immediately preceding the 2012 Olympic Games while a large amount of upgrade work was underway, following which capacity rose sharply back to a point in line with the long term trend in 2012.

Figure 10: Underground scheduled and operated train kilometres

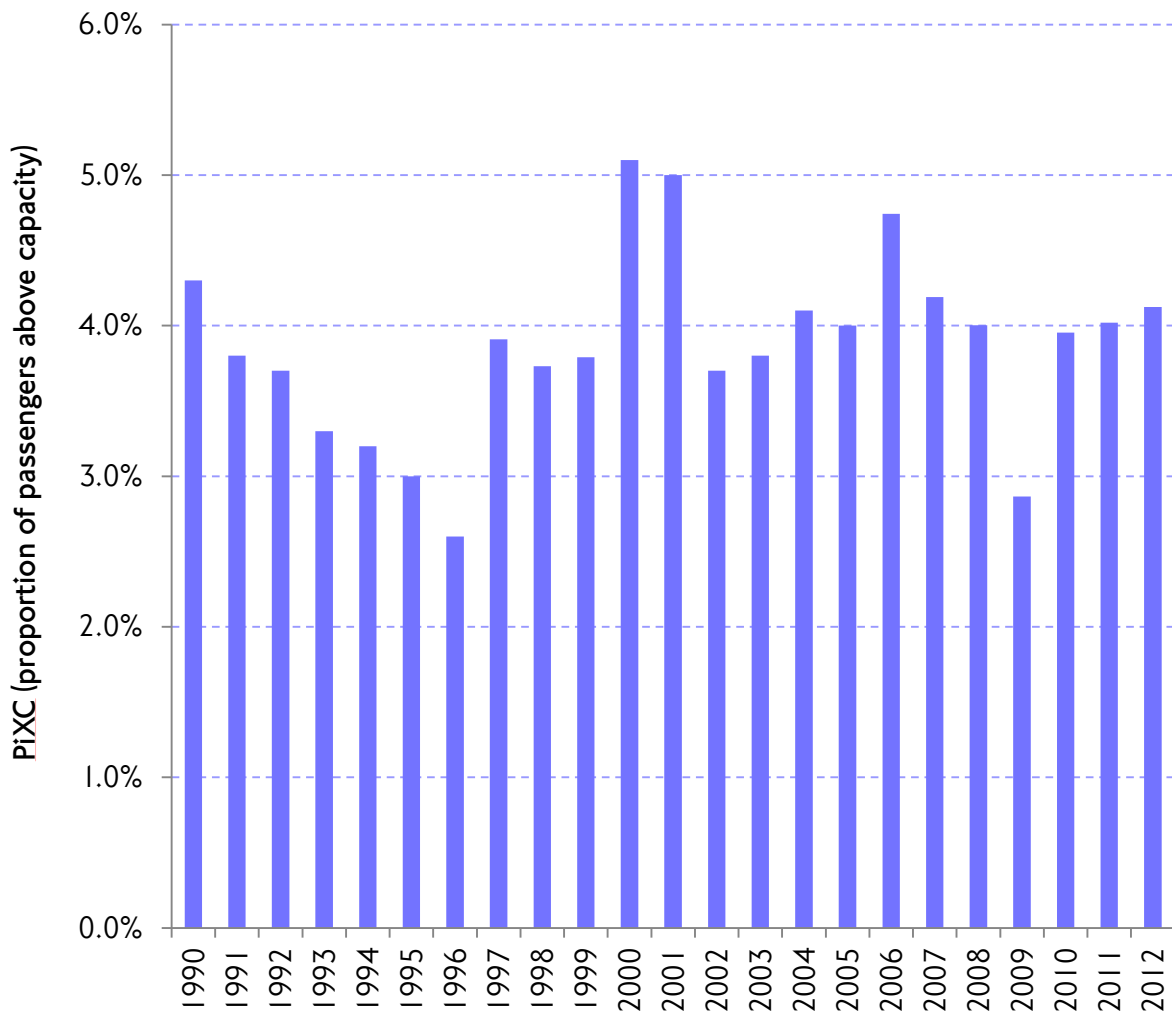


Source: London Underground

National Rail services in London are not operated by TfL, and directly comparable statistics on capacity are not readily available. There has, though, been an increase in capacity, with more frequent services and longer trains on many routes.

At the aggregate level this is demonstrated by the fact that crowding has remained relatively constant (Figure 11) while passenger numbers have risen substantially, with 50 per cent growth in the period since 2000 (Figure 7).

Figure 11: Passengers in Excess of Capacity, London and South East region



Source: Department for Transport

Supply factors

In contrast to the increases in capacity seen on the public transport modes that have kept pace with or in some cases outstripped growth in population, road network capacity in London has been declining over the long term.

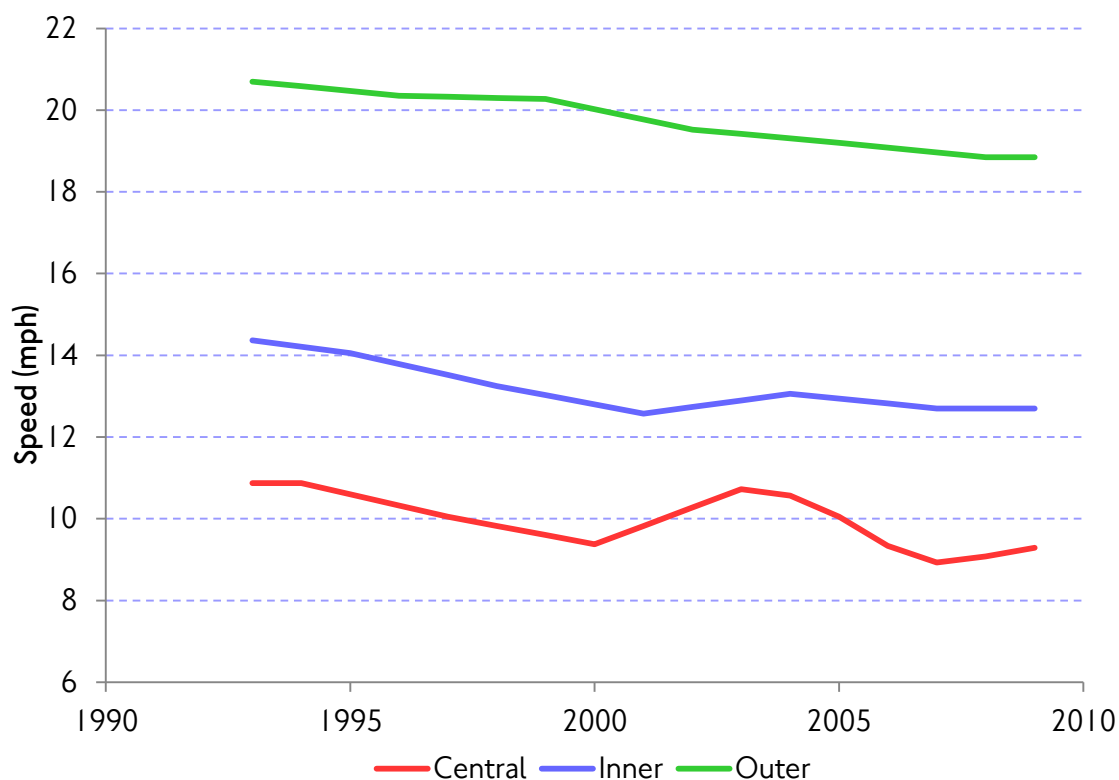
The decline in road capacity can not be observed directly, but can be inferred from the relationship between traffic volumes and the average speed of travel on the network.

The volume of traffic in inner London reached a peak in 1999, and has since been declining. The rate of decline in inner London has been faster than that in outer London, with traffic levels down around 20 per cent on the 1999 peak by 2012 in inner London and by around 10 per cent in outer London.

With the volume of traffic declining across London, it would be expected that congestion would reduce, and therefore the speed of travel on the network to increase. In fact, there has been no increase in average traffic speed in inner or central London since 2000, and a fall in speed of travel in outer London over the same period (Figure 12).

The explanation for the lack of rising network speeds while traffic volumes have declined is that *effective* road network capacity has been reduced, with space having been reallocated from general motor traffic to other purposes such as bus and cycle lanes, safety initiatives or improvements to the public realm. A full explanation of this phenomenon is given in [technical note 10](#) produced for the Mayor of London's Roads Task Force.

Figure 12: Traffic speeds over time based on moving car survey observations



Source: TfL Planning, Strategic Analysis

Quality of service on public transport has improved

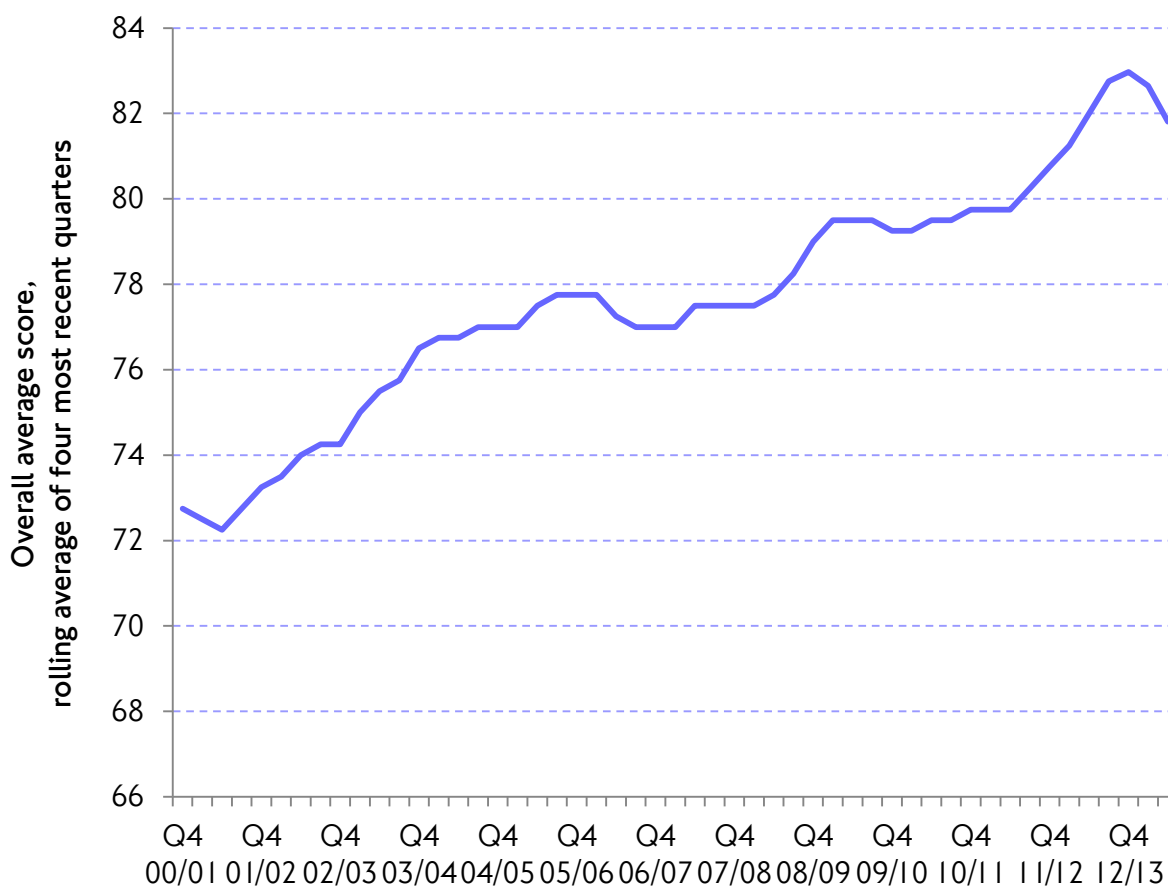
Investment in London's public transport network has not only seen increased capacity, giving greater coverage and reducing crowding, but has also led to improved quality of service.

Many aspects of service quality have been transformed since 2000, for example:

- **Information** – both in vehicle, such as the introduction of bus stop announcements, and elsewhere, such as improved mapping and real time updates
- **Ease of payment** – the introduction of Oyster brought a single reusable and flexible ticketing system to the public transport network as a whole
- **Accessibility** – all 8,500 London buses are low-floor step-free, and 76 per cent of bus stops now meet DfT accessibility standards
- **Security** – crime rates have fallen on all TfL modes

Figure 13 shows the long term increase in customer satisfaction on the Underground to a peak in 2012 during the Olympic Games, reflecting the improvements to many elements of customer experience.

Figure 13: Customer Satisfaction Overall Average Score, London Underground



Source: London Underground

Cost of travel has gone up, but not consistently

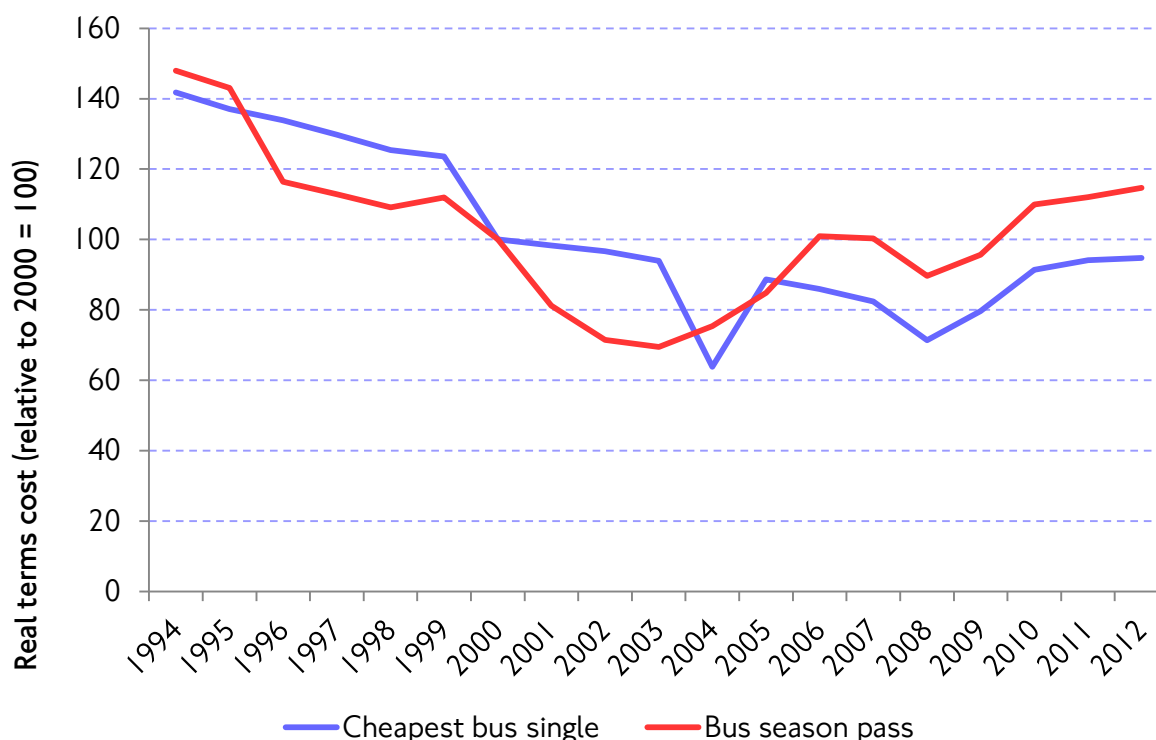
The improvements in capacity and quality of service in London’s public transport, both in absolute terms and even more so relative to the road network, are only one half of the equation in relation to the supply of transport. Cost of travel is also a major factor in the modes of transport people choose, and in the amount they choose to travel.

Single fares for both bus (Figure 14) and Underground (Figure 15) cost approximately the same in 2012 as they did in 2000 in real terms. Following an initial drop on the introduction of Oyster in 2003, the nominal price for a single bus fare remained at £1 from 2005 to 2009. Similarly, a single zone 1-4 Underground fare was reduced in 2005 after the introduction of Oyster and then remained constant in nominal terms at £2.50 until 2008.

The cost of season tickets has increased in real terms for both bus season passes and Travelcards, by around 10 to 15 per cent. In the case of bus season passes there was an initial real terms reduction in cost of 30 per cent between 2000 and 2003 – coinciding with the 20 per cent increase in capacity on the bus network – before later rises.

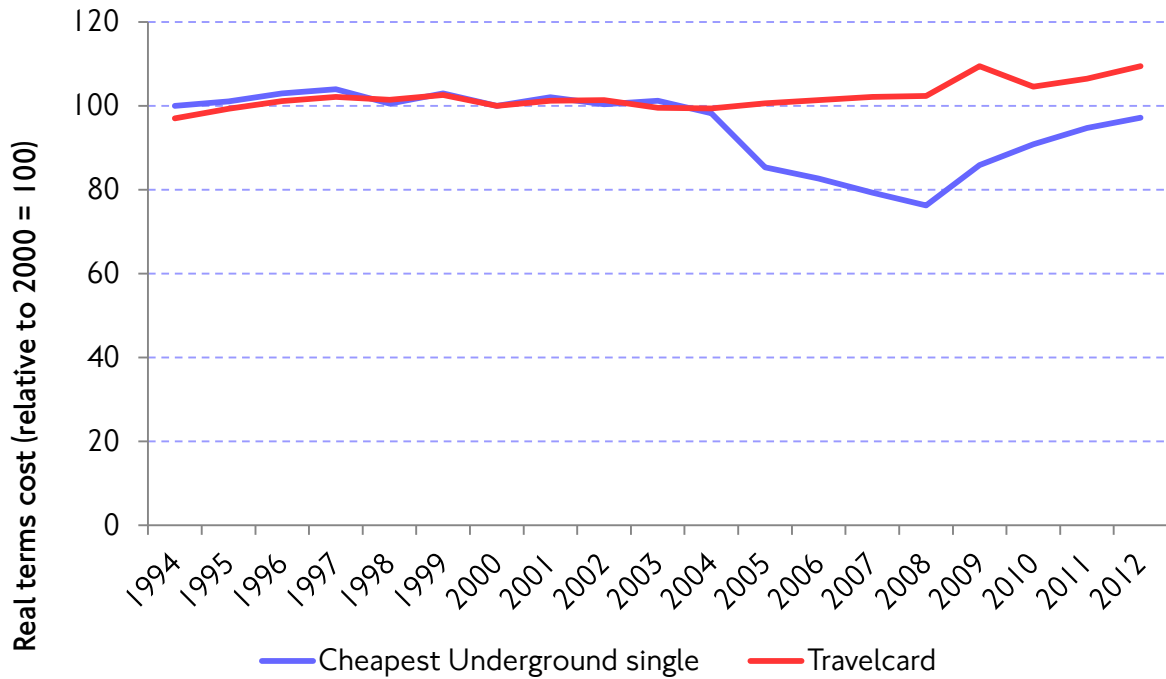
Rail fares have also increased in real terms (Figure 16), with season tickets up around 15 per cent in the 10 years to 2013 and single tickets rising slightly faster at around 20 per cent.

Figure 14: Trend in real terms bus ticket costs (indexed by RPI)



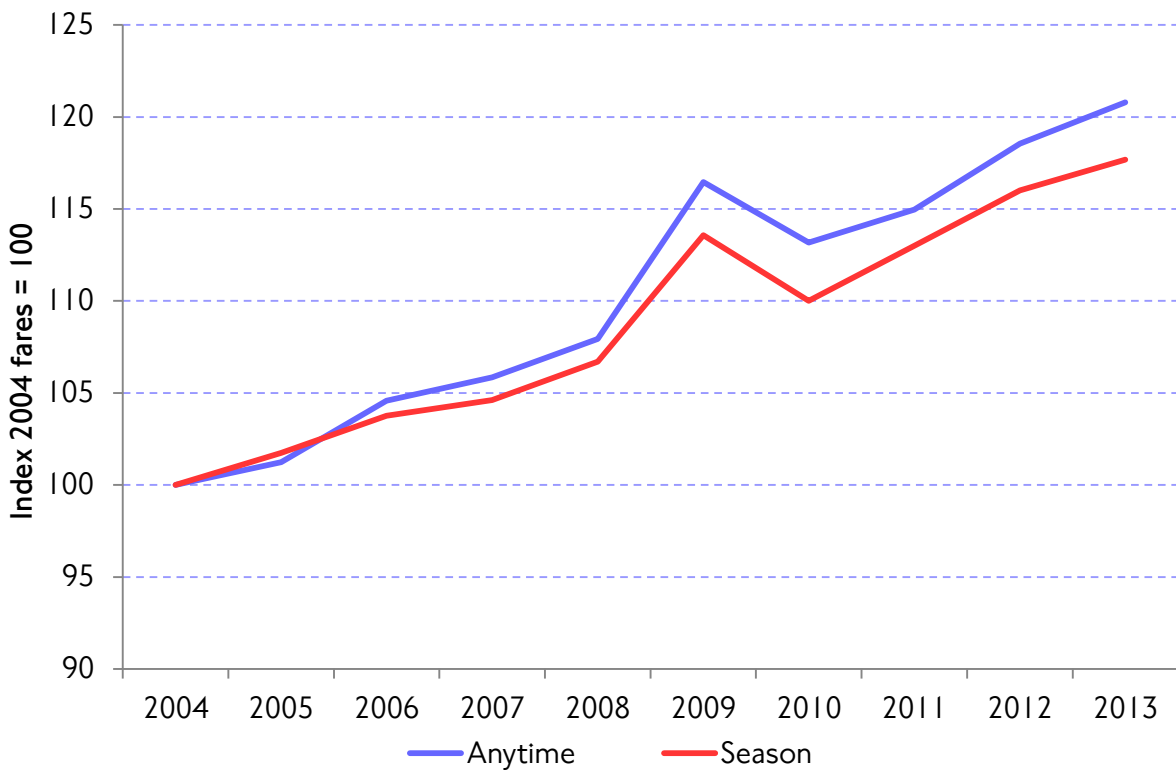
Source: TfLfares data

Figure 15: Trend in real terms Underground ticket costs (indexed by RPI)



Source: TfL fares data

Figure 16: Rail fares index in real terms, London & South East region



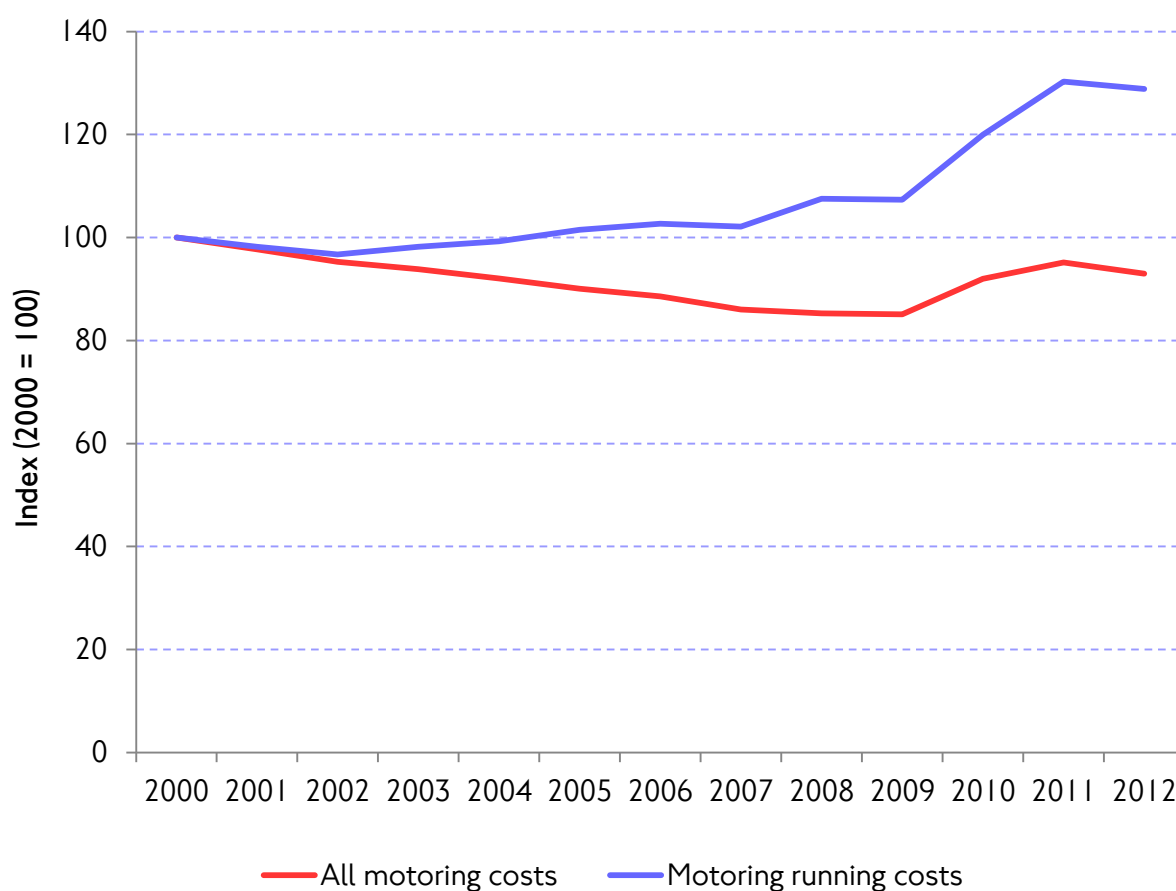
Source: Department for Transport

Supply factors

Since 2000, motoring costs as a whole have grown at a slower rate than RPI – that is to say growth in the cost of owning and running a car has been slower than growth in the cost of living in general (Figure 17). However, this has not been a smooth trend that all aspects of the costs of owning a car have followed: insurance costs saw double-digit percentage rises in successive years from 2009, affecting young drivers disproportionately.

In addition, motoring running costs have increased substantially over the same period, and were 29 per cent higher in 2012 than in 2000. The variable, or per trip, cost of travel by car has therefore increased at a faster rate than public transport fares.

Figure 17: Motoring costs relative to RPI

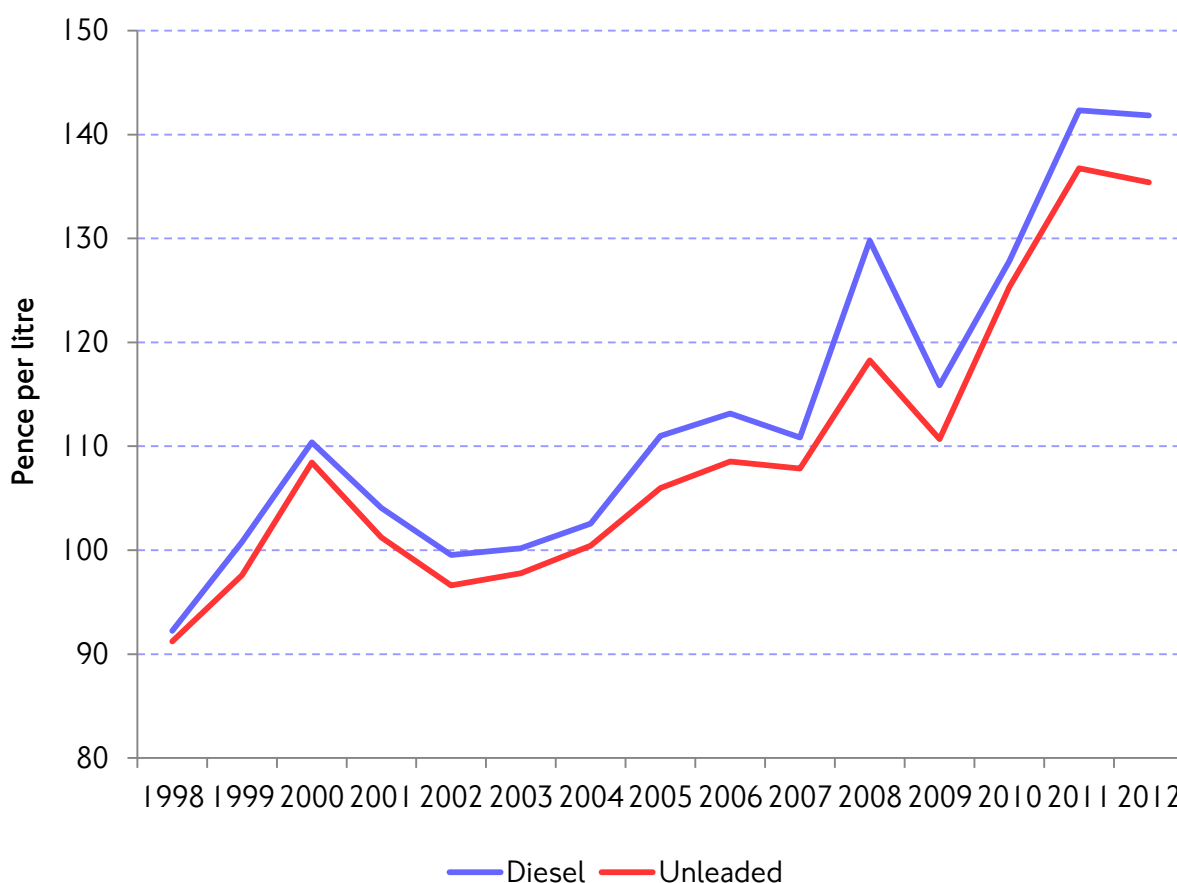


Source: Department for Transport

Fuel costs have risen by around 40 per cent in real terms since 2000 (Figure 18), with much of this down to a sharp rise in the period since 2009. The rise in fuel prices has counteracted improvements in engine efficiency that have been achieved over the same period

This means that while today's newest vehicles require a substantially smaller quantity of fuel than a new vehicle in 2000 did to travel the same distance, in real terms cost of this smaller quantity of fuel is approximately equal to the cost of the fuel required in 2000 – i.e. the fuel cost per kilometre travelled now is about the same as it was in 2000 despite improved fuel efficiency of vehicles.

Figure 18: Fuel cost at 2012 prices (indexed by RPIJ¹)



Source: Department for Energy and Climate Change

¹ RPI was downgraded by the ONS and is no longer a National Statistic. RPIJ was subsequently introduced, and is regarded as representing inflation more accurately according to international standards.

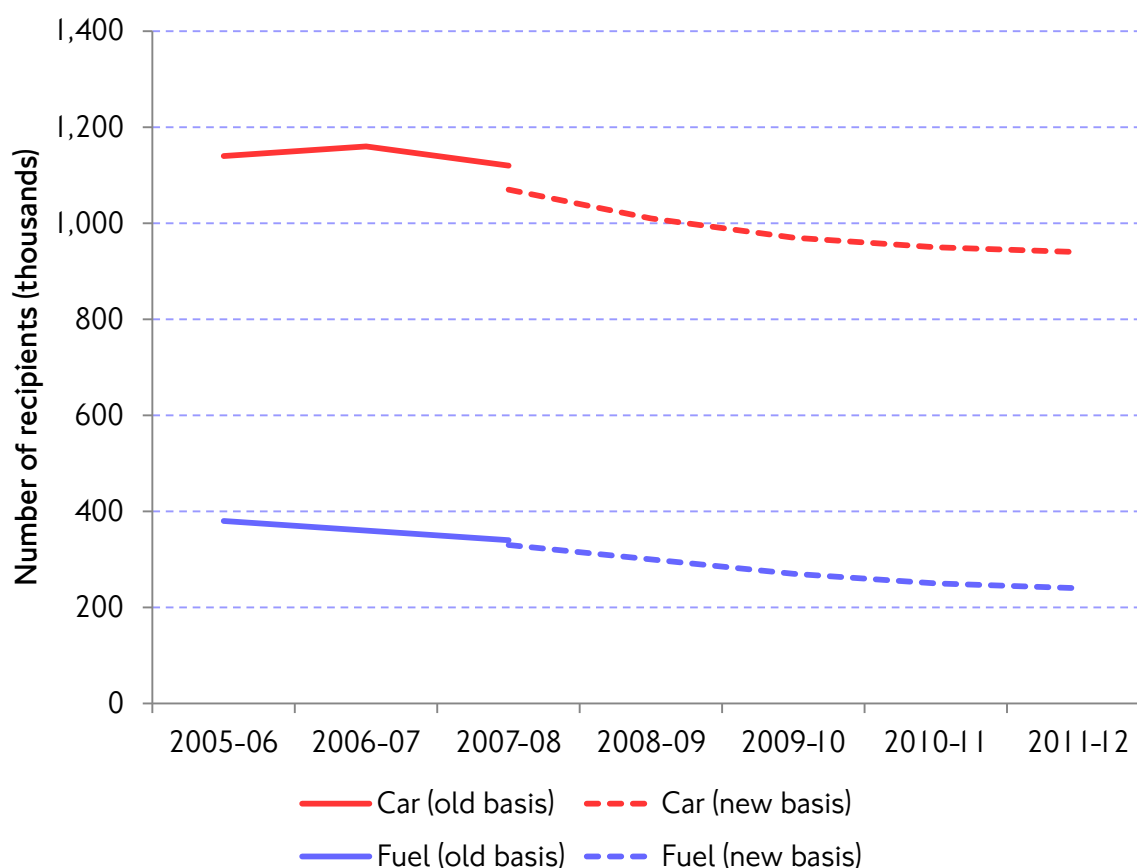
Supply factors

The number of people provided with company cars in the UK has been declining, with 14 per cent fewer registered in 2011 than in 2005 (Figure 19).

An even greater reduction has taken place in the number of people receiving car fuel benefit (where employers provide fuel for private use of a car, as opposed to fuel for the use of the car while on the employer's business), with a 35 per cent drop over the same period.

While people receiving these benefits represent only a minority of all drivers, the reduction in the number of people receiving these benefits represents a substantial number of people becoming obliged to shoulder the full costs of motoring themselves, thereby dramatically increasing the cost they perceive.

Figure 19: Recipients of company car and fuel benefits



Source: Department for Transport

Note: The methodology used by the ONS to calculate these statistics changed in 2007-08, hence the discontinuity in the data.

Parking policy was changed in the mid-1990s

While monetary cost of travel and time costs incurred during travel are factors common to both car travel and public transport, car travel also involves a further supply-constrained element: parking. Parking can involve both monetary costs (e.g. metered parking or residents' parking permits) and time costs (where scarcity of spaces leads to more time searching for a space or parking further from the desired location).

Although parking accounts for a significant element of the generalised cost of travel by car, there is a lack of robust data relating to either the cost of parking or the extent to which policy has affected its supply over the long term. However, there have been changes in parking regulation with effects during the period of interest to this review.

Regulations relating to the provision of both off-street parking and on-street parking both saw substantial changes in the 1990s.

Off-street parking regulation saw a reversal of the historical policy of minimum standards for parking associated with new developments, with maximum standards introduced instead. This meant that the quantity of additional parking supply delivered through new developments has been constrained over the past 10 to 15 years.

At the same time, on-street parking supply has also been altered as a result of a change in the ownership of responsibility for its regulation and enforcement. In the early 1990s local authorities were granted responsibility for parking enforcement, which had previously been held by the police. This change was implemented in London in 1993/94. The consequence of this was increased enforcement of residential parking regulations, but also the spread of restrictions both spatially and temporally, including restrictions during evenings and weekends.

These changes in parking policy form part of the context in which the changes in travel demand that have been observed in London took place and, despite a lack of quantified evidence, are likely to have had an influence on the quantity of car travel in London.

Summary

The single largest change in supply of transport in London has been the substantial increase in public transport capacity, especially in the period since 2000. A decline in the capacity of the road network for general traffic over the same period made the appeal of public transport stronger again.

Some public transport fares have not increased in real terms since 2000 and, even where they have, increases have been similar to the change in cost of travel by car. Given that the capacities of the public and private transport networks have gone in opposite directions, any small change in cost differential between them has probably had a relatively insubstantial effect on the split of demand between the two.

In addition to the more concrete effects of changes in cost and capacity, the balance has been tipped further towards use of public transport by improvements to many aspects of customer experience. Making public transport easier to navigate, safer and more integrated has eroded some of the appeal of car travel based on its ease of use.

Underlying demand factors

Unlike the supply factors, the underlying demand factors that have influenced travel patterns do not relate to changes within the immediate realm of transport. These factors relate to the number of people who want to travel in London and how much they want to travel.

The supply of transport in London has changed substantially over the past two decades, contributing to a shift in the point of supply-demand equilibrium that determines the quantity and type of travel that takes place in London. But at the same time the number of people living and working in London and the things that make them want to travel have changed, further complicating the shift in the supply-demand equilibrium.

Traditionally, rising incomes and a growing economy would have been expected to lead to greater car ownership and more travel by relatively expensive and faster modes of transport. While London has seen greater economic growth than the rest of the UK over the past two decades, the story is less straightforward when looking at different geographical areas, and in particular at the distinction between trends in inner London and outer London.

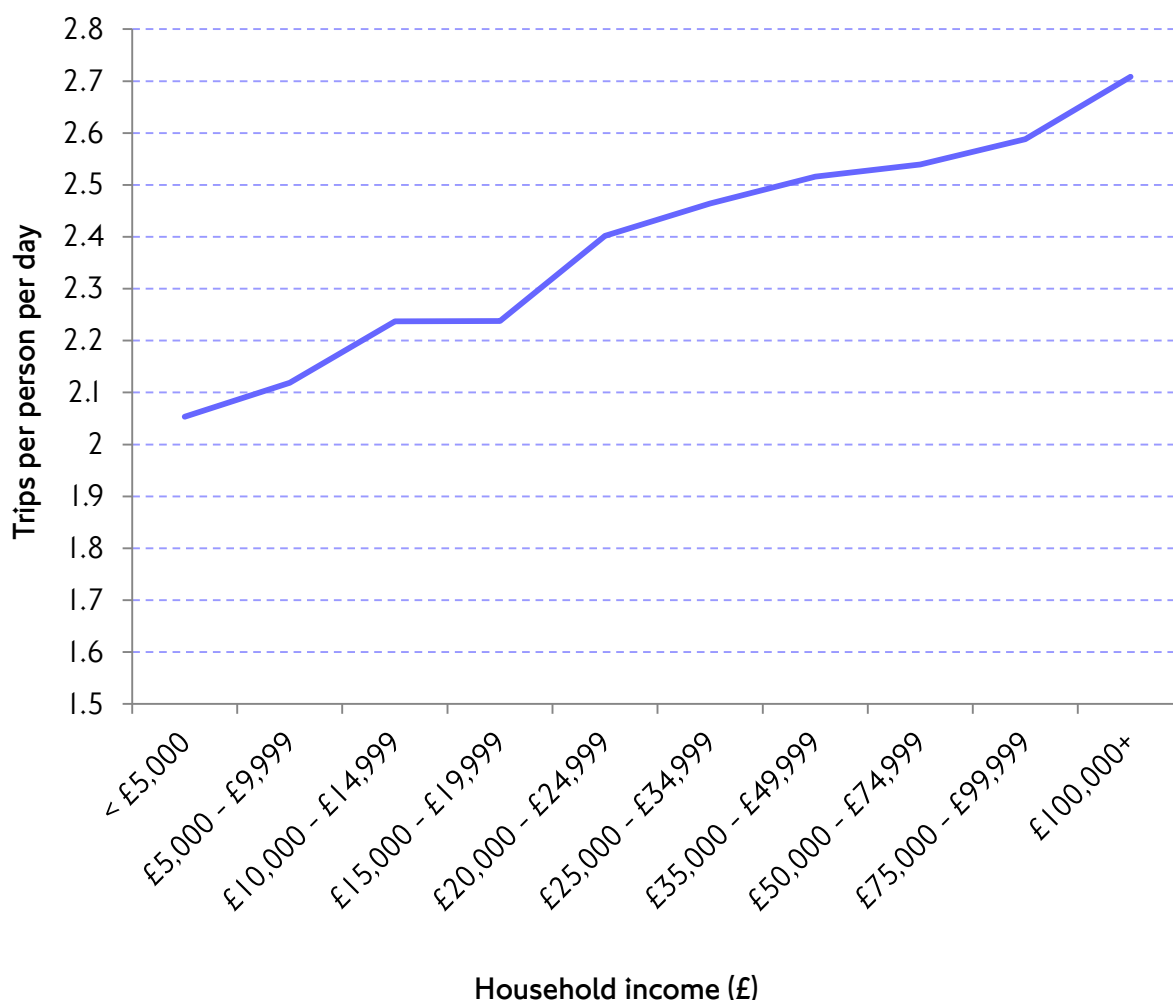
Income continues to affect travel behaviour

Trip rates (the number of trips made per person per day) by all modes rise with household income (Figure 20.)

Londoners living in households with incomes above £100,000 make 32 per cent more trips per day than those living in households with an income below £5,000 which, while significant, suggests there is a minimum amount of ‘necessary’ travel at around 2 trips per day on average amongst those with the lowest household incomes, and that there is an upper bound to the amount of travel that is considered desirable regardless of income.

Different patterns emerge when looking at the link between household incomes and trip rates by individual modes, as explored below.

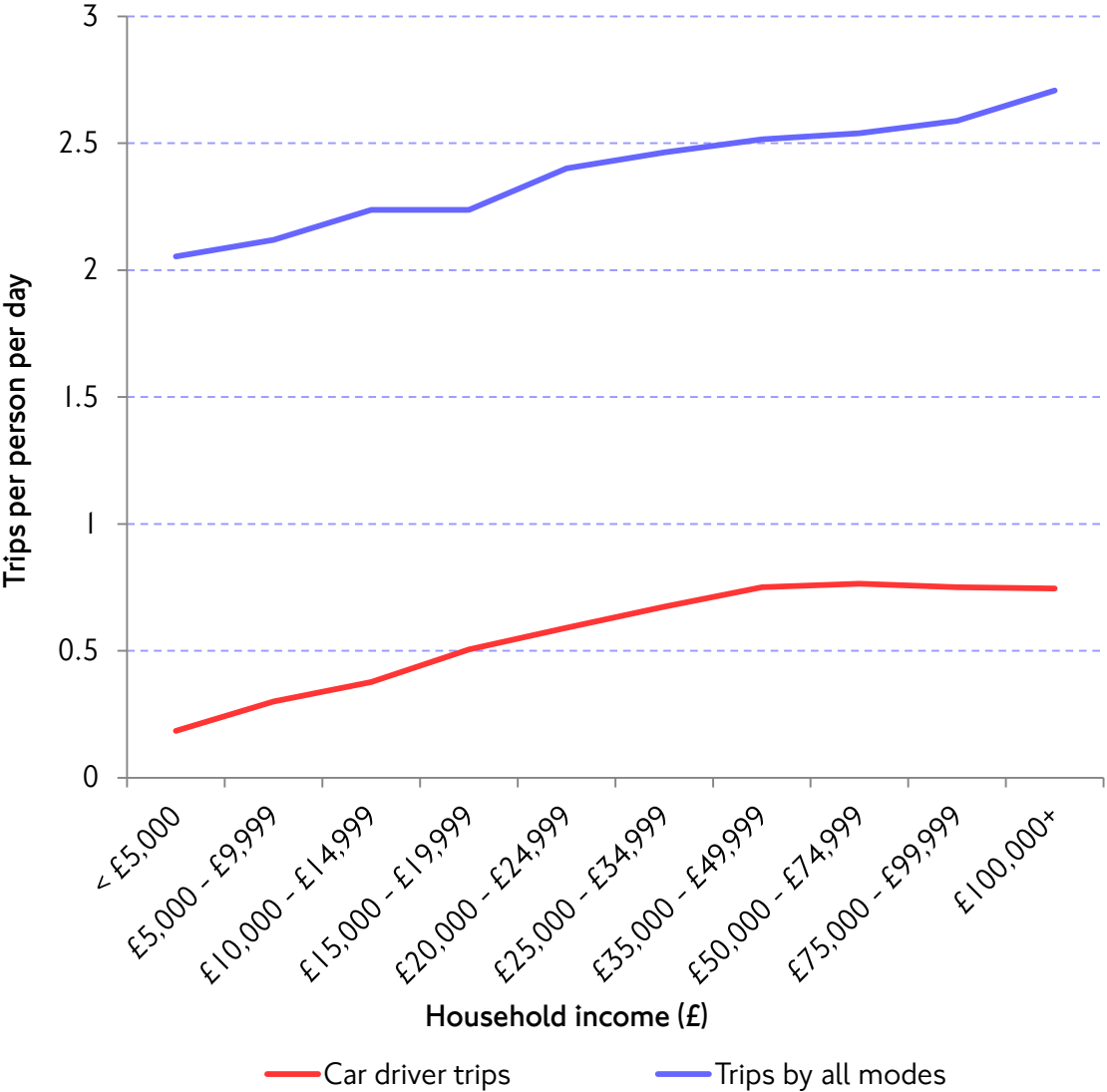
Figure 20: Trip rates and household income



Source: LTDS 2010/11, 2011/12, 2012/13

For those with household incomes below the £35-50k band car trip rates rise in line with income (Figure 21) in approximately the same way as trip rates by all modes do, but there is a structural break in the relationship beyond this point and people with higher household incomes cease to make more car trips.

Figure 21: Trip rates by car and all modes by household income



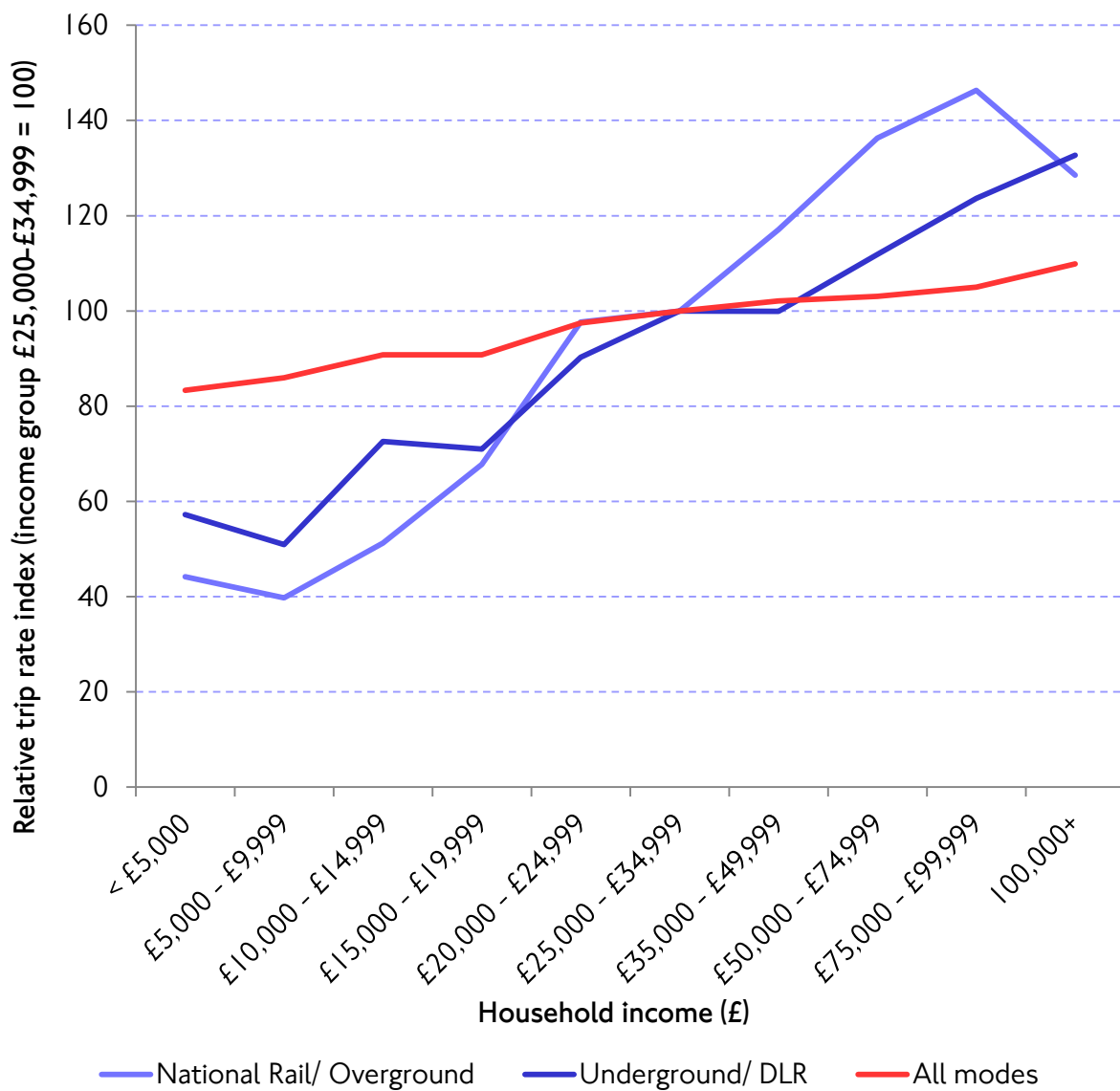
Source: LTDS 2010/11, 2011/12, 2012/13

Underlying demand factors

Use of London Underground and National Rail services rises as household incomes rise. In both cases the elasticity with respect to income is greater than the income elasticity of demand for travel in general (Figure 22), meaning that people’s desire to travel by rail modes rises with income at a faster rate than their desire for travel of all types.

Travel by rail is particularly strongly linked to household income. This may be related to the observation that passenger numbers have continued to rise even while fares have increased by around 20 per cent in real terms, as detailed in the previous chapter.

Figure 22: Indexed trip rates for Rail, Underground and all modes



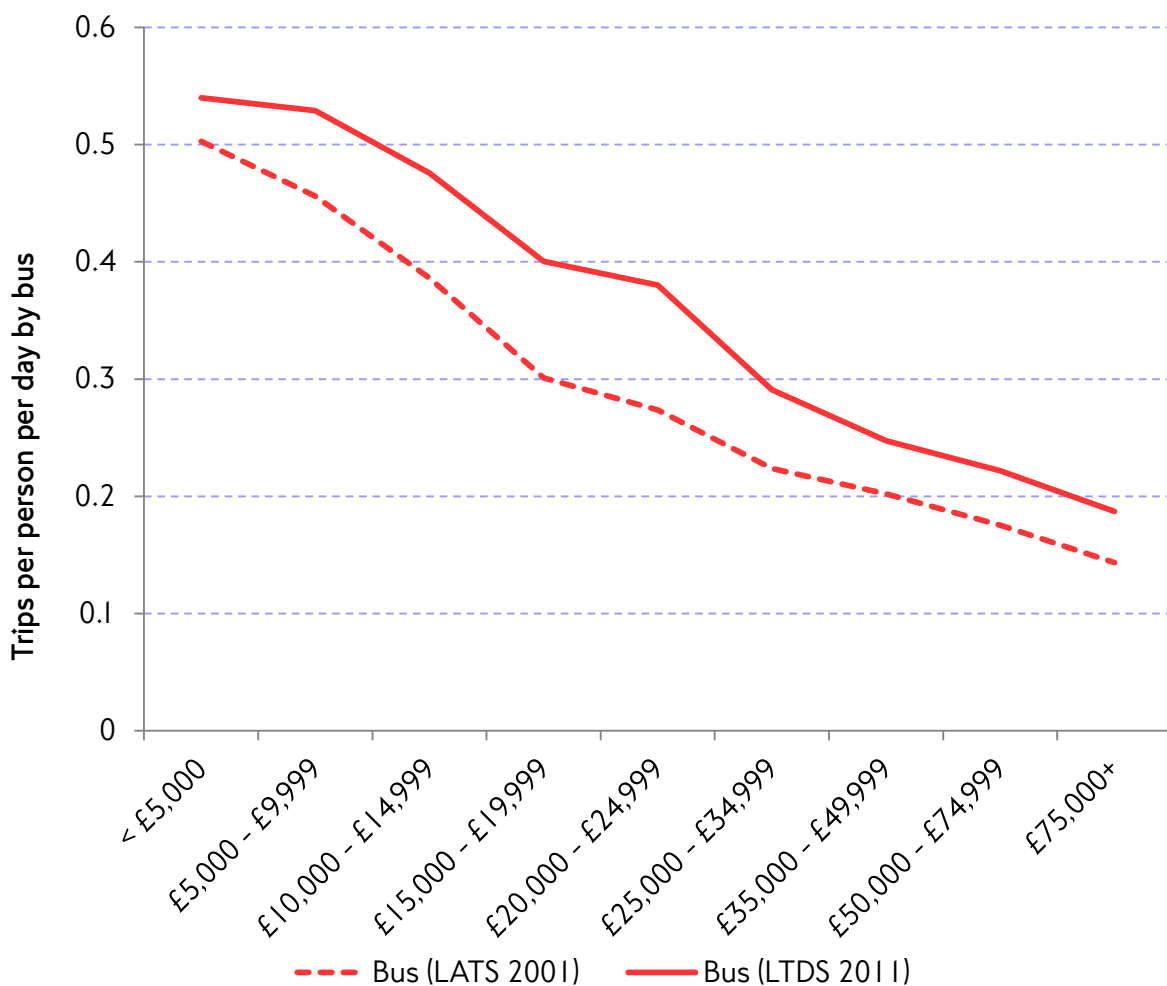
Source: LTDS 2010/11, 2011/12, 2012/13

The relationship between income and trip rates is reversed when looking at bus travel: as household income rises people make fewer trips by bus, with those in the top income band making just 35 per cent the number of bus trips of those in the bottom income band (Figure 23).

While data are presented on trip rates for both 2001 and 2011, these series are not directly comparable due to inflation: £1 in 2001 is worth about £1.30 in 2011, so the £20k-25k band in 2001 is roughly equivalent to the £25k-35k band in 2011. Taking this into account, London residents in some incomes appear to be making more bus trips in 2011 than they would have in 2001, especially in the middle income bands – for example those in the £20-25k band in 2011 made 25 per cent more bus trips than those in the equivalent £15-20k band in 2001.

Aside from the inflation effect, the relationship between bus trip rates and household income appears not to have changed substantially between 2001 and 2011, which is perhaps surprising given the improvements in quality of service that have been delivered over the same period.

Figure 23: Bus trip rates by household income 2001 and 2011



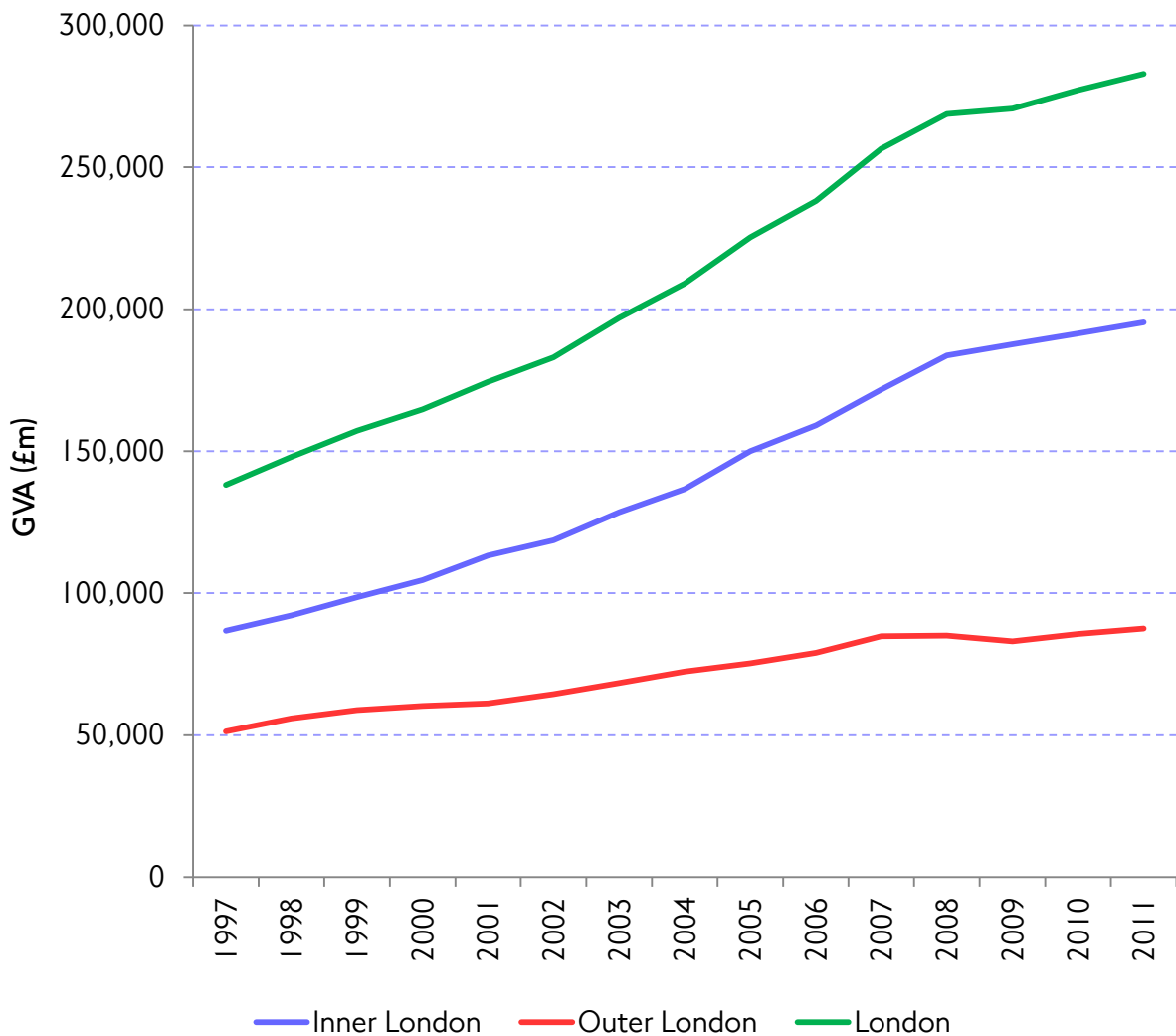
Source: LTDS 2010/11, 2011/12, 2012/13

Economic performance in inner and outer London has differed

The productivity of London’s economy, measured in Gross Value Added (GVA), increased steadily from 1997 through to 2007 (Figure 24). The majority of the growth in productivity in London as a whole over this period was down to strong growth in inner London. Inner London’s already larger output more than doubled, while outer London added 70 per cent.

From 2007 onwards, the difference in economic performance between inner and outer London became even more stark. While growth in inner London slowed from the rate it had been growing at prior to the recession, in outer London GVA barely increased at all, adding just 3 per cent from 2007 to 2011.

Figure 24: GVA: Inner London, outer London, London total



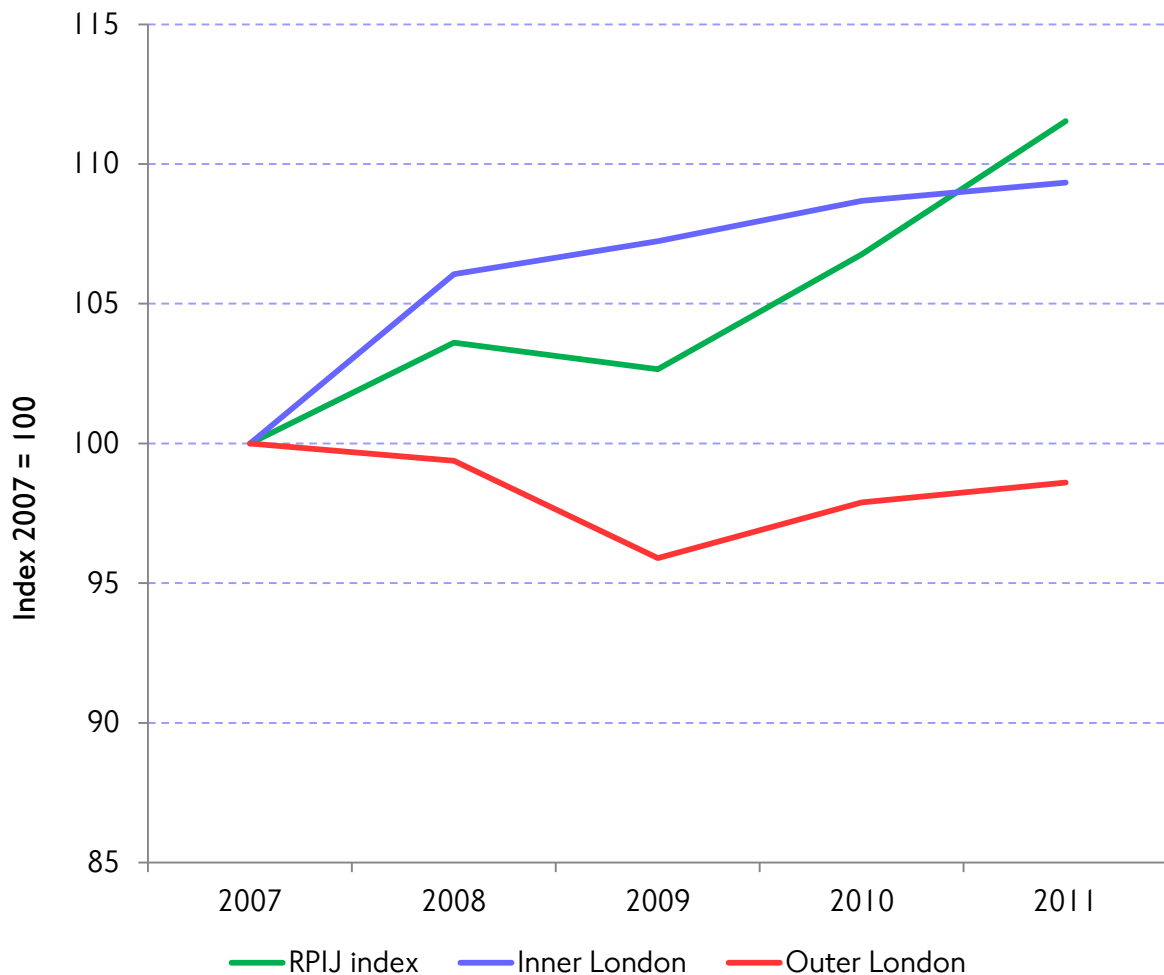
Source: Office for National Statistics

The growth seen in inner & outer London's economies during the recession following the 'credit crunch' in 2007 was in part due to the continued growth in population in both regions.

Taking the growing population into account and looking at production per capita, it becomes apparent that inner London became less productive after 2007 and remained so until 2011 (Figure 25).

The same approach shows that while production per capita in inner London continued to rise during the recession, it grew by less than inflation as measured by RPIJ over the period from 2007 to 2011. While these statistics are not directly comparable since the former relates to economic output in London and the latter to cost of living in the UK as a whole, this suggests that even in inner London productivity did not increase in real terms for a number of years.

Figure 25: GVA per head & RPIJ (index 2007 = 100)



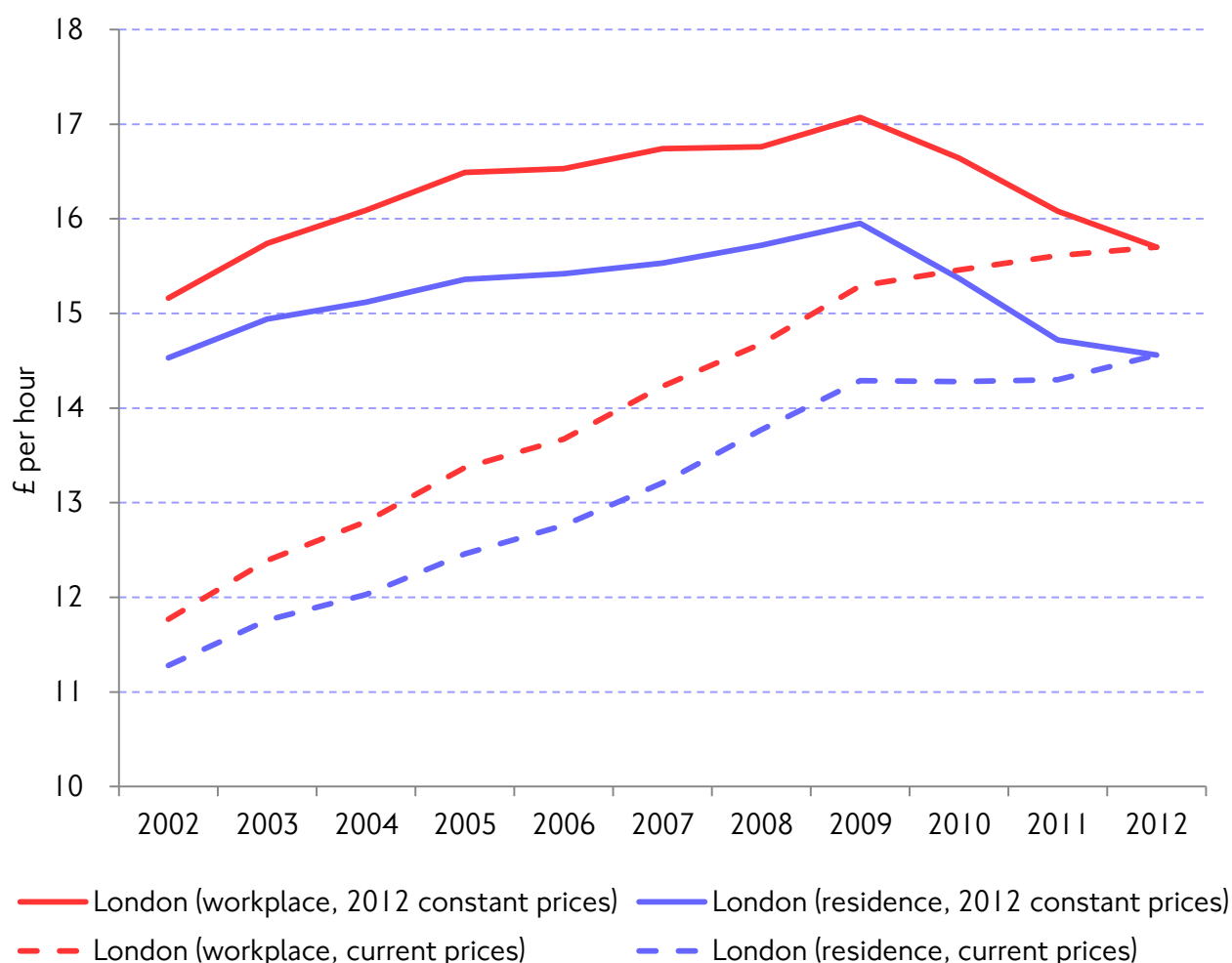
Source: Office for National Statistics

Incomes did not increase for a number of years

Wages of people working in London saw real-terms growth of 13 per cent between 2002 and 2009 (Figure 26), although the wages of London residents saw lower growth of 7 per cent over the same period. The median wage for those working in London was also 7 per cent higher than that of London residents in 2009, reflecting the fact that those commuting longer distances from outside London are travelling to higher value jobs.

After 2009, wages declined in real terms both for those working in London and for London residents. In the case of London residents', this decline meant that wages were back to 2002 levels by 2012, while the 9 per cent drop from the 2009 peak in wages for London workplaces took them back to 2003 levels.

Figure 26: Median hourly earnings excluding overtime of all employees

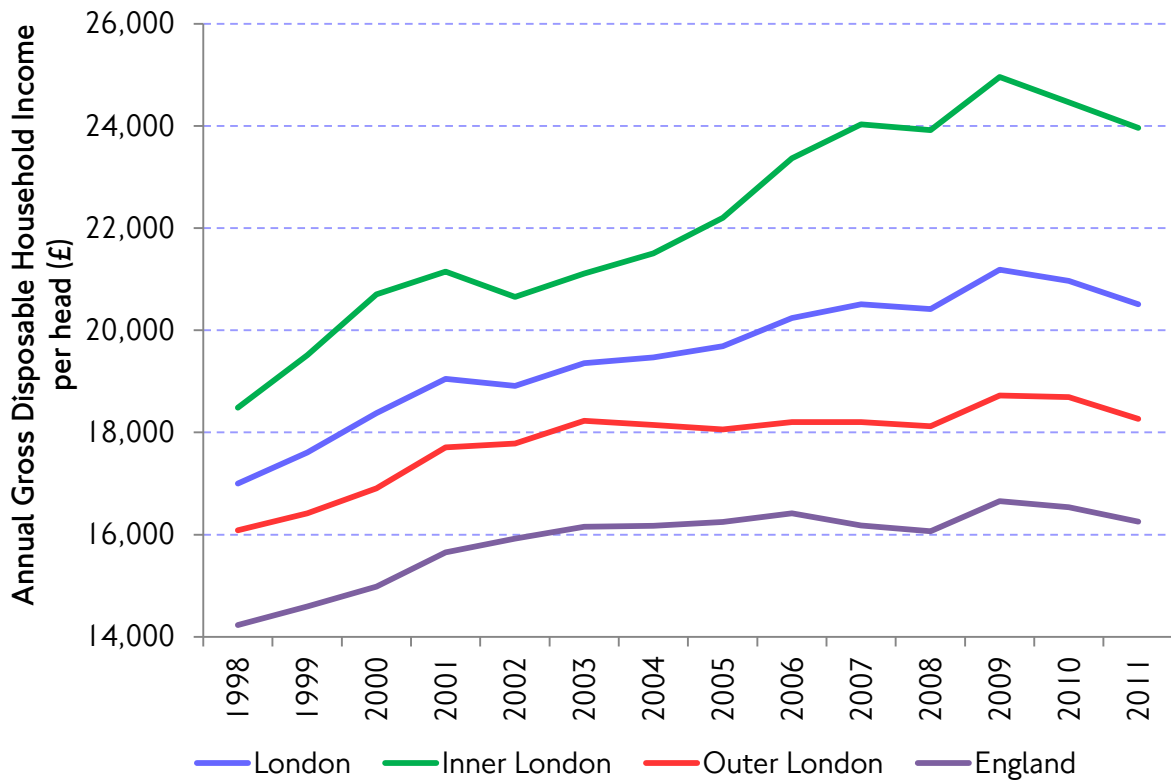


Further exploring trends in income broken down by inner and outer London, a similar pattern to that seen in economic output in the two regions becomes apparent.

Real incomes per capita declined both in inner London and in outer London from a 2009 peak, but there were very different scales of growth in the period before this (Figure 27). From 2003 to 2009 inner London incomes rose by 18 per cent before falling back to a cumulative 14 per cent by 2011. In contrast, outer London incomes increased by just 3 per cent between 2003 and 2009, and from 2009 to 2011 even this growth was eroded, meaning by 2011 income per person in outer London was back to 2003 levels.

This phenomenon is an important explanatory factor in the trend in car travel that has been observed at the London-wide level. Since car ownership and use are linked to higher incomes, the fact that outer London incomes have not increased for almost 10 years means that the upward pressure on ownership and use of cars in outer London that was present until the early 2000s (while incomes were increasing) has been removed. Without any upward influence on the quantity of car travel from growth in household incomes, the downward influence of the supply factors detailed in the previous chapter appears to have led to a decrease in the volume traffic in outer London, where around 70 per cent of car trips in London occur.

Figure 27: Household income per head (2011 prices indexed by RPIJ)



Source: Office for National Statistics

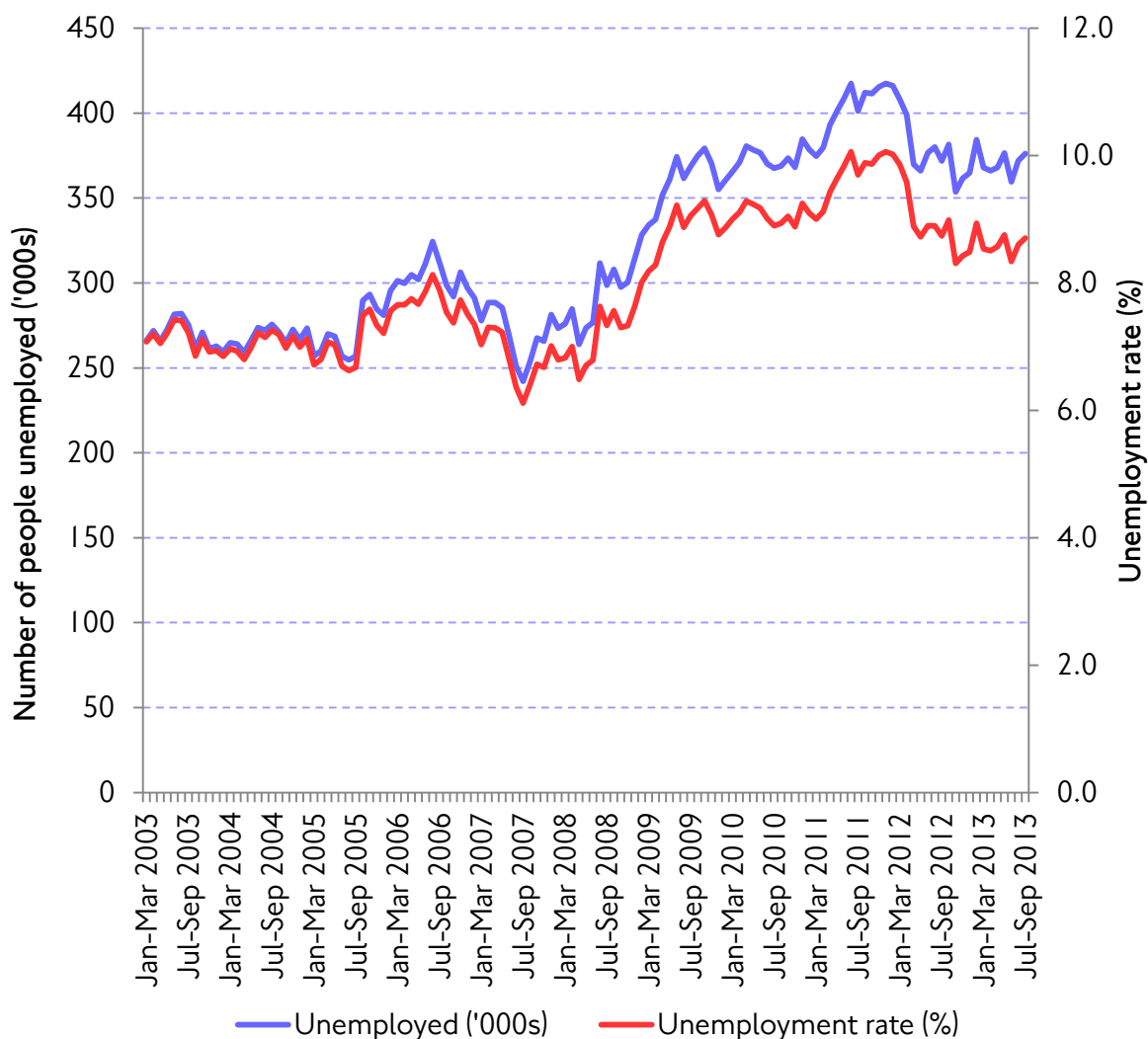
Transport demand fell after the recession

As has been seen above, the impact of the recession in London was significant even if London’s economy did not decrease in size.

One illustration of how the slow-down in GVA growth affected transport demand is the increase in unemployment in London during the recession (Figure 28). London’s unemployment rate rose from a low of 6.4 per cent in summer 2007 to a peak of 10.1 per cent in summer 2011.

Travel behaviour amongst unemployed people is significantly different to that of the rest of the working age population, with the unemployed making only 60 per cent the number of trips by mechanised transport that the full-time employed do, and only 40 per cent the number of car trips. So while the increased unemployment rate represented just 3 or 4 per cent of Londoners, it would have had substantial consequences for their travel behaviour.

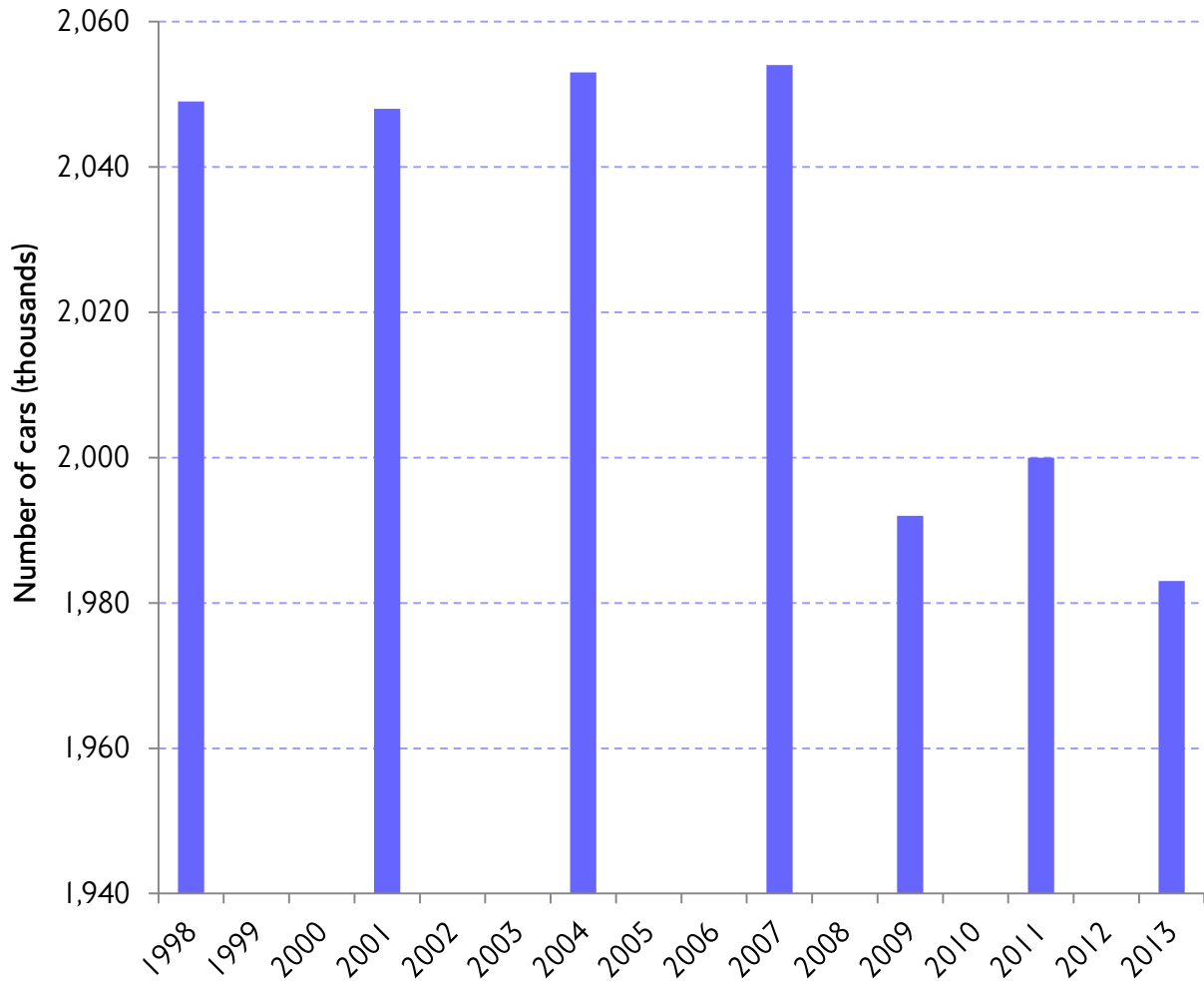
Figure 28: Unemployment in London 2003-2013



Source: Office for National Statistics

Since the start of the recession there has been a small but sustained drop in the number of cars crossing the London boundary cordon (Figure 29). This reduction of 3 per cent came after a period of 10 years where the number of cars crossing the boundary cordon remained unchanged, suggesting this fall was also a consequence of the recession.

Figure 29: Combined direction 24 hour count of cars crossing the London boundary cordon



Source: TfL Surface Transport, Traffic Analysis Centre

Summary

At the individual level, many of the established theories linking personal incomes to quantity of travel and mode choice appear still to hold true, even as London has changed. The total quantity of travel is higher amongst those with higher incomes, and the elasticity of demand for travel with relation to income differs by mode: demand for rail modes increases faster than demand for travel in general as incomes rise, while demand for bus travel decreases.

The relationship between incomes and car ownership and use is more unusual. Demand for car travel appears to saturate once household incomes reach £35,000-£50,000 even as the demand for travel in general continues to rise at higher incomes. Car ownership levels also appear to saturate, albeit at a higher level of household income.

The recession had a substantial effect on travel, as changes in productivity, incomes and economic activity led to reduced travel. But beyond this, there is a longer term trend in outer London for no increase in productivity or incomes for the past 10 years, which means that even the conventional theory linking growth in car travel to economic growth and increasing wealth would be consistent with the lack of growth in car travel that has been observed in outer London for the past decade.

Structural changes

In a constant, unchanging society, changes in transport demand could be explained through trends in supply and demand factors of the type explored in the two previous chapters. With sufficient understanding of the responses to each factor, a comprehensive, if complex, theory could be formulated to fully explain the observed changes in travel patterns.

In reality, the task is far more complicated than this due to the evolution of society, which leads to changes in the way people respond to transport supply, and thus changes the relationship between supply and demand. These changes in people's personal preferences can be caused by a number of things, including changes in the balance of demographics; changes in attitudes across generations; or changes in the structure of the economy leading to desires to undertake different kinds of activities.

London has changed in a number of ways over the past 20 years, with consequent changes in the supply and demand relationship meaning that travel patterns today are very different from what they would have been had London's simply experienced population growth of 1.5million people while retaining all the other characteristics it had in 1991.

The balance between inner and outer London shifted

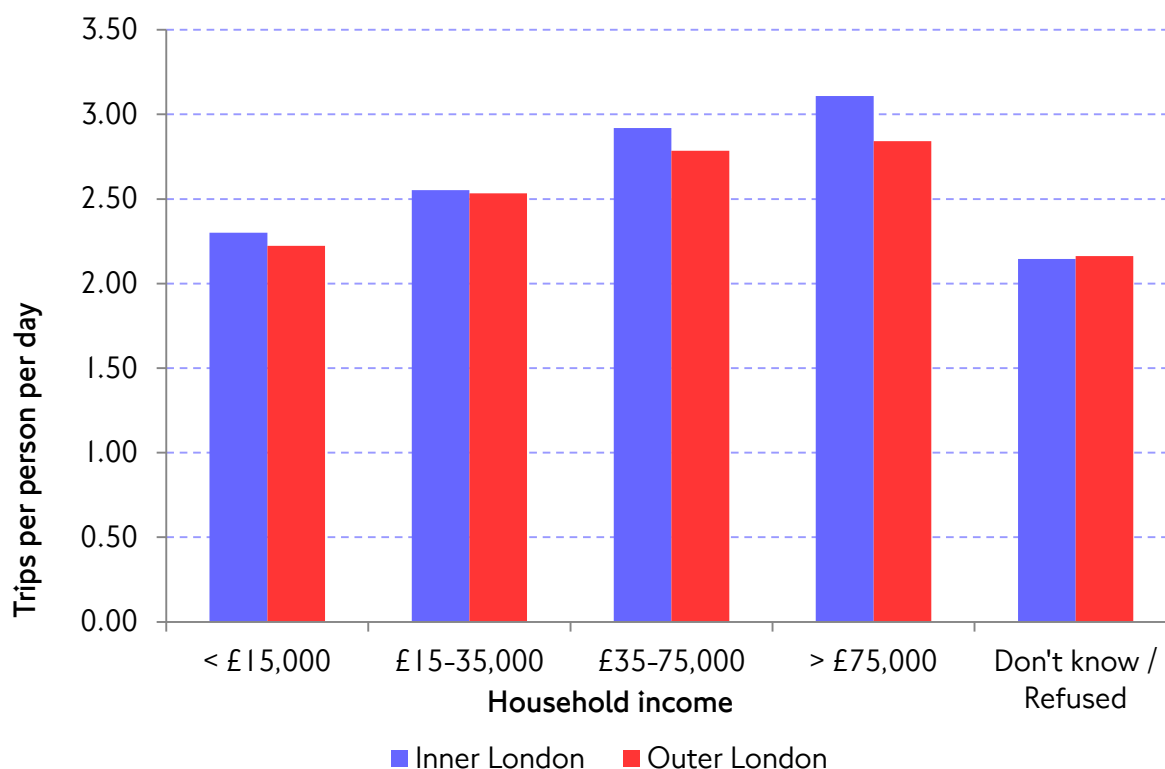
The differing economic performance of inner and outer London that was explored in the previous chapter is not the only distinction between the two regions.

Travel behaviour amongst inner London residents is very different to that of outer Londoners. While the total trip rate by all modes is similar for residents of both regions (Figure 30), a difference in behaviour becomes apparent when looking at trip rates by mechanised modes (Figure 31).

Across all income bands, residents of outer London make 15 to 25 per cent more trips by mechanised modes than inner Londoners. The other side of this fact is that inner Londoners therefore make more trips by walking and cycling, making up the difference in the total all-mode trip rate.

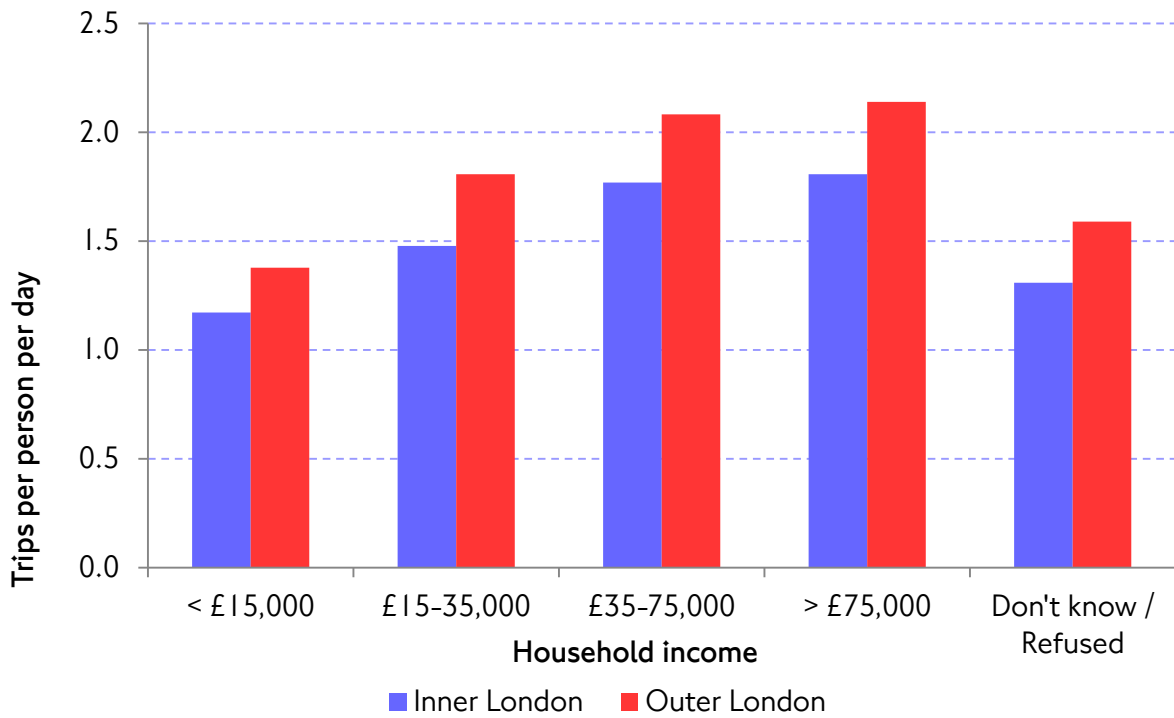
There is a further even greater distinction when looking at car driver trip rates (Figure 32). Across all income bands, outer London residents make twice as many car trips as inner London residents. The distinction between inner London and outer London therefore has a greater influence on car trip rates than income.

Figure 30: Trip rates by income, inner and outer London



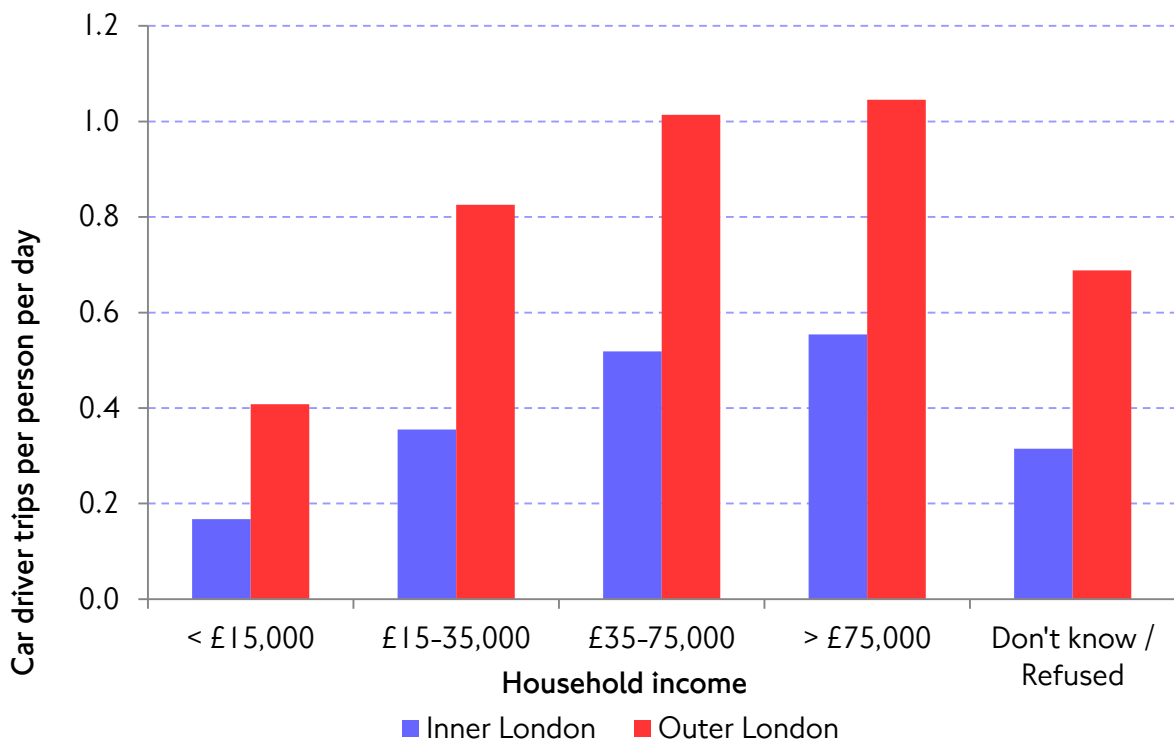
Source: LTDS 2010/11, 2011/12, 2012/13

Figure 31: Mechanised trip rates by income, inner and outer London



Source: LTDS 2010/11, 2011/12, 2012/13

Figure 32: Car driver trip rates by income, inner and outer London



Source: LTDS 2010/11, 2011/12, 2012/13

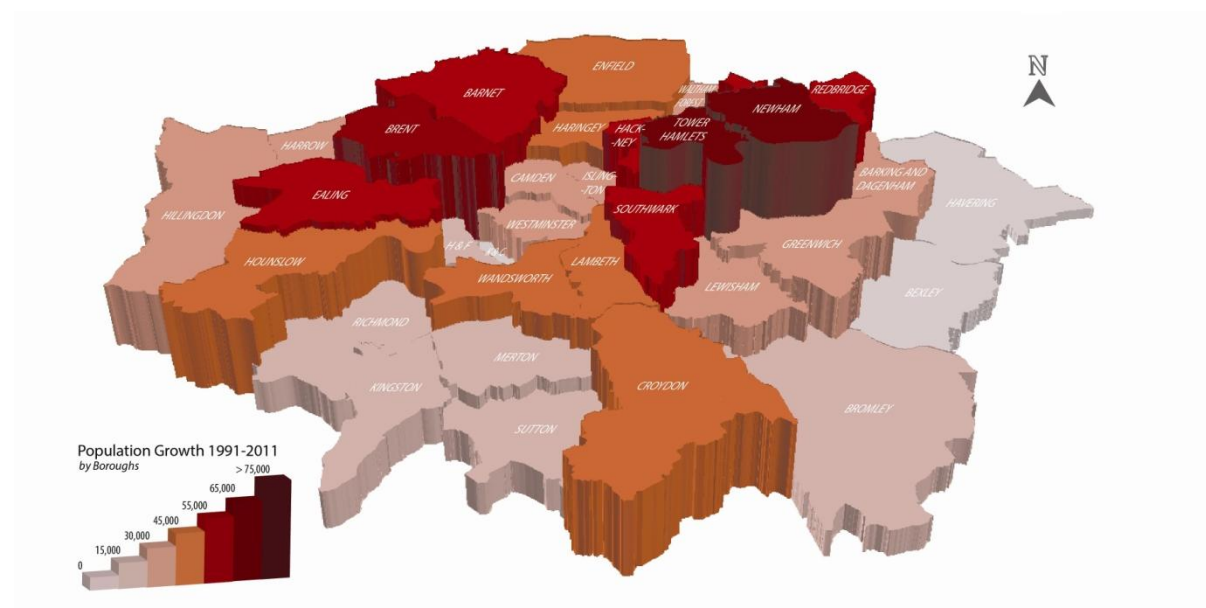
Structural changes

The marked difference between inner and outer London in travel behaviour, and in particular in car travel, is magnified by the distribution of population growth in London from 1991 to 2011. The share of population growth between inner London and outer London over this period was fairly even, with 47 per cent in inner London despite the fact that the land area of outer London is four times the size of that of inner London (Figure 33 shows the volume of population growth by borough).

In 1991, 62 per cent of London's population was in outer London, but by 2011 this had reduced to 60 per cent as a consequence of the relatively even distribution of population growth. This change means that the volume of car travel in London is not as high as it would have been had the balance between inner and outer London remained the same as was the case 20 years ago.

The other aspect of the distribution of population growth is that inner London became relatively even more densely populated than outer London between 1991 and 2011. This increase in density itself encourages mode shift away from car use towards walking, cycling and public transport for a number of reasons: the space necessary to keep a car becomes more scarce; necessary services such as shops are often provided closer by; and it becomes easier to justify investing in public transport in denser areas – a justification that has been capitalised on based on the evidence relating to supply factors.

Figure 33: Population growth between 1991 and 2011 by borough



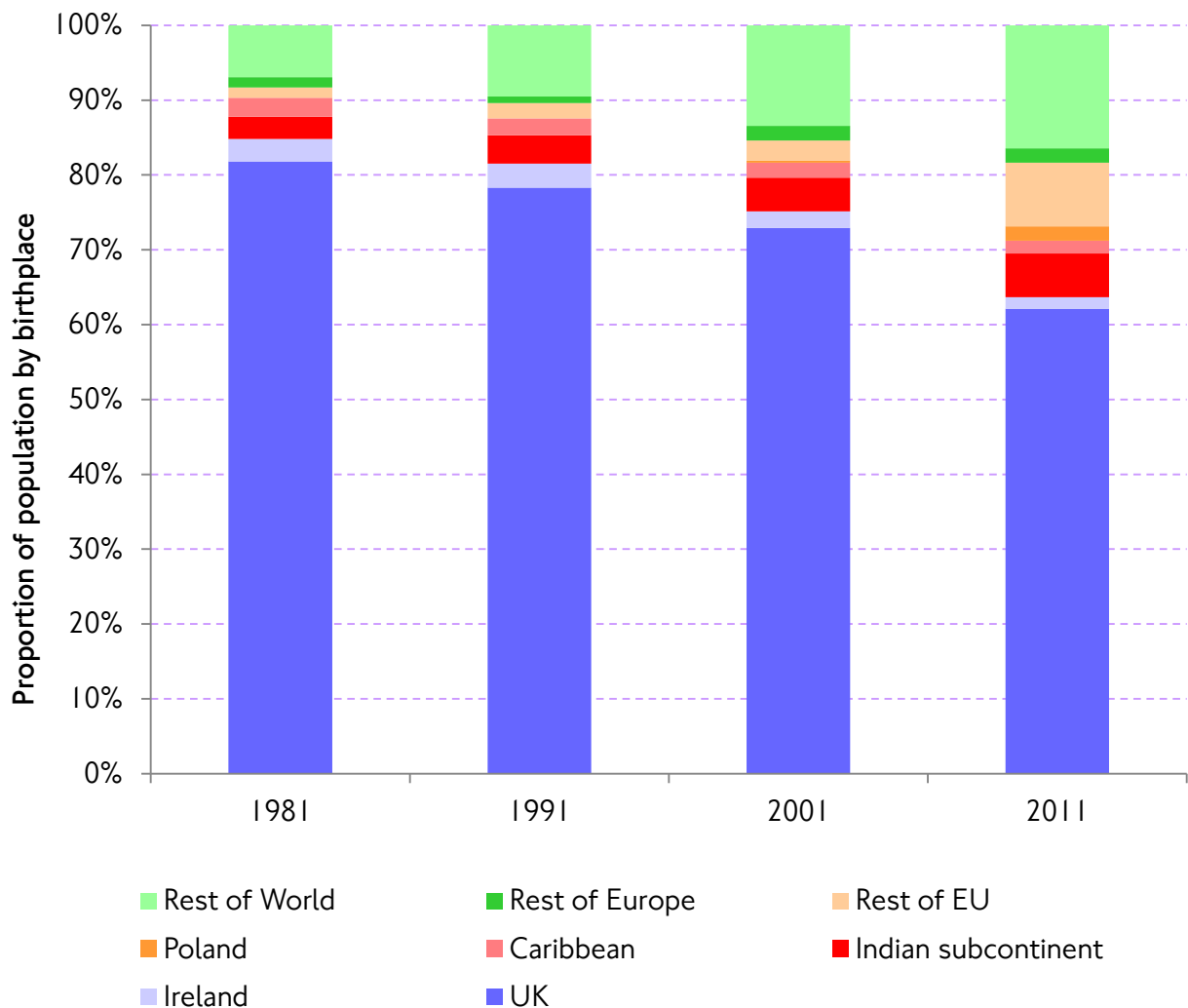
Source: UK Census

Both domestic and international migration patterns changed

The breakdown of London's population by nation of birth became more varied between 2001 and 2011.

The proportion of Londoners born in the UK fell by nine percentage points between 2001 and 2011 (Figure 34). This shift was largely accounted for by in-migration from the EU: the proportion of Londoners born in EU states other than the UK & Ireland rose from 3 per cent to 11 per cent between 2001 and 2011.

Figure 34: Breakdown of London's population by place of birth 1981 to 2011



Source: UK Census

Structural changes

Migration patterns within the UK also changed significantly over the past 10 years. In the early 2000s, there was net migration from London to the rest of England and Wales of around 100,000 people each year (Figure 35). Stereotypically, this was driven by people moving out of London as their life stage changed, perhaps to buy a home or start a family.

From 2004 onwards the level of net migration began to reduce each year until 2009, when it dropped below 50,000, before stabilising. The decreased net out-migration was caused largely by increased in-migration, but also by a small decrease in out-migration.

Figure 35: Internal (England & Wales) migration, London, 12-month periods ending June

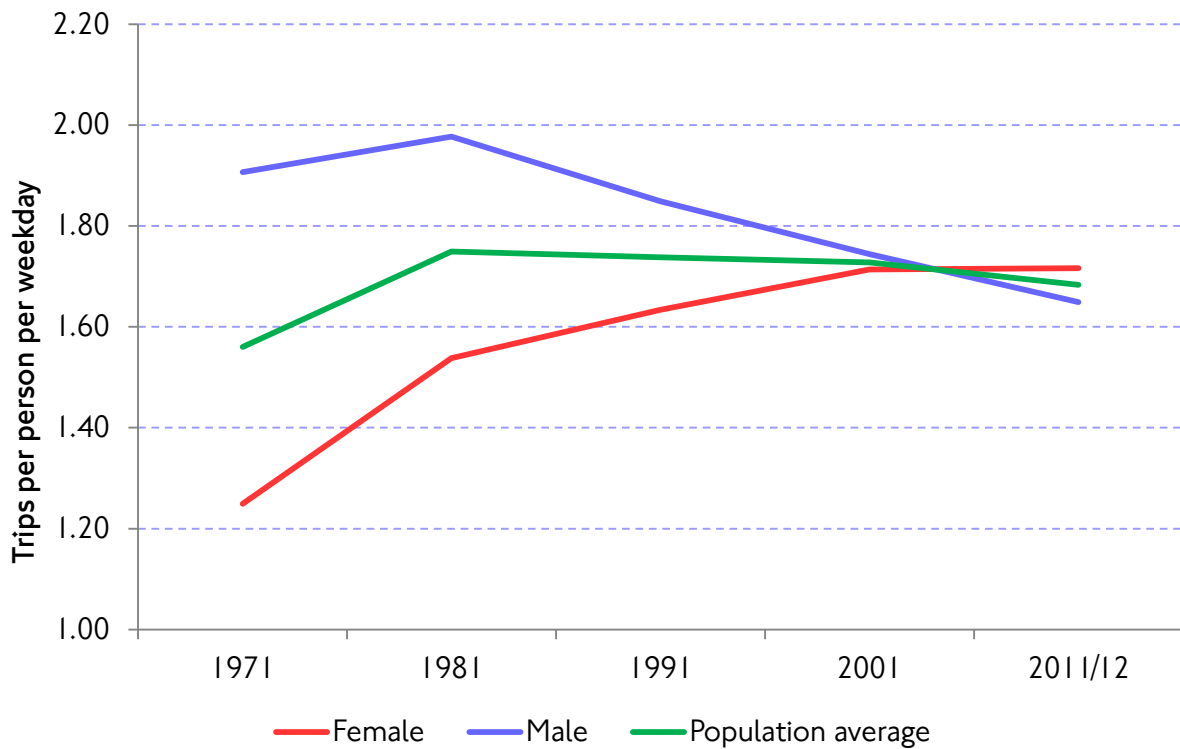


Source: GLA based on NHSCR moves and HESA data within the UK year ending June 2012 (ONS/PRDS)

The demographics of Londoners continues to have an effect

Over the very long term, travel characteristics by gender have converged from markedly different points (Figure 36). In 1971, men made 50 per cent more trips by motorised modes than women. By 2001 this difference had almost entirely disappeared, and by 2011 women made slightly more motorised trips than men.

Figure 36: Trip rates by gender (motorised modes only)

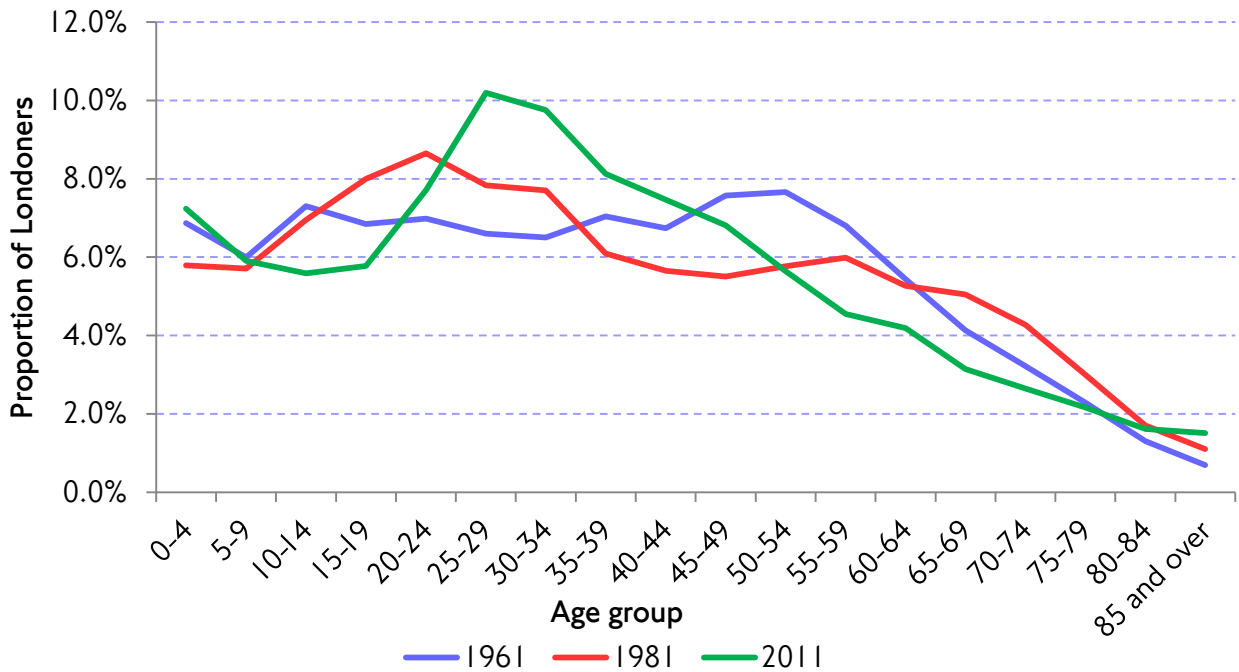


Source: LATS and LTDS

Structural changes

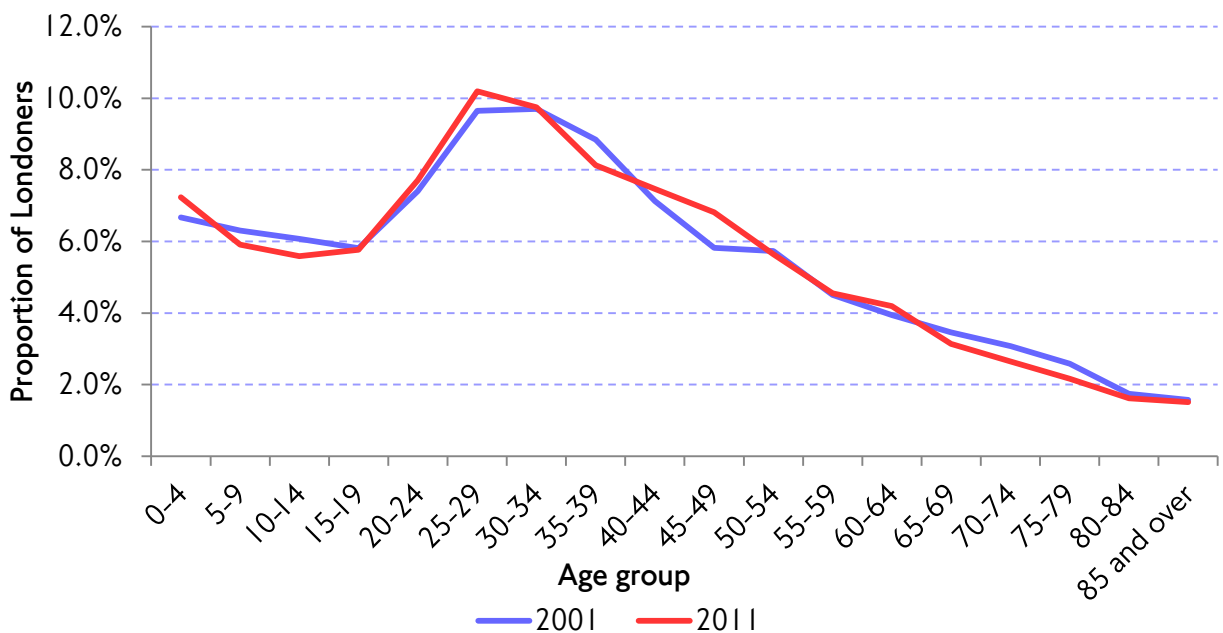
Over the long term London’s population has also become increasingly concentrated in young age bands, with the proportion in the 25-29 age band up from 6.6 per cent to 10.2 per cent between 1961 and 2001 (Figure 37). There was, however, little change in London residents’ age profile between 2001 and 2011 (Figure 38) suggesting a change in the age distribution amongst the population has not been a major cause of the change in travel patterns observed in the last 10 years.

Figure 37: Age profile of Londoners: 1961, 1981, 2011



Source: ONS

Figure 38: Age profile of Londoners: 2001, 2011

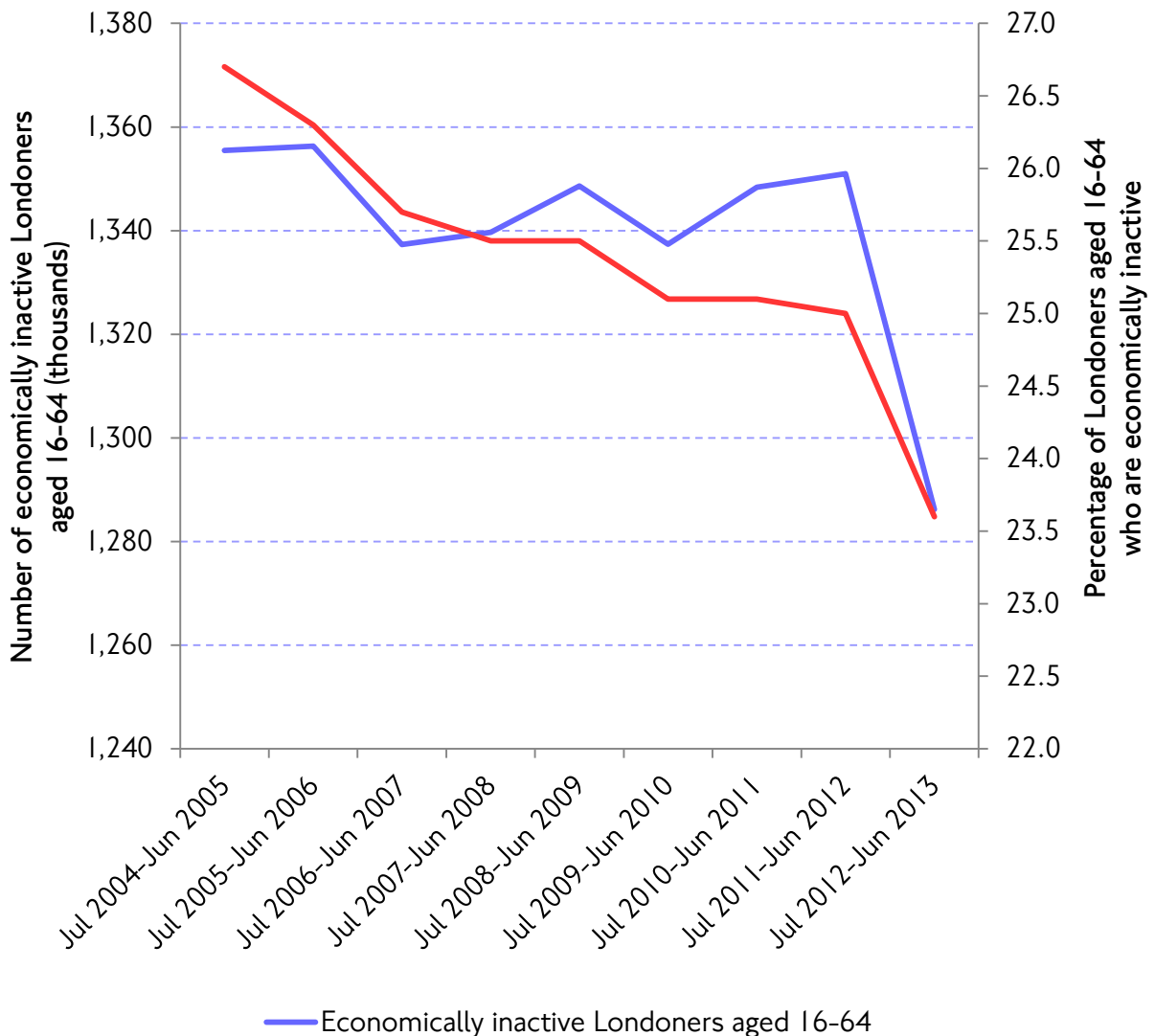


Source: ONS

The number of economically inactive Londoners was fairly constant between 2004 and 2012, and with population increasing substantially over this period the proportion of economically inactive Londoners consequently fell steadily (Figure 39). From 2012 to 2013 there was a relatively pronounced fall in the number of economically inactive Londoners and, again, the proportion that were economically active.

Trip rates are lower among the economically inactive, so this decline in economic inactivity should imply more travel, but the data on economic activity at this aggregate level masks two effects that become apparent when the data is disaggregated.

Figure 39: Economic inactivity in London, 2005 - 2013



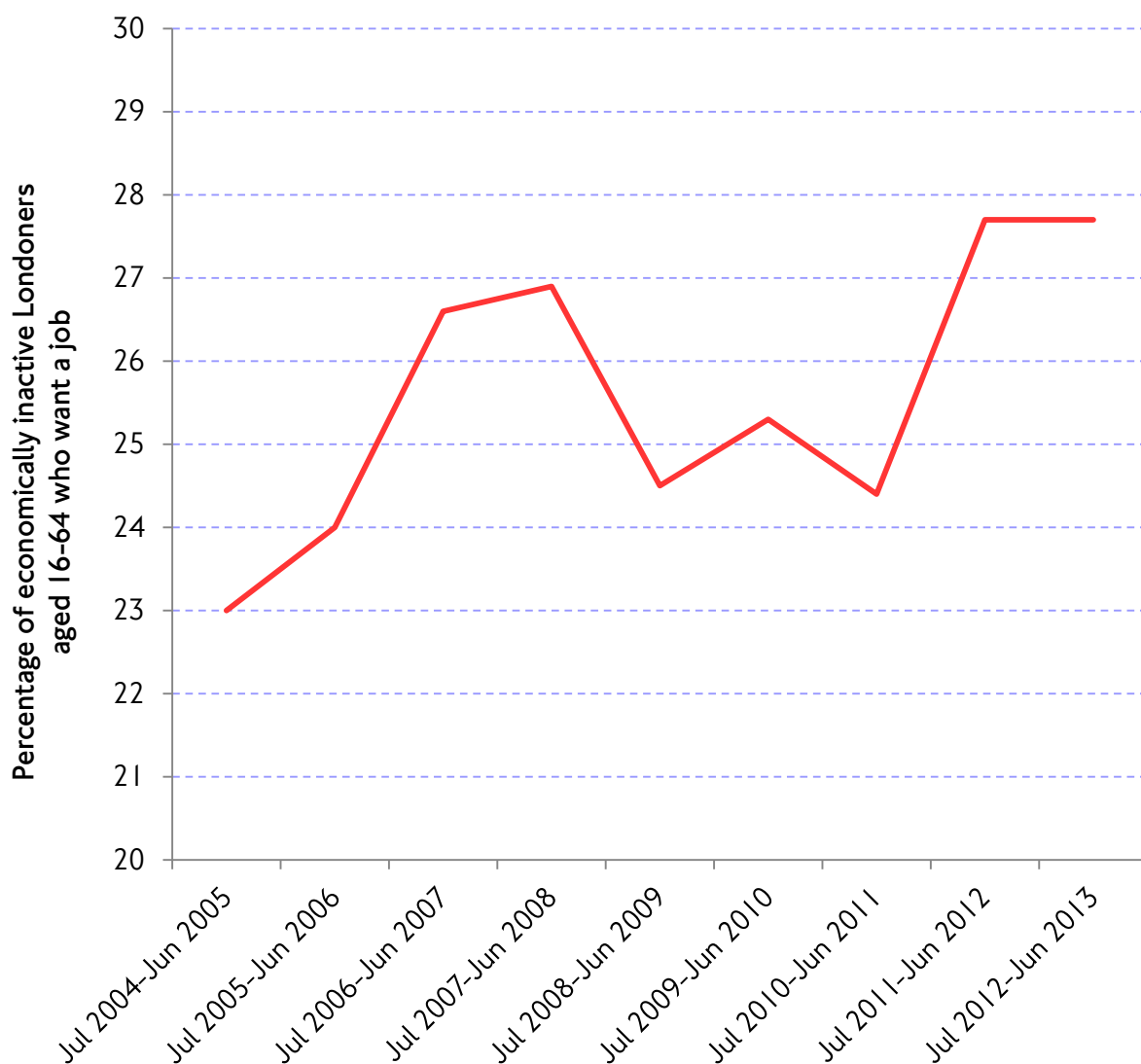
Source: ONS

Structural changes

The proportion of economically inactive Londoners who are looking for a job has risen (Figure 40) and people in this category make less than half as many car driver trips than those in full time employment. The mix of the economically inactive population is therefore becoming less prone to travel, especially by car.

Some other types of economic inactivity are associated with higher than average trip rates. For example those that look after the home/family make 3.0 trips per day, compared to the overall average of 2.6 trips per day.

Figure 40: Proportion of economically inactive Londoners who want a job

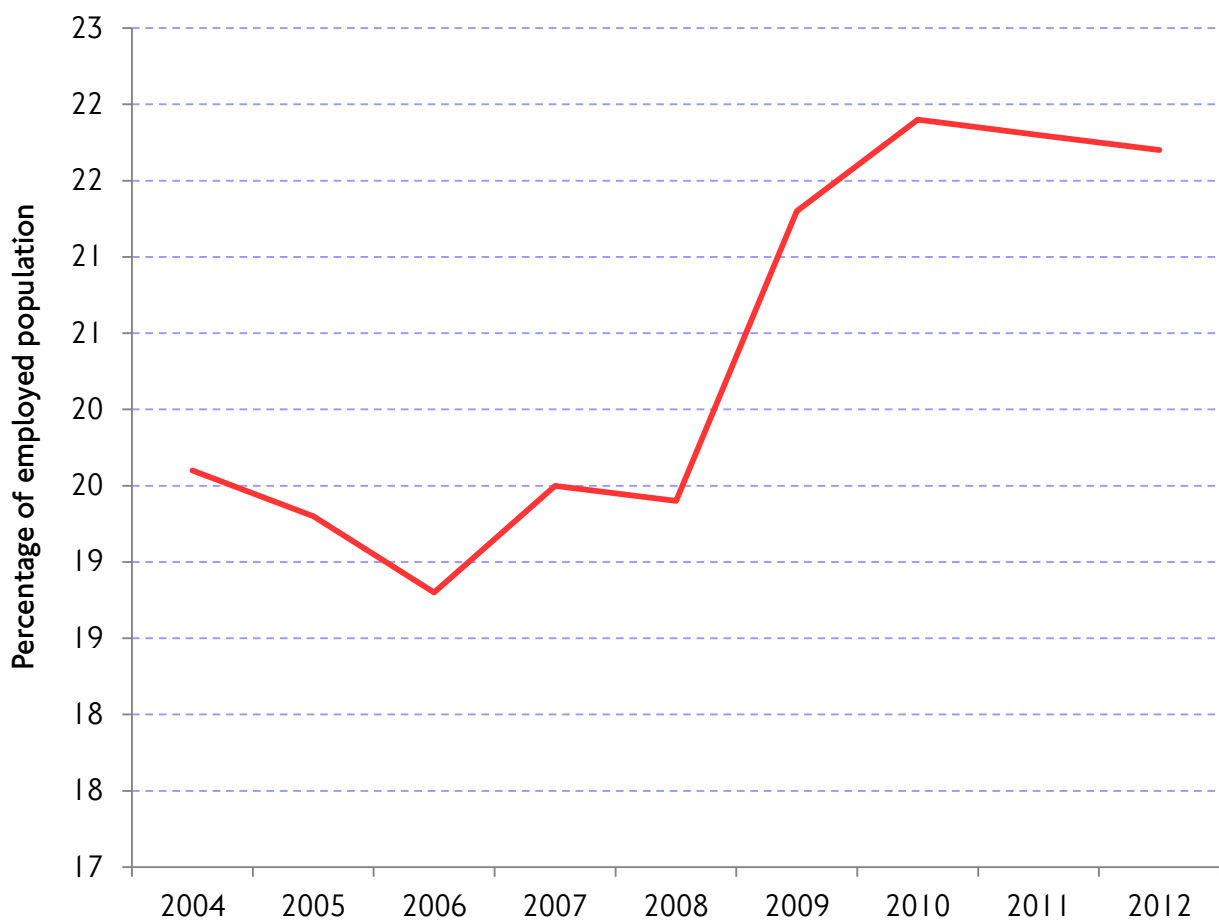


Source: ONS

There has also been a change in the types of economic activity amongst those who are economically active. The economically active are now more likely to work part-time (Figure 41), and therefore travel more: the part-time employed make over 20 per cent more trips than the full-time employed, and almost 50 per cent more car driver trips.

The proportion of working age Londoners who are self employed has also risen, from 15.5 per cent to 17.3 per cent. The self-employed have the highest car driver trip rate of any economic activity group.

Figure 41: Proportion of employed population in part-time employment



Source: ONS

Travel behaviour has been evolving across generations of Londoners

The change in travel patterns at the aggregate level that has been observed in London over recent years can be looked in two distinct ways.

One approach is to look at a static cross section of the population, such as 40-49 year olds, at different points in time and observe how this group behaves differently at different points. The second (longitudinal) approach is to examine the same particular group of people, for example those born in the 1980s, and observe how their behaviour changes over their lifetimes.

Figure 42 shows both cross-sectional and longitudinal trends for driver licence holding amongst London residents, with the lines joining points that represent the same cohort over time, and the arrows indicating the change in cross-sectional behaviour between one cohort and the next.

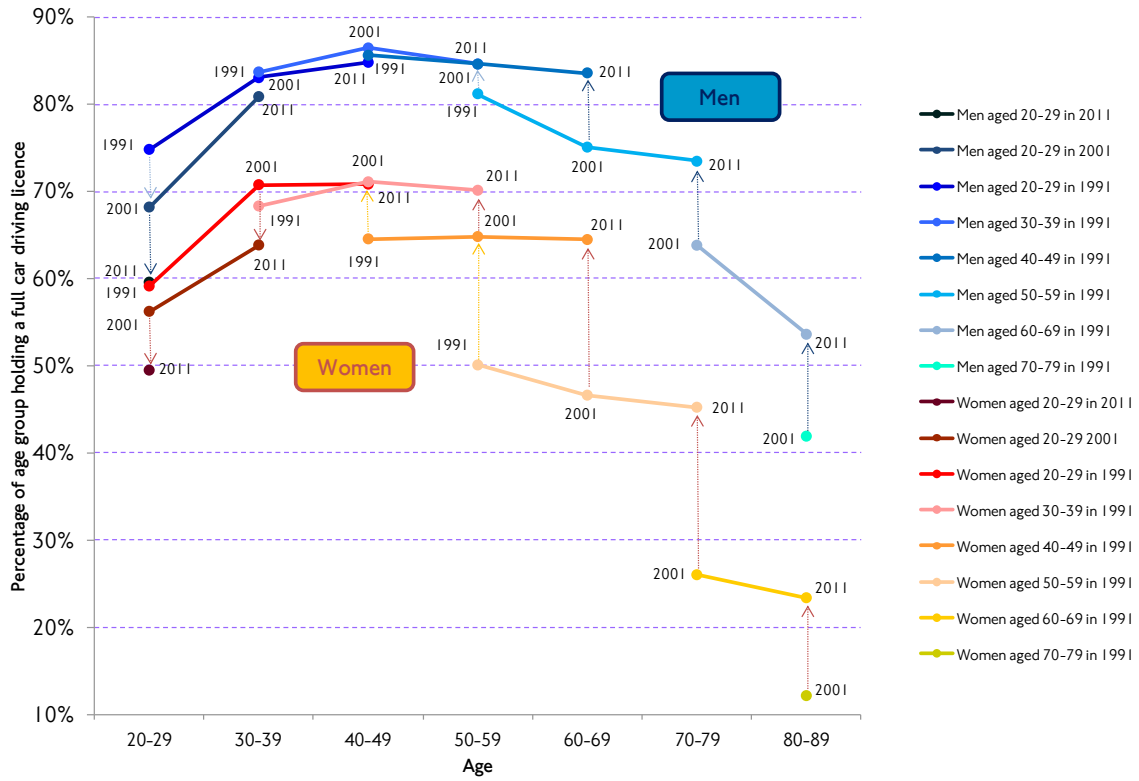
The section on the right of the chart shows that licence holding increased from one cohort to the next for Londoners who were in the 50-59 age group or older in 1991. This represents car use becoming more prevalent over the decades in the post-war period

There is then a period where each cohort behaves similarly to its predecessor, with little difference in the cross-sectional points for Londoners who were aged between 20 and 40 in 1991. Licence holding had therefore stabilised by this time, suggesting the process of car use becoming 'normal' had finished.

Finally, on the left side of the chart, the trend of increasing licence holding from one cohort to the next is reversed. Since 1991, each successive cohort of Londoners has had a lower rate of licence holding while in their 20s.

The decline in licence holding amongst the youngest generations of Londoners potentially has significant implications for future travel demand. If these groups maintain their lower level of licence holding as they age, car trip rates per person could fall in future, resulting in a continuation of the divergence between population growth and the volume of car travel.

Figure 42: Car driver licence holding by age-cohort groups (1991, 2001 and 2011)



Source: LATS and LTDS

Summary

The distinct travel patterns in inner and outer London explain some of the lack of growth in car use in line with population when it is considered that there has been an equal amount of population growth in the two areas despite outer London covering approximately four times as much land as inner London.

London continues to see net outflows of migration to the rest of the UK, but at a lower level than previously. At the same time, there has been an influx of migrants from EU accession states, who in many cases fit profiles linked to low levels of car use.

Patterns of economic activity have changed, with some changes linked to increased travel (e.g. more part-time working) and others to decreased travel (e.g. a greater number of people seeking a job). Further redistribution away from full time work to other types of economic activity such as self-employment in future would likely lead to a significant change in the range of trip rates observed in London.

London's age profile has changed very little since 2001, while the substantial change in travel by women that had taken place prior to 2001 also appears to have stabilised, meaning age and gender have not been significant sources of change in travel patterns over the past 10 to 15 years.

While London's age profile has not changed substantially in recent times, the travel behaviour profiles of Londoners of different ages have changed. In addition to car driver licence holding rates having decreased amongst the youngest age cross-section of Londoners, other differing trends, for example relating to travel by bicycle, have been observed amongst the various age groups. Some of these topics will be explored in more detail in a supplementary report.

Conclusions

This review has confirmed some existing theories explaining transport demand, but has also given new insights into some areas: the differing economic performance of inner and outer London and its relation to travel demand; the apparent saturation for travel by car at a certain level of income even when general travel demand continues to rise at higher incomes; and the stark difference in car use amongst the youngest cohort of Londoners.

In the broadest terms, travel demand remains dependent on a range of exogenous factors such as the economy, population, and demographics that are already taken into account in forecasts of future demand. While existing approaches to modelling future travel demand describes the largest of these influences – such as population growth – well, there are areas where continued change in society could amplify factors that currently have a relatively small influence and result in significantly different levels of demand.

While travel demand can only be explained by a wide range of interrelated factors, it is apparent that over the past 10 to 20 years many of the most significant of these factors have been contributing to a shift away from private car travel towards travel by walking, cycling and public transport in London.

Figure 43 shows some of these major influences, as evidenced in this review, and the time-span over which they have been in effect. The number of these influences has increased in recent years, with the effects of the recession adding to the many other factors contributing to mode shift over the long term.

It remains to be seen whether these factors continue to have a downward influence on the level of car use in future. While service standards on public transport can be maintained and capacity can continue to be increased, some factors are outside the control of transport policy makers. If outer London returns to more prosperous times, desire for increased car ownership and use amongst its residents may follow. Similarly, if the next 20 years see spatial growth skewed more toward outer London than was the case for the last 20 years the associated growth in travel demand is more likely to be for car travel in the absence of a substantial change in the balance of transport supply.

Bearing the above in mind, Figure 43 also gives some possible directions in which the drivers of demand could continue to develop. Ensuring the transport network continues to support London's status as a prosperous world city with a high quality of life will require policy and investment decisions based on meeting the needs of and responding to the changing social and economic structure of the capital.

Conclusions

Figure 43: Major factors contributing to mode shift away from car travel over time

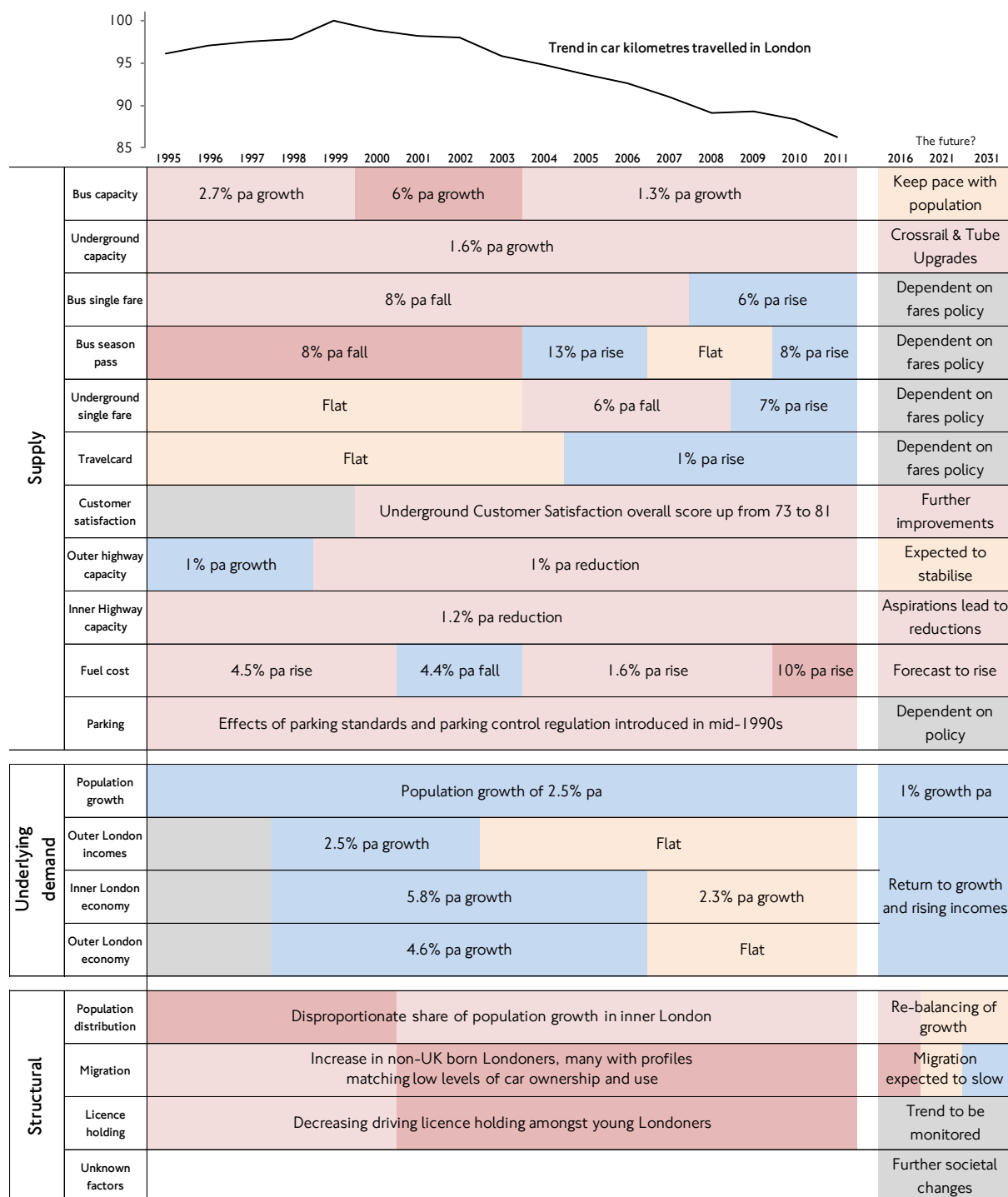


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